Contribution of Social Determinant of Health Factors to Rural-Urban Preventive Care Differences Among Medicaid Enrollees

Rose Y. Hardy, PhD, MPH; Gilbert C. Liu, MD, MS; Kelly Kelleher, MD, MPH

From the Abigail Wexner Research Institute at Nationwide Children's Hospital, Center for Innovation in Pediatric Practice (RY Hardy and K Kelleher), Columbus, Ohio; Partners For Kids, Nationwide Children's Hospital (GC Liu), Columbus, Ohio; and Department of Pediatrics, Nationwide Children's Hospital (K Kelleher), Columbus, Ohio
The authors have no conflicts of interest to disclose.
Address correspondence to Rose Y. Hardy, PhD, MPH, Abigail Wexner Research Institute at Nationwide Children's Hospital, Center for Innovation in Pediatric Practice, 700 Children's Dr, Columbus, OH 43215 (e-mail: Rose.hardy@nationwidechildrens.org).
Received for publication May 12, 2020; accepted August 30, 2020.

Abstract

Objective: 1) Assess whether rural-urban disparities are present in pediatric preventive health care utilization; and 2) use regression decomposition to measure the contribution of social determinants of health (SDH) to those disparities.

Methods: With an Ohio Medicaid population served by a pediatric Accountable Care Organization, Partners For Kids, between 2017 and 2019, we used regression decomposition (a nonlinear multivariate regression decomposition model) to analyze the contribution of patient, provider, and SDH factors to the rural-urban well-child visit gap among children in Ohio.

Results: Among the 453,519 eligible Medicaid enrollees, 61.2% of urban children received a well-child visit. Well-child visit receipt among children from large rural cities/towns and small/isolated towns was 58.2% and 55.5%, respectively. Comparing large rural towns to urban centers, 55.8% of the 3.0 percentage-point difference was explained by patient, provider, and community-level SDH factors. In comparing small/isolated town to urban centers, 89.8% of the 5.7 percentage-point difference was explained by these characteristics. Of provider characteristics, pediatrician providers were associated with increased well visit receipt. Of the SDH factors, unemployment and education contributed the most to the explained difference in large rural towns while unemployment, education, and food deserts contributed significantly to the small/isolated town difference.

Conclusions: The receipt of pediatric preventive care is slightly lower in rural communities. While modest, the largest part of the rural-urban preventive care gap can be explained by differences in provider type, poverty, unemployment, and education levels. More could be done to improve pediatric preventive care in all communities.

Keywords: rural health care; social determinants of health; well-child care

Academic Pediatrics 2021;21:93−100

What's New

Differences in rural-urban pediatric preventive care are explained by provider or social determinant of health factors. More should be done so all children receive preventive care and select factors should be considered to increase prevention for children in rural communities.

Around 20% of children in the United States live in rural communities.[1] With the relative decline of rural economies, children in rural communities now have higher rates of disabilities, poverty, and mental disorders. They are also less likely to have access to pediatric specialists, have a medical home, or receive high-quality care, especially for mental disorders and other chronic conditions.[2,3]

Even as we acknowledge these challenges, rural-urban disparities in health care access and utilization continue to grow.[4,5] Most literature examining these disparities addresses distance to care,[6] provider supply,[7] and access to health care services[8] and how these factors negatively impact rural communities. Less emphasis has been placed on community-level factors, although poverty, unemployment, and related sequelae have increased.[9] Along with the decline of rural economies, rural schools and children's services are declining relative to other parts of the country, and negatively impacting the health and well-being of children.

Although there are many ways to define social determinants of health (SDH), we can view them on the community level.[10] Housing conditions, education levels, workers that commute, lack of access to fresh food (food deserts), health insurance rates, and unemployment rates impact the health of community members. Counties with higher unemployment and mental health clinician shortages can experience higher neonatal abstinence syndrome rates.[11] County-level demographic, educational, and economic factors are associated with health care utilization and drug adherence.[12]

Recently, the rural-urban gap in economic and other SDH community-level factors has widened, particularly in Appalachia. The Appalachian regional population experiences

lower income levels, lower educational achievement, and is older.[13] The region also displays more obesity, opioid misuse, and smoking.[13] While some of these characteristics make Appalachian communities distinct from other communities, Appalachia resembles many rural communities that experience higher uninsured rates,[14] higher unemployment,[15] and lower high school graduation.[16] In addition to limited health care access, another theme common among rural communities is limited access to other services, like grocery stores, leading to food insecurity.[17]

The way SDH factors impact an urban community may be quite different than the way they impact a smaller rural community. Understanding the nuances of how SDH factors contribute to disparities in health care utilization among different types of communities is vital for effective child health interventions. One tool for considering the specific contributions of SDH is regression decomposition, a nonlinear multivariate regression decomposition model. Regression decomposition is a commonly used econometric approach to understand group differences, including racial health disparities,[18] gender wage disparities,[19] and rural-urban health disparities.[20] In this study, we assessed if preventive care utilization differed by rurality and, using regression decomposition, what patient, provider, and SDH factors contributed to that rural-urban preventive care disparity.

