Medicaid Managed Care Reduces Readmissions for Youths With Type 1 Diabetes

Kathleen Healy-Collier, CSSBB, DHA; Walter J. Jones, PhD; James E. Shmerling, DHA, FACHE; Kenneth R. Robertson, MD, MBA; and Robert J. Ferry, Jr, MD, FAAP

ABSTRACT

Objectives: To determine whether the likelihood of readmission (adjusted for severity on first admission) for pediatric type 1 diabetes (T1D) differs between Medicaid managed care and non–managed care.

Study Design: De-identified patients were retrospectively selected from the Pediatric Health Information Systems database of the Children's Hospital Association (CHA). The cohort of 42 hospitals across 25 states included discharges between 2008 and 2011 for patients who were receiving Medicaid at the time of service and had T1D as their diagnosis.

Methods: Multiple factors and co-variants for readmission were analyzed by logistic regression, including age, race, gender, severity of illness, and state of admission.

Results: Of 14,544 T1D discharges with Medicaid, 4985 were readmitted, including 1792 readmitted for diabetic ketoacidosis (DKA). Despite similar rates of DKA between the managed care and non–managed care cohorts, overall 90-day readmission was 1.12 times more likely for Medicaid patients on non–managed care plans than those on managed care (odds ratio, 1.12; range = 1.04-1.20; both adjusted for severity of illness). Significant contributors were race, age, and gender; the relationship of location (state) and days between readmissions was also significant. The conservative estimate of cost reduction from Medicaid managed care related to lower readmission rate for pediatric T1D across CHA institutions between 2008 and 2011 was $2.6 million.

Conclusions: From the largest, national, defined cohort available for contemporary study, youths with T1D on Medicaid managed care plans were less likely to be readmitted within 90 days of discharge.

Am J Manag Care. 2016;22(4):250-256

As many as 3 million US individuals were affected by type 1 diabetes (T1D) in 2011, with youths aged under 20 years comprising a large group at particular risk for healthcare disparities.[1] Over 15,000 US children are newly diagnosed with T1D each year,[1] and for unclear reasons, the incidence of T1D in children under the age of 14 has been reported to be increasing by 3% annually worldwide.[2,3] Most alarming, the incidence of diabetic ketoacidosis (DKA) in the United States continues to increase even more rapidly than the incidence of patients being newly diagnosed with diabetes.[4-6] Since readmission for pediatric DKA is expensive, associated with significant morbidity and mortality, and largely preventable, active research has been focusing on variation in resource use.[6]

A significant proportion of youths are enrolled in a state Medicaid program, and lack of standardization among these programs can contribute to disparities in access and quality of care for those with diabetes.[7] Many state Medicaid programs have had some level of managed care penetration for over 30 years, with mixed evidence for reduced healthcare costs in adults.[8-11] Medicaid programs have been set up as traditional indemnity plans, or as various managed care organizations (MCOs) with mixed levels of implied risk. The potential benefits of MCOs include provision of comprehensive healthcare at reduced cost.[11] Economic and clinical strategies within managed care plans also directly affect physician compliance with best practices, efforts to improve outcomes, and coordination of care across clinical services through case management.[12-15] Tools applied within MCOs have included: 1) maintaining a "gatekeeper" in efforts to improve coordination of care, 2) limiting access to services with prior authorizations and pre-certifications, 3) limiting formularies, 4) sharing risk by arrangement, and 5) controlling access to supplies and equipment.[11]

Although each state coordinates its own Medicaid program, the federal government now pays an average of 57% of the total Medicaid program costs.[10,16] As leaders of federal and state Medicaid programs have recognized the rising cost, they have implemented programs to manage care in order to reduce expenditures; this trend has accelerated over the past 15 years, despite mixed evidence of actual cost reduction (vs traditional fee-for-service).[17] Medicaid expansion and reforms related to the Affordable Care Act (ACA) will hopefully yield more meaningful analyses in this regard.

Take-Away Points

This large national study of 42 free-standing children's hospitals across 25 states compared youths with type 1 diabetes (T1D) on Medicaid insurance who received a managed care product with peers who did not. Key findings were:

- Youths with T1D on Medicaid managed care were less likely to be readmitted within 90 days, adjusting for severity, despite similar rates of diabetic ketoacidosis (DKA).
- States displayed wide variation in overall readmission rates for diabetes and those presenting in DKA.
- Policy makers should build on specific successes with the use of managed care tools (eg, case management, health information technology) to reduce preventable readmissions related to pediatric T1D.