METHODS

DATA

We used Medicaid administrative claims data from January 2017 to December 2019 from members of a pediatric Accountable Care Organization (ACO), Partners For Kids (PFK), in Ohio. The study population included the following Medicaid eligible groups: low-income families, foster care children, and disabled children. The study outcomes were Healthcare Effectiveness Data and Information Set (HEDIS) Child and Adolescent Well-Care (AWC) visit measures. Following HEDIS methodology, this meant eligible enrollees were covered by Medicaid for at least 11 of the last 12 months. HEDIS measures were calculated using administrative claims data without electronic health record review. Study outcomes included: W15, W34, well-child care, ages 7 to 11, and AWC, obstetrician-gynecologist. Children were either age 15 months or between the ages of 3 and 21 years during the calendar year. We excluded the well-child visit for 2-year-olds as they could be eligible for 2 measures in the same calendar year. The W15 measure was calculated among eligible children (age 15 months) who received at least 6 preventive care visits with a primary care provider (PCP) by age 15 months. The W34 was calculated among eligible 3- to 6-year-olds who received at least 1 preventive care visit with a PCP within 12 months. The well-child care, ages 7 to 11 was similarly calculated but among 7- to 11-year-olds. Finally, the AWC was measured among 12- to 21-year-olds who received at least 1 preventive care visit with a PCP or obstetrician-gynecologist provider within 12 months. We additionally restricted this analysis to Medicaid enrollees residing outside Columbus, Ohio and without an attributed provider practicing in Columbus, Ohio. This restriction was due to the many child health focused interventions occurring in the city during this time period.

Community-level data were obtained from the Health Resources and Services Administration Area Health Resource File. Using 5-digit zip code information on Medicaid enrollees, we connected data with the 2017 5-year American Community Survey estimates (2013−2017) census tract-level data. Census tracts are defined by the US Census Bureau and are subdivisions of US counties.[21] On average, they have a population of 4000, but can have as few as 1200 residents or as many as 8000.[21] We included the 2015 Food Access Research Atlas from the US Department of Agriculture Economic Research Service to determine census tract food access. We additionally used the National Plan and Provider Enumeration System National Provider Identifier registry to link Medicaid enrollees' attributed provider to provider-level data.[22] Practice-level characteristics were also included in the model. This included an indicator for practices engaged in quality improvement projects with PFK (QI-engaged practice) and for financially contracting with PFK (PFK-contracted practice).

RURAL-URBAN CLASSIFICATION

We used the Rural-Urban Commuting Area Secondary codes to create our rural-urban variable. Categorization B was used to separate the census tracts into urban, large rural city/town, and small/isolated small rural town.[23]

STATISTICAL ANALYSIS

We used a nonlinear multivariate regression decomposition model. We stratified by rural-urban residence to understand the contribution of different factors to the difference in well-child visit receipt. Regression decomposition separates these differences into those due to observed characteristics ("explained" differences) and unexplained differences.[19] The explained differences are due to the distribution of their observed characteristics; in this case, the portion explained by observed characteristics of the rural and urban communities. The unexplained differences are due to the model coefficients, or the behavioral responses of these groups. In this analysis, the unexplained portion relates to the association between the community characteristics and the outcome in a model that includes only rural or only urban Medicaid enrollees. We used the multivariate decomposition for nonlinear response models as our outcome variable was binary.[24] We compared gaps in receipt of well-child visits between large rural town versus urban and between small/isolated rural town versus urban.

Differences between urban, large rural city/town, and small/isolated rural towns were tested using appropriate analysis of variance and chi-square tests. Two-sided P values $<.05$ were considered statistically significant. All

statistical analyses were performed using Stata, version 16.0 (StataCorp, College Station, Tex).[25]

This study received approval from the Nationwide Children's Hospital Institutional Review Board with a waiver of consent.

RESULTS

Between 2017 and 2019, there were 453,519 eligible Medicaid enrollees with an attributed health care provider (Table 1). Children in rural towns were slightly older, and fewer enrolled in care coordination. The provider and practice characteristics differed by community size as well. Children from small/isolated rural towns were less likely to have a female provider (46.1%) compared to large rural cities/towns (49.9%) and urban cities (51.7%, $P < .001$). Children from large rural cities and towns had more attributed providers at QI-engaged practices (27.6%) than children from small/isolated rural towns (21.6%) and urban cities (18.0%, $P < .001$). However, children from small/isolated rural towns had fewer attributed providers at PFK-contracted practices (17.9%) compared to large rural cities/towns (27.7%) and urban cities (29.3%, $P < .001$). Rural children also had more nonphysicians (20.4% small/isolated rural, 15.1% large rural, 6.6% urban, $P < .001$) and fewer pediatricians (42.5% small/isolated rural, 53.1% large rural, 64.1% urban, $P < .001$) as their attributed provider.

In addition, these communities differed by their community SDH characteristics (Table 1). The percentage of high school graduates decreased as children resided in more rural communities. Residing in a food desert occurred more frequently in rural communities compared to urban cities. The percentage of uninsured and unemployment increased with rurality.

In general, receipt of the well-child visit occurred more frequently in urban children compared to rural children (Table 2). We see the largest differences in well-child visits among children between the ages of 7 and 11 years of age. Among these 7- to 11-year-olds, children in large rural towns and small/isolated rural towns received an annual well-child visit less frequently (47.4% and 45.0%, respectively) than urban children (56.4%, $P < .001$). Among all well-child visit measures, children in large rural towns and small/isolated rural towns received an annual well-child visit less frequently (58.2% and 55.5%, respectively) than urban children (61.2%, $P < .001$).

We assessed the patient, provider, and SDH community-level factors contributing to the large rural city/town-urban city difference (Table 3). In all well-child visit measures, the characteristics of patients, their providers, and their communities explained ~55.8% of the 3.0 percentage point difference. Having a pediatrician, level of education, and county unemployment contributed to most of this difference. This meant that if children from large rural towns were served by a similar number of pediatricians as urban children, the overall difference in well-child visit receipt would decrease by ~1.0 percentage point. Decreasing the percentage of children with a nonphysician attributed provider would increase the difference by 0.2 percentage points. If children from large rural cities and towns resided in communities with higher levels of education, the difference in well-child visit receipt would decrease by 0.2 percentage points. Finally, if these children resided in communities with lower unemployment, the difference in meeting the well-child visit

Table 1. Sample Characteristics of Well-Child Eligible Medicaid Enrollees, Their Providers/Practices, and Their Communities, 2017 to 2019

	Urban	Large Rural City/Town	Small/Isolated Rural Town	*P* Value
N	188,100	195,336	70,083	
Patient characteristics				
Age in years, n (%)				
1	7430 (3.95)	8275 (4.24)	2667 (3.81)	<.001
3–6	45,707 (24.30)	47,327 (24.23)	16,056 (22.91)	
7–11	56,427 (30.00)	58,143 (29.77)	20,570 (29.35)	
12–21	78,536 (41.75)	71,591 (41.77)	30,790 (43.93)	
Female, n (%)	91,012 (48.38)	95,119 (48.70)	34,193 (48.79)	.077
Enrolled in care coordination, n (%)	1241 (0.66)	1028 (0.53)	368 (0.53)	<.001
Provider/practice characteristics				
Female provider, n (%)	97,272 (51.71)	97,512 (49.92)	32,309 (46.10)	<.001
Quality improvement engaged practice, n (%)	33,873 (18.01)	53,937 (27.61)	15,102 (21.55)	<.001
PFK-contracted practice, n (%)	55,068 (29.28)	58,065 (29.73)	12,543 (17.90)	<.001
Nonphysician, n (%)	12,397 (6.59)	29,490 (15.10)	14,260 (20.35)	<.001
Pediatrician, n (%)	120,571 (64.10)	103,699 (53.09)	29,803 (42.53)	<.001
Community SDH characteristics*				
Average percentage owner occupied housing	68.41	62.46	68.49	<.001
Average percentage high school graduate or more	91.30	87.86	84.99	<.001
Average percentage commute 60 minutes or more	6.42	7.39	11.35	<.001
Average percentage residing in food desert	19.69	31.58	30.82	<.001
Average percentage uninsured	6.65	6.95	8.75	<.001
Average percentage unemployed	4.88	7.90	8.08	<.001

PFK indicates Partners For Kids; SDH, social determinants of health.

P values from chi-square tests or ANOVA tests.

*Average at the census tract level.

Table 2. Percentage of Well-Child Visit Receipt Among Sample of Eligible Medicaid Enrollees by Rurality

	Urban n (%)	Large Rural City/Town n (%)	Small/Isolated Rural Town n (%)	*P* Value
Well-child care, age 15 months	4105 (55.25)	4362 (52.71)	1314 (49.27)	<.001
Well-child care, ages 3–6 years	35,940 (78.63)	37,066 (78.32)	12,433 (77.44)	.007
Well-child care, ages 7–11 years	31,813 (56.38)	27,571 (47.42)	9258 (45.01)	<.001
Adolescent well-care visit, ages 12–21 years	43,206 (55.01)	44,685 (54.77)	15,897 (51.63)	<.001
All well-child visit measures, ages 15 months and 3–21 years*	115,064 (61.17)	113,684 (58.20)	38,902 (55.51)	<.001

P value from chi-square tests.

Well-child care, age 15 months is HEDIS measure W15 and was assessed in children that turned 15 months during the calendar year. Visit receipt indicates they received 6 or more well-child visits from a primary care practitioner by 15 months of age.