Compounding regional workforce challenges for youths with diabetes,[18] recent studies have demonstrated that those with public or no insurance were more likely to be hospitalized than those on private insurance.[19] Market efforts to evaluate the effects of competition and risk models through managed care have yielded mixed evidence for optimizing clinical outcomes.[20] To our knowledge, no study to date has focused directly on the national impact of managed care on pediatric diabetes.

Using the Pediatric Health Information Systems (PHIS) database from the Children's Hospital Association (CHA), the present study compares managed care to non–managed care by evaluating all readmissions within 90 days for youths with T1D receiving Medicaid. The goal of this research is to understand the effects of managed care for youths admitted on their initial visits with T1D, those readmitted for T1D, and those readmitted for DKA, while adjusting for admissions related to nondiabetic issues.

METHODS

Forty-two institutions across 25 states comprise the CHA, the nation's largest consortium of children's hospitals. De-identified administrative and clinical data were retrieved from the CHA's PHIS database between 2008 and 2011. The primary sample was the multi-state cohort of all patients from the CHA data set, including 25 states and 42 children's hospitals that had consistently submitted data between 2008 and 2011; 1 hospital was removed from the data analysis due to inconsistencies with data from that site. Data for analysis included all patients who were discharged from any participating CHA institution between 2008 and 2011. Data were filtered for those patients on a Medicaid program, and then for T1D; all episodes were grouped using the All Patients Refined Diagnosis-Related Group approach, with severity of illness assigned on the first admission. Data for the sample were based on the following final diagnoses for any patient in the data set: 250.01 (T1D without mention of complication; 50%); 250.03 (uncontrolled T1D; 6%); 250.11 (T1D with ketoacidosis, not stated as uncontrolled; 3%); and 250.13 (T1D with ketoacidosis, uncontrolled; 41%).

Across the 42 hospitals contributing to the data set, 14,544 patients with diabetes on in-state Medicaid were flagged as either "managed care" (7835) or "other" (6709). We excluded out-of-state Medicaid patients due to concern about potential confounding of the analysis if the patient was unlikely to return to the same hospital. Although the analysis included all patients with these diagnoses, data were classified as either: 1) all diabetic readmissions with a coded diabetes diagnosis, or 2) all diabetes, whether readmitted or not with DKA. Across the data set, 9633 patients with diabetes were not readmitted (66.6%) (Table 1), and of the 4985 readmissions, 1792 were diagnosed with DKA. For this retrospective longitudinal cohort, all participants were continuously enrolled over the time period studied and were not excluded if they did not have a readmission.

The dependent variable was diabetic readmission for diabetes (Yes/No) or for diabetes with DKA (Yes/No). The independent variables were managed care flag (primary as a categorical variable) and age, gender, race, and severity of illness on first admission. Covariates were measured at the time of discharge. The blinded data set lacked personal health information linked to any specific patient. Severity of illness was determined by CHA institutions, as previously described.[21] All analyses were performed using SAS version 9.2 (SAS Institute, Cary, North Carolina). The CHA and the Medical University of South Carolina Institutional Review Board approved the study.

To estimate the cost savings associated with reduced readmissions, we adapted our previously reported method.[22] Based on 1 representative CHA hospital's average daily charge ($4695) for ward admission of pediatric diabetes, we multiplied this average daily charge by the CHA's reported average for readmission length of stay and by the calculated difference in readmission rates with managed care. Cost estimates are reported in 2013 US dollars.

Table 1. Raw Rates for Diabetic Readmission Across All Points of Re-entry[a] in 42 CHA Institutions, 2008-2011