Well-child care, ages 3 to 6 is HEDIS measure W34 and was assessed in children aged 3 to 6 years of age and receipt indicates the child received at least 1 well-child visit from a primary care practitioner during the year.

Well-child care, ages 7 to 11 is assessed in children aged 7 to 11 years of age and receipt indicates the child received at least 1 well-child visit from a primary care practitioner during the year.

Adolescent well-care visit is HEDIS measure AWC and was assessed in adolescents and young adults between the ages of 12 and 21 years of age. Visit receipt indicates the adolescent/young adult received at least 1 comprehensive well-care visit with a primary care provider or OB/GYN provider during the year.

*This includes all measures (W15, W34, WCC 7–11, and AWC).

measure would decrease by 0.7 percentage points. In comparing the larger ~9.0 percentage point difference seen in well-child care among older children (7- to 11-year-olds), the same factors (pediatrician, level of education, and unemployment) contribute to the explained difference. For this age group, patient, provider, and community characteristics explained less (39.6%) of the rural-urban difference.

When comparing the small/isolated rural towns to urban cities, there were larger rural-urban differences and more of this difference was explained by patient,

Table 3. Percentage Difference in Large Rural City/Town-Urban Cities Well-Child Visit Receipt "Explained" and "Unexplained" by Patient-, Provider-, and Community-Level Characteristics

	All Well-Child Visit Measures, Ages 15 Months and 3–21 Years*		Well-Child Care, Ages 7–11 Years	
	Percent (95% CI)	*P* Value	Percent (95% CI)	*P* Value
"Explained" difference	1.659 (1.398, 1.92)	<.001	3.548 (3.041, 4.055)	<.001
"Unexplained" difference	1.314 (0.915, 1.713)	<.001	5.412 (4.65, 6.174)	<.001
Total rural-urban visit receipt difference	2.973 (2.669, 3.276)	<.001	8.96 (8.392, 9.527)	<.001
"Explained" difference due to:				
Patient characteristics				
Age	−0.008 (−0.008, −0.008)	<.001	0.022 (0.019, 0.026)	<.001
Male	−0.004 (−0.005, −0.002)	<.001	0.005 (0.004, 0.007)	<.001
Enrolled in care coordination	0.013 (0.009, 0.018)	<.001	0.021 (0.014, 0.027)	<.001
Health care provider characteristics				
Female provider	0.048 (0.039, 0.056)	<.001	0.123 (0.103, 0.143)	<.001
Quality improvement engaged practice	−0.251 (−0.312, −0.19)	<.001	−0.259 (−0.365, −0.153)	<.001
PFK-contracted practice	−0.015 (−0.018, −0.012)	<.001	−0.004 (−0.006, −0.002)	.001
Nonphysician	−0.241 (−0.301, −0.181)	<.001	−0.052 (−0.165, 0.06)	.360
Pediatrician	0.978 (0.919, 1.036)	<.001	1.278 (1.152, 1.403)	<.001
SDH characteristics				
Percentage owner occupied housing	−0.072 (−0.192, 0.047)	.234	−0.061 (−0.291, 0.169)	.602
Percentage high school graduate or more	0.217 (0.036, 0.398)	.019	0.807 (0.465, 1.149)	<.001
Percentage commute 60 minutes or more	0.191 (0.12, 0.263)	<.001	0.246 (0.103, 0.388)	.001
Percentage residing in food desert	−0.013 (−0.071, 0.045)	.662	−0.162 (−0.271, −0.052)	.004
Percentage uninsured	0.139 (0.116, 0.161)	<.001	0.177 (0.134, 0.221)	<.001
Percentage unemployed	0.677 (0.42, 0.933)	<.001	1.407 (0.915, 1.898)	<.001

CI indicates confidence interval; PFK, Partners For Kids; and SDH, social determinants of health.

SDH characteristics are social determinants of health characteristics at the census-tract level.

Food desert is defined as low accessibility between 1 and 10 miles.

*This includes all measures (W15, W34, WCC 7–11, and AWC).

W15 was assessed in children that turned 15 months during the calendar year. Visit receipt indicates they received 6 or more well-child visits from a primary care practitioner by 15 months of age.

W34 was assessed in children aged 3 to 6 years of age and receipt indicates the child received at least 1 well-child visit from a primary care practitioner during the year.

WCC 7–11 (well-child care, ages 7–11) was assessed in children aged 7 to 11 years of age and receipt indicates the child received at least 1 well-child visit from a primary care practitioner during the year.

AWC was assessed in adolescents and young adults between the ages of 12 and 21 years of age. Visit receipt indicates the adolescent/young adult received at least 1 comprehensive well-care visit with a primary care provider or OB/GYN provider during the year.

Table 4. Percentage Difference in Small/Isolated Rural Town-Urban Well-Child Visit Receipt "Explained" and "Unexplained" by Patient-, Provider-, and Community-Level Characteristics

	All Well-Child Visit Measures, Ages 15 Months and 3–21 Years*		Well-Child Care, Ages 7–11 Years	
	Percent (95% CI)	*P* value	Percent (95% CI)	*P* value
"Explained" difference	5.084 (4.403, 5.765)	<.001	7.915 (6.607, 9.222)	<.001
"Unexplained" difference	0.579 (−0.215, 1.373)	.153	3.457 (1.932, 4.983)	<.001
Total rural-urban visit receipt difference	5.663 (5.243, 6.083)	<.001	11.372 (10.589, 12.155)	<.001
"Explained" difference due to:				
Patient characteristics				
Age	0.31 (0.294, 0.327)	<.001	0.037 (0.027, 0.047)	<.001
Male	−0.005 (−0.008, −0.002)	.001	0.001 (0.0001, 0.001)	.031
Enrolled in care coordination	0.018 (0.01, 0.025)	<.001	0.018 (0.008, 0.028)	.001
Health care provider characteristics				
Female provider	0.109 (0.062, 0.156)	<.001	0.204 (0.107, 0.301)	<.001
Quality improvement engaged practice	−0.007 (−0.045, 0.031)	.722	0.076 (0.017, 0.134)	.011
ACO-contracted practice	0.54 (0.403, 0.676)	<.001	0.818 (0.558, 1.077)	<.001
Nonphysician	−0.627 (−0.781, −0.473)	<.001	−0.266 (−0.554, 0.023)	.071
Pediatrician	2.00 (1.813, 2.187)	<.001	2.314 (1.935, 2.694)	<.001
SDH characteristics				
Percentage owner occupied housing	0.009 (0.005, 0.013)	<.001	0.007 (0.001, 0.014)	.027
Percentage high school graduate or more	1.07 (0.455, 1.686)	.001	1.907 (0.738, 3.076)	.001
Percentage commute 60 minutes or more	0.06 (−0.329, 0.448)	.762	0.441 (−0.302, 1.185)	.244
Percentage residing in food desert	0.278 (0.176, 0.38)	<.001	0.557 (0.37, 0.744)	<.001
Percentage uninsured	−0.100 (−0.382, 0.182)	.488	−0.728 (−1.255, −0.202)	.007
Percentage unemployed	1.428 (1.029, 1.828)	<.001	2.528 (1.749, 3.307)	<.001

ACO indicates the Accountable Care Organization; CI, confidence interval; and SDH, social determinants of health.

SDH characteristics are social determinants of health characteristics at the census-tract level.

Food desert is defined as low accessibility between 1 and 10 miles.

*This includes all measures (W15, W34, WCC 7–11, and AWC).

W15 was assessed in children that turned 15 months during the calendar year. Visit receipt indicates they received 6 or more well-child visits from a primary care practitioner by 15 months of age.

W34 was assessed in children aged 3 to 6 years of age and receipt indicates the child received at least 1 well-child visit from a primary care practitioner during the year.

WCC 7–11 (well-child care, ages 7–11) was assessed in children aged 7 to 11 years of age and receipt indicates the child received at least 1 well-child visit from a primary care practitioner during the year.

AWC was assessed in adolescents and young adults between the ages of 12 and 21 years of age. Visit receipt indicates the adolescent/young adult received at least 1 comprehensive well-care visit with a primary care provider or OB/GYN provider during the year.

provider, and SDH characteristics (Table 4). In all well-child visit measures, we see a 5.7 percentage point difference, with ~89.8% (5.1 percentage points) explained by patient, provider, and SDH characteristics. While having a pediatrician continued to explain much of the difference (2.0 percentage points), increasing the number of PFK-contracted practices, education, residing in a food desert, and unemployment also contributed to the explained difference. If rural patients had more providers working at a PFK-contracted practice the difference would decrease by 0.53 percentage points. Residing in a community with higher levels of educational attainment would decrease the difference by 1.1 percentage points. Residing in a community with lower unemployment would decrease the difference by 1.4 percentage points. Residing in a community with fewer food deserts would decrease that difference by 0.28 percentage points. As was seen in the large rural town-urban results, increasing the number of physicians would increase the difference unless that physician was a pediatrician. Again, there was a larger difference seen in 7- to 11-year-olds. Approximately 69.6% of that 11.4 percentage point difference was explained by patient, provider, and SDH characteristics. The same characteristics (PFK-contracted practice, pediatrician, education level, residing in a food desert, and unemployment) contributed to the majority of this explained difference.

Discussion

Ensuring that all children receive appropriate care is vital; however, those residing in rural communities face distinctive barriers that must be addressed for optimal care delivery. Rural communities can be stereotyped as either a bucolic life filled with fresh air, open spaces, and slow paced, friendly communities or as declining communities with deep economic losses, unwelcoming to outsiders, and slow to change; yet the realities are more nuanced.[26] Just as urban communities are not a monolith, neither are rural communities. They are often filled with contradictions that mean similar factors can impact communities in different ways.