Hospital State	Total Hospitals	Readmit With Diabetes	Readmit Diabetes Primary	Readmit With DKA
AL	1	17.74%	16.03%	16.03%
AR	1	15.03%	13.34%	13.04%
AZ	1	11.49%	9.58%	4.60%
CA	6	7.14%	6.47%	4.89%
CO	1	7.75%	5.54%	3.69%
CT	1	6.82%	6.82%	5.68%
FL	2	16.38%	14.82%	12.95%
GA	1	8.25%	7.87%	6.72%
IL	1	10.28%	8.27%	5.51%
IN	1	8.23%	6.96%	6.33%
LA	1	17.19%	14.84%	14.06%
MA	1	13.64%	11.93%	7.95%
MI	1	27.33%	24.82%	25.33%
MN	1	11.44%	10.90%	8.99%
MO	2	25.35%	23.56%	18.54%
NE	1	4.49%	4.08%	3.67%
NY	2	23.54%	21.35%	18.61%
OH	4	15.22%	13.42%	11.52%
PA	2	11.44%	10.04%	7.53%
TN	3	15.67%	15.31%	14.86%
TX	4	15.55%	14.32%	14.06%
UT	1	8.81%	7.25%	7.77%
VA	1	14.81%	14.03%	14.03%
WA	1	11.97%	10.83%	10.54%
WI	1	14.79%	12.68%	12.68%
Total[b]	**42**	**14.96%**	**13.57%**	**12.10%**

CHA indicates Children's Hospital Association; DKA: diabetic ketoacidosis; readmit, readmitted.
[a] Including inpatient, observation, and emergency department.
[b] One hospital was removed from this total due to data integrity issues from the site and was not included in this table.

RESULTS

During the study period, 14,544 qualifying discharges for pediatric diabetes among 42 hospitals met our entry criteria, and these data represented 12,618 individual patients. Table 1 illustrates the total numbers of readmissions by category. Patients are not unique in each category because those who are readmitted for diabetes may also be readmitted due to DKA. Overall, 14.9% of the 12,618 patients were readmitted with a diagnosis of T1D within 90 days, and 12.1% of those were readmitted with DKA. Time to readmission ranged from 0 to 90 days, with a mean of 38.5 days between readmissions.

Crude readmission rates for diabetes, sorted by state (Table 1), ranged from 4.08% to 24.82% (mean = 13.57%), with readmission rates for DKA ranging from 3.69% to 25.33% (mean = 12.10%). For the overall diabetic admission rate, the patient's race (P <.0001), age (P <.0001), and gender (P <.03) were all significant factors (Table 2). When combined with any of these factors, the primary insurance type contributed significantly to the model. Adjusting for severity of illness, logistic regression revealed that overall readmissions at 90 days were 1.12 times more likely for Medicaid patients on non–managed care plans than for those on managed care plans (odds ratio, 1.12; 95% CI, 1.04-1.20) (Table 3). When both the overall diabetic readmission rate and the DKA readmission rate were introduced as factors into the model, primary insurance type became more significant. Analysis demonstrated a highly significant relationship between the US state and the number of days between readmissions (P <.0001), even after adjusting for severity. For those patients readmitted with DKA, we observed no difference in readmissions between managed care and non–managed care groups. No significant differences were observed for DKA readmissions at 7 days or 30 days.

To estimate actual cost savings from managed care during this study period, we assessed the observed rate of readmission of 14.9% for 14,544 readmissions; thus, 2167 readmissions were diabetes-related. The average daily charge for ward admission of pediatric patients with T1D was $4695 at one CHA-participating hospital, which can be used as an average amount across the other CHA hospitals.[22] During this study period, the CHA reported that the average readmission length of stay for pediatric diabetes was 2.37 days, and the calculated difference in overall readmission rates with Medicaid managed care was 7.6%, or 549 readmission days, between 2008 and 2011. Adapting our previously reported method[22] conservatively yields an estimated cost savings of $2.6 million for the overall 4 years (2008-2011), or $644,388 per year with Medicaid managed care across the CHA.

DISCUSSION

To our knowledge, this study is the first national, multihospital evaluation of readmission rates for children with diabetes on Medicaid by focusing on the type of health plan and its relationship to readmissions. This is also the first national study to demonstrate that youths with T1D enrolled in Medicaid managed care plans are significantly less likely to be readmitted compared with non–managed care Medicaid plans. We observed significant differences

Table 2. Sociodemographic Characteristics With Severity of Illness and Risk of Mortality of T1D Patients in 42 CHA Institutions

Variable	Managed Care n (%)	Non–Managed Care n (%)	*P* Baseline
Race			
White	3829 (26.3%)	3092 (21.3%)	<.0001
Black	3086 (21.4%)	2522 (17.3%)	
Other	920 (6.3%)	1095 (7.5%)	
Gender			
Male	3376 (23.2%)	3014 (20.7%)	.03
Female	4459 (30.7%)	3695 (25.4%)	
Age, years			
<1	22 (0.2%)	35 (0.2%)	
1-2	274 (1.9%)	271 (1.9%)	
3-5	589 (4.0%)	472 (3.2%)	<.0001
6-12	3156 (21.7%)	2483 (17.1%)	
>12	3794 (26.1%)	3448 (23.7%)	
SOI			
1	2927 (36.3%)	2387 (34.6%)	
2	4713 (58.5%)	4202 (60.9%)	.03
3	347 (4.3%)	256 (3.7%)	
4	64 (0.7%)	44 (0.6%)	

CHA indicates Children's Hospital Association; SOI, severity of illness; T1D, type 1 diabetes.

in readmission rates at 90 days across these free-standing children's hospitals; the 90-day interval is clinically relevant, because routine follow-up of patients with diabetes is conducted every 3 months. Although CMS uses 30-day admission to indicate quality of care, this traditional approach derived primarily from surgical cases and nondiabetic medical conditions in which the acute morbidity within 30 days is more relevant, in contrast to the generally healthy youths with T1D in our present study. Used universally to assess chronic glycemic control (ie, diabetes care), the glycated hemoglobin A1C (A1C) reflects turnover of the circulating erythrocyte population, which typically occurs every 90 to 120 days.[23] Thus, the full effect from changes in diabetes care after a hospital admission would not be reflected in the A1C until at least 90 days after discharge. Unfortunately, the PHIS database lacked specific clinical values such as A1C.

A surprising finding of the present CHA study was that youths with T1D were *not* more likely to be readmitted for DKA based on their primary insurance type. This unexpected observation may reflect that patients who are not on a managed care product are more likely to use the hospital and/or the emergency department (ED) as a primary care setting compared with those on a managed care Medicaid plan. The likelihood of seeking healthcare at an inappropriate setting might be greater for those patients not on managed care plans. On the other hand, however, patients with DKA may simply be more likely to present at a hospital once they are clinically compromised, regardless of insurance type.

A particular strength of our study was the inclusion of inpatient, observation, and ED readmissions. This approach enabled deeper analysis of the type of services provided, both on initial visit (adjusted for severity) and on return. Other studies of readmission have focused only on initial inpatient hospitalization and/or ED encounters, which do not account for patients who leave the ED nor those who were on observation status.[6,24] Moreover, prior studies have not considered those who returned to the hospital but were not admitted as inpatients.[25,26] Our present study concurs with other reports suggesting that race is the most significant factor with respect to diabetic readmissions, although age and gender are also significant risk contributors.[25] These observations support the need for interventions focused on specific races and age groups, early diabetic education, and improved engagement of the family in outpatient settings.[22]

Copious literature validates readmission as one proxy indicator for quality of diabetes care and affirms that specific clinical pathways can prevent hospital readmissions.[27-30] A high readmission rate reflects the quality of the initial hospitalization and underscores areas needing improvement, especially for those with DKA.[31,32] A health plan's expectations of providers directly influence the key interventions cited nationally as best practices for diabetes care.[33,34] Nearly all hospitals in our CHA study displayed significant variation of readmission rates, both for overall diabetes and for DKA-specific etiologies. Connecticut, Indiana, and Utah displayed the largest observed variation in days between readmissions in this analysis; however, only 1 free-standing children's hospital exists within each of these states, so these results should not infer a causal relationship with the state Medicaid plan structure. Future insights might be gleaned from states presenting a greater number of hospitals per state to evaluate (eg, TX, FL, CA, TN). Future studies could compare the managed care relationship across states with a larger sample of children's hospitals.

For most states, the CHA-participating hospitals capture the majority of pediatric admissions for subspecialty care.[21] Incomplete access to data by state limits our analysis, because PHIS data only represent children encountered at one of the participating CHA children's hospitals. PHIS for CHA cannot capture all admissions for youths with diabetes within these states. Lag time prior to accessing these

■ **Table 3.** Unadjusted and Adjusted Odds Ratios Between Factors and 90-Day Readmissions for Diabetes Among Patients With T1D