Significant emphasis is placed on routine receipt of health promotion and prevention for pediatric patients.[27] Our study findings suggest that this message may not be reaching all communities and all age groups. As we find that pediatricians and nonphysicians contribute significantly to the rural-urban difference in well-child visit receipt, there may be more that can be done to increase this message to family practice and internal medicine

providers, particularly in rural communities. Additionally, nurse practitioners and physician assistants are valuable providers in these communities and ensuring the inclusion of their voices in the discussion of rural health care delivery remains vital. As we consider the types of providers in these different communities, our findings do not necessarily mean that more pediatricians or more PFK-contracted practices are required in rural communities. However, it does require thoughtful consideration of how provider type in these communities informs initiatives to promote preventive services. In small rural communities, federally qualified health centers and local health departments may provide more of the clinical care. Given how their payment structures differ from other clinical practices, ACOs may be less likely to contract with federally qualified health centers or local health departments, and thus less likely to be able to financially incentivize or otherwise support increased preventive services by such providers. Consequently, thinking about how we improve health outcomes and increase well-child visits without health system consolidation is important. While there is a very modest discrepancy favoring urban cities for this care, unfortunately, the rates in both urban and rural areas among Medicaid enrollees are low, with almost half of children and adolescents not receiving preventive care.

The modest differences in our study between rural and urban areas for health promotion and prevention, typically delivered in primary care,[27] contrast to prior studies of rural-urban disparities in use of pediatric specialty care where large differences have been found.[28] One factor that may have influenced the higher than expected primary care in this part of Appalachian Ohio is the presence of a pediatric Medicaid ACO that provides some incentives for a subset of pediatric providers to deliver well care, helps practices to conduct quality improvement projects on well care, and assists Community Health Centers in the expansion of direct health care services to some schools in the area. The overall 5.7 percentage point gap for children from small and isolated rural towns, if corrected, would translate into an additional 3967 children receiving timely health maintenance and preventive services for the ACO. This degree of improvement would also represent significant gains, both from a financial and population health perspective, for the managed care plans that are typically held accountable by state Medicaid agencies for HEDIS well-child measures.

Among older children, other factors appear to make up a larger portion of the difference. The lack of immunization requirements and immunization exceptions for school enrollment could account for some of these differences in older children. Rural communities are more likely to have nonmedical exemptions to immunizations and if this is a motivating reason for a well-child visit, this could impact preventive care utilization.[29] Additionally, this older age group (7- to 11-year-olds) is generally not yet subject to physicals for team sport participation which is another reason children may visit their health care provider. This well-child measure among 7- to 11-year-olds was not included in specifications for HEDIS measures until 2020, perhaps reducing the focus by state Medicaid programs and commercial health plans on promoting well-child visits for this age group. While others have found preventive health care counseling and services are less utilized in rural communities,[30] they have focused on states where transportation, weather, and provider supply issues may play a more substantial role than in Ohio.[31,32] Using Ohio with a large low-income, rural Appalachian community allows us to understand how other SDH factors, such as those related to poverty and educational attainment, are associated with preventive health care utilization.

Across the United States, we often say urban or rural as though they are monolith definitions, misrepresenting how communities vary significantly from one another. For example, community characteristics of larger rural towns may impact health care utilization in a different way than in smaller or isolated rural towns. Regardless of this variability, financial barriers and distressed economic conditions of the community negatively impact families residing within the community. We find that county unemployment was one of the largest SDH contributors to the rural-urban preventive care gap. Literature has demonstrated that unemployment and health disparities co-exist,[33] and our findings are consistent with those studies. Responses should be tailored according to the variety of American rural communities as we undertake mitigating how SDH factors negatively influencing communities.

As we address rural health disparities, regression decomposition provides insight into what factors account for these differences. Results can guide us as we design interventions and implement policies improving access and health care use in different communities across the country. However, informed conversations with community partners will be crucial for effective interventions and policies.

In rural communities, education level contributes significantly to the preventive care utilization gap. There could be multiple reasons for the difference, including differences in the types of jobs held and parent's flexibility to schedule their child's medical appointments. Although low health literacy affects all income and education levels, those with less education may also have lower health literacy.[34] Literature has shown worse health outcomes among those with lower health literacy.[35] Addressing the educational needs of communities may increase health literacy as well as decrease unemployment. These improvements could increase families' ability to access and utilize care services. As economic and educational factors are closely aligned with one another, educational gains in rural communities could help to not only increase appropriate health care utilization but also improve the economic well-being of rural communities. In small/isolated rural communities, access to resources may play a more significant role than in larger rural communities. Food desert census tracts may be areas with less access to other resources and support services. Ensuring food security or increasing access to other services could help support families.

There are several limitations to our study. The measures were calculated using Medicaid administrative claims data without an electronic health record review and there may be coding differences by rural and urban providers impacting the rural-urban difference. These data are retrospective and only looked at well-child visit receipt. As such, we cannot make any claims on the quality of the well-child visit or on any other type of care. Individuals residing in rural regions have been described as being more medically complex.[36] Although this study assessed medical complexity by analyzing a patient level factor of receiving care coordination, this approach may not fully capture how medical complexity contributes to rural urban difference in the delivery of well-child care. Due to the study design, associations, not causal relationships, were measured.

Pediatric ACOs remain uncommon and therefore the experience of a Medicaid ACO may not generalize to other populations. As stated earlier, rural is not a monolith and rural communities in South Central Ohio may look quite different than other parts of the country. The results from this paper are not generalizable to all rural and urban communities. However, results provide insight into some of the ways that community-level SDH characteristics are associated with health care utilization. Furthermore, the analyses do not account for ACO quality improvement projects that occurred within Franklin county but have spillover effects in rural counties.

We find modest differences in preventive care among Ohio pediatric Medicaid enrollees, with widening disparities by rurality. We also find that provider and SDH characteristics explained more of the rural-urban preventive health care utilization disparity in small/isolated rural towns than in larger rural communities. Rural heterogeneity across the country could lead to variability in such health care disparities. While the disparity in preventive health care utilization may not seem large, recognizing the ways SDH characteristics are associated with health care utilization will be important in future discussions of health care delivery.[37] Finally the percentage of children receiving guideline concordant preventive care across all communities is low and suggests that much more could be done to improve the care that Medicaid children receive.

CONCLUSIONS

Although only slightly less likely to receive preventive services than urban children, rural children are still missing a great deal of preventive care in the traditional medical model. This model will be under further assault with the harsh economic realities in many rural communities as many health clinics and hospitals face financial challenges and closure.[8] Rural provider offices are often smaller and those in private practice may find it financially unsustainable to remain open. As access to specialty and primary care decreases in these rural communities, it is likely that utilization disparities will widen. There are no simple approaches to reversing the decline of rural communities and increasing preventive care for the children residing there.

There is a recognition that financial investment in local health departments, social services, and population health is scarce in rural communities, making successful interventions challenging.[38] Even though community assets for addressing social determinants may be scarce, such assets can still be more integrated with ACOs and other agencies so that the safety net weave is as tight as possible. Low density of health professionals and patients demands optimal use of technology to deliver care remotely. Rural communities need tailored policies that allow flexibility considering the greater challenges they face. ACOs and other health care systems should work in partnership with health plans, government agencies, community organizations, and other stakeholders to adapt systems needed to support the health of rural families in these uncertain times.

ACKNOWLEDGMENTS

We gratefully acknowledge Dr Sean Gleeson and Kimberly Conkol for their valuable insights and thoughtful manuscript edits. We also thank the Partners For Kids Data Team for their efforts to share information included in the analyses.

REFERENCES

1. U.S. Department of Health and Human Services Health Resources and Services Administration Maternal and Child Health Bureau. *The Health and Well-Being of Children in Rural Areas: A Portrait of the Nation 2007*. Rockville, Md: U.S. Department of Health and Human Services; 2011.
2. Henning-Smith C, Prasad S, Casey M, et al. Rural-urban differences in Medicare quality scores persist after adjusting for sociodemographic and environmental characteristics. *J Rural Health*. 2019;35:58–67.
3. Nayar P, Yu F, Apenteng BA. Frontier America's health system challenges and population health outcomes. *J Rural Health*. 2013;29:258–265.
4. Kilany M, Morrissey JP, Domino ME, et al. Utilization and adherence in medical homes: an assessment of rural-urban differences for people with severe mental illness. *Med Care*. 2018;56:870–876.
5. Yawn BP, Mainous AG 3rd, Love MM, et al. Do rural and urban children have comparable asthma care utilization? *J Rural Health*. 2001;17:32–39.
6. Buzza C, Ono SS, Turvey C, et al. Distance is relative: unpacking a principal barrier in rural healthcare. *J Gen Intern Med*. 2011;26 (suppl 2):648–654.
7. deSante-Bertkau JE, Shubkin CD, Nelson WA, et al. When specialty care is unavailable to rural families. *Pediatrics*. 2019;144:e20191120. https://doi.org/10.1542/peds.2019-1130.
8. Germack HD, Kandrack R, Martsolf GR. When rural hospitals close, the physician workforce goes. *Health Aff*. 2019;38:2086–2094.
9. Anderson BR, Fieldston ES, Newburger JW, et al. Disparities in outcomes and resource use after hospitalization for cardiac surgery by neighborhood income. *Pediatrics*. 2018;141:e20172432. https://doi.org/10.1542/peds.2017-2432.
10. Sokol R, Austin A, Chandler C, et al. Screening children for social determinants of health: a systematic review. *Pediatrics*. 2019;144:e20191622.
11. Patrick SW, Faherty LJ, Dick AW, et al. Association among county-level economic factors, clinician supply, metropolitan or rural location, and neonatal abstinence syndrome. *JAMA*. 2019;321:385–393.