Non-DKA Readmissions for Diabetes			
Variable	**Readmissions**	**Unadjusted OR (95% CI)**	**Adjusted for Severity OR (95% CI)**
Payment type			
Managed care	53.8%	ref	
Non–managed care	46.2%	1.11 (1.03-1.19)	1.12 (1.04-1.20)
Race			
White	48.0%	ref	
Black	38.1%	1.86 (1.73-2.01)	1.79 (1.66-1.94)
Other	13.9%	0.87 (0.77-0.97)	0.88 (0.78-0.99)
Gender			
Male	44.0%	ref	
Female	56.0%	1.47 (1.37-1.58)	1.404 (1.31-1.51)
Age, years			
<1	1.0%	4.49 (2.54-7.93)	4.820 (2.65-8.76)
1-2	3.2%	1.10 (0.86-1.41)	1.174 (0.91-1.51)
3-5	7.2%	ref	
6-12	38.8%	1.24 (1.06-1.45)	1.141 (0.974-1.34)
>12	49.8%	2.12 (1.82-2.47)	1.898 (1.63-2.22)
SOI			
1	32%	ref	
2	63%	1.26 (1.17-1.36)	1.19 (1.10-1.28)
3	4%	1.21 (1.00-1.45)	1.03 (0.85-1.25)
4	1%	2.05 (1.32-3.18)	1.93 (1.27-2.93)

DKA indicates diabetic ketoacidosis; OR, odds ratio; ref, reference; SOI, severity of illness; T1D, type 1 diabetes.

data also contributes to this ascertainment bias. However, the available PHIS data were well vetted by consistent data submissions by each participating hospital during 2008 through 2011. Using PHIS data, Stone et al recently reported primary payer status as an independent predictor of risk-adjusted postoperative mortality, morbidity, and resource utilization among pediatric surgical patients.[35]

Limitations

A potential limitation of this study relates to interpretation of "managed care" across institutions. Although the PHIS data dictionary defines managed care, each individual hospital can independently interpret this concept due to variation in Medicaid programs nationally (eg, level of benefits, number of providers by plan, access to specialists and subspecialists, and the amount of patient/family coinsurance). Many nondiabetic reasons for readmissions were not assessable with the available data set. Additionally, our study could not directly test for educational level of the parents, family income levels (although assumed to be less than the minimum federal poverty threshold in order to acquire Medicaid), or other socioeconomic contributors. Therefore, the observed results do not necessarily indicate poor care quality for those hospitals with higher readmissions. Our observations do affirm successful access to care for many health plan formats. Managed care plans can provide greater support for addressing specific social variables, such as parental support and education, socioeconomic indicators, racial disparities, school system support, and insurance continuity for youths with diabetes.[36-41] Medicaid plans address many of these challenges and have reduced readmissions unrelated to diabetes.[24,42]

The American Diabetes Association has successfully promoted enacting laws to require state-regulated health insurers to cover diabetes supplies. Opposition persists to such statutes because of concern about increased overall system costs, but public health insurance has been shown to improve pediatric diabetes management by increasing access to critical supplies and equipment (eg, glucose monitoring strips and insulin pen devices).[43] Studying patients with diabetes in 31 health plans across the United States, Roski et al observed extreme variations in resource utilization, yet minor variance in quality outcomes.[44] Analyzing data from 42 CHA hospitals in the PHIS database, Feudtner et al recently reported that better-performing hospitals (as defined by the Commonwealth Fund) were more likely to have higher readmission rates.[45] Saha et al observed that preventable hospitalizations for adults with diabetes increased with improved access to care.[46] Even if such data imply that utilization of particular resources does not affect readmission outcomes, the direct benefits to patients from access to appropriate care cannot be understated. The present CHA study design could not estimate additional—and potentially significant—cost savings for families related to reduced absenteeism (from work or school) and reduced commuting time between their homes and the hospitals due to lower readmission rates.[22]

Finally, the retrospective design limits generalization. The inability to fully control an outpatient environment precludes conclusions applicable across all Medicaid programs, even for a cohort as specific as youths with T1D. Differences in populations, provider access, eligibility criteria, and plan benefits represent major variables; we attempted to account for demographic differences, but unique variables by plan could not be controlled retrospectively. Moreover, it is not feasible to control prospectively for these differences between states, so one should not assume that individual case studies for one state will yield the same result elsewhere.

CONCLUSIONS

After adjusting for severity, youths with T1D on Medicaid managed care in this national CHA cohort were significantly less likely to be readmitted within 90 days. Being in a managed care plan resulted in substantial cost savings during 2008 through 2011, despite large variation across 26 states with respect to readmission rates. Policy makers should consider these data when structuring and monitoring state Medicaid products.[16] Policy makers should explore specific successes with managed care tools (eg, health information technology, case management) to improve adherence to evidence-based practice for T1D as approaches to reduce preventable readmissions.[22,24] As national efforts evolve to develop "Medicare type solutions" for chronic pediatric disease management, this CHA study could guide ACA implementation and Medicaid expansion to develop and leverage managed care tools that reduce expensive readmissions.