12. Cook BL, Zuvekas SH, Chen J, et al. Assessing the individual, neighborhood, and policy predictors of disparities in mental health care. *Med Care Res Rev*. 2017;74:404–430.
13. Pollard K, Jacobsen LA. The Appalachian region: a data overview from the 2013−2017 American Community Survey. Chartbook. Appalachian Regional Commission; 2019. Available at: https://www.arc.gov/research/researchreportdetails.asp?REPORT_ID=159. Accessed February 3, 2020.
14. Coburn AF, McBride TD, Ziller EC. Patterns of health insurance coverage among rural and urban children. *Med Care Res Rev*. 2002;59:272–292.
15. Keyes KM, Cerda M, Brady JE, et al. Understanding the rural-urban differences in nonmedical prescription opioid use and abuse in the United States. *Am J Public Health*. 2014;104:e52–e59.
16. Byun SY, Meece JL, Irvin MJ. Rural-nonrural disparities in postsecondary educational attainment revisited. *Am Educ Res J*. 2012;49:412–437.
17. Mayer VL, Hillier A, Bachhuber MA, et al. Food insecurity, neighborhood food access, and food assistance in Philadelphia. *J Urban Health*. 2014;91:1087–1097.
18. Benmarhnia T, Huang J, Basu R, et al. Decomposition analysis of black−white disparities in birth outcomes: the relative contribution of air pollution and social factors in California. *Environ Health Perspect*. 2017;125:107003.
19. Oaxaca R. Male-female wage differentials in urban labor markets. *Int Econ Rev*. 1973;14:693–709.
20. Sharaf MF, Rashad AS. Regional inequalities in child malnutrition in Egypt, Jordan, and Yemen: a Blinder-Oaxaca decomposition analysis. *Health Econ Rev*. 2016;6:23.
21. US Census Bureau. Glossary. Available at: https://www.census.gov/programs-surveys/geography/about/glossary.html#par_textimage_13. Accessed July 30, 2020.
22. Centers for Medicare & Medicaid Services. NPI files. 2019. Available at: https://download.cms.gov/nppes/NPI_Files.html. Accessed December 17, 2019.
23. RUCA data: using RUCA data. Available at: https://depts.washington.edu/uwruca/ruca-uses.php. Accessed January 7, 2020.
24. Powers DA, Yoshioka H, Yun MS. mvdcmp: multivariate decomposition for nonlinear response models. *Stata J*. 2011;11:556–576.
25. StataCorp. *Stata Statistical Software: Release 16*. College Station, Tex: StataCorp LLC; 2019.
26. Bostrom M. Perceptions & misperceptions: an analysis of qualitative research exploring views of rural America. Public Knowledge LLC: A Report Prepared for the Kellogg Foundation. 2003. Available at: https://www.frameworksinstitute.org/publication/perceptions-misperceptions-an-analysis-of-qualitative-research-exploring-views-of-rural-america/. Accessed February 17, 2020.
27. American Academy of Pediatrics. Bright futures. Available at: https://brightfutures.aap.org/Pages/default.aspx. Accessed February 20, 2020.
28. Leonhard MJ, Wright DA, Fu R, et al. Urban/rural disparities in Oregon pediatric traumatic brain injury. *Inj Epidemiol*. 2015;2:32.
29. Wang E, Clymer J, Davis-Hayes C, et al. Nonmedical exemptions from school immunization requirements: a systematic review. *Am J Public Health*. 2014;104:e62–e84.
30. Probst JC, Moore CG, Baxley EG, et al. Rural-urban differences in visits to primary care physicians. *Fam Med*. 2002;34:609–615.
31. Earle LP, Burman ME. Benefits and barriers to well-child care: perceptions of mothers in a rural state. *Public Health Nurs*. 1998;15:180–187.
32. Greene J. Using consumer incentives to increase well-child visits among low-income children. *Med Care Res Rev*. 2011;68:579–593.
33. Bartley M. Unemployment and ill health: understanding the relationship. *J Epidemiol Community Health*. 1994;48:333–337.
34. Yin HS, Johnson M, Mendelsohn AL, et al. The health literacy of parents in the United States: a nationally representative study. *Pediatrics*. 2009;124(suppl 3):S289–S298.
35. Dewalt DA, Berkman ND, Sheridan S, et al. Literacy and health outcomes: a systematic review of the literature. *J Gen Intern Med*. 2004;19:1228–1239.
36. Cohen E, Berry JG, Camacho X, et al. Patterns and costs of health care use of children with medical complexity. *Pediatrics*. 2012;130:e1463–e1470. https://doi.org/10.1542/peds.2012-0175.
37. Fierman AH, Beck AF, Chung EK, et al. Redesigning health care practices to address childhood poverty. *Acad Pediatr*. 2016;16(3 suppl):S136–S146.
38. Leider JP, Meit M, McCullough JM, et al. The state of rural public health: enduring needs in a new decade. *Am J Public Health*. 2020;110:1283–1290.