Acknowledgments

Dr Healy-Collier deeply thanks the CHA (formerly National Association of Children's Hospitals and Related Institutions) for providing data. Portions of this work were presented in abstract form at the American Public Health Association 141st Annual Meeting and Expo, on November 4, 2013, at Boston, MA.

Author Affiliations: Brookwood Medical Center (KH-C), Birmingham AL; Health Administration & Policy, College of Health Professions, Medical University of South Carolina (WJJ), Charleston SC; Connecticut Children's Medical Center (JES), Denver CO; Le Bonheur Children's Hospital (KRR), Memphis, TN; Division of Pediatric Endocrinology (RJF), and Department of Pediatrics (KRR), University of Tennessee Health Science Center, Memphis, TN; Department of Psychology, University of Memphis (RJF), Memphis, TN.

Source of Funding: NIH U01 DK085465 and Juvenile Diabetes Research Foundation International grant 1-2011-597 (to RJF).

Author Disclosures: Dr Ferry discloses receipt of unrelated research support from Takeda, Bristol-Myers Squibb, and Eli Lilly. Dr Healy-Collier conceived the study, obtained institutional review board approval, researched data, contributed to discussion, and wrote the manuscript. Drs Healy-Collier and Ferry are the guarantors of this work and, as such, had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. The remaining authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (RJF, KH-C, WJJ, KRR, JES); acquisition of data (KH-C); analysis and interpretation of data (RJF, KH-C, KRR, JES); drafting of the manuscript (WJJ, RJF, KH-C, JES); critical revision of the manuscript for important intellectual content (RJF, WJJ); statistical analysis (KH-C); provision of patients or study materials (RJF); obtaining funding (RJF); administrative, technical, or logistic support (KH-C, WJJ, RJF); and supervision (WJJ, RJF, KRR, JES).

Address correspondence to: Robert Ferry, Jr, MD, 858 Madison Ave, MSB 501A, Memphis, TN 38103-3409. E-mail bob@uthsc.edu.

REFERENCES

1. Hamman RF, Bell RA, Dabelea D, et al; SEARCH For Diabetes In Youth Study Group. The SEARCH For Diabetes in Youth Study Group: rationale, findings, and future directions. *Diabetes Care*. 2014;37:3336-3344. doi: 10.2337/dc14-0574.
2. Lipman TH, Levitt Katz LE, Ratcliffe SJ, et al. Increasing incidence of type 1 diabetes in youth: twenty years of the Philadelphia Pediatric Diabetes Registry. *Diabetes Care*. 2013;36(6):1597-1603. doi: 10.2337/dc12-0767.
3. Zhao Z, Sun C, Wang C, et al. Rapidly rising incidence of childhood type 1 diabetes in Chinese population: epidemiology in Shanghai during 1997-2011. *Acta Diabetol*. 2014;51(6):947-953. doi: 10.1007/s00592-014-0590-2.
4. Dabelea D, Rewers A, Stafford JM, et al; SEARCH for Diabetes in Youth Study Group. Trends in the prevalence of ketoacidosis at diabetes diagnosis: the SEARCH for Diabetes in Youth study. *Pediatrics*. 2014;133(4):e938-e945. doi: 10.1542/peds.2013-2795.
5. Maniatis AK, Goehrig SH, Gao D, Rewers A, Walravens P, Klingensmith GJ. Increased incidence and severity of diabetic ketoacidosis among uninsured children with newly diagnosed type 1 diabetes mellitus. *Pediatr Diabetes*. 2005;6(2):79-83.
6. Tieder JS, McLeod L, Keren R, et al; Pediatric Research in Inpatient Settings Network. Variation in resource use and readmission for diabetic ketoacidosis in children's hospitals. *Pediatrics*. 2013;132(2):229-236. doi: 10.1542/peds.2013-0359.
7. Zhang JX, Huang ES, Drum ML, et al. Insurance status and quality of diabetes care in community health centers. *Am J Public Health*. 2009;99(4):742-747. doi: 10.2105/AJPH.2007.125534.
8. Chang CF, Troyer JL. The impact of Tenncare on hospital efficiency. *Health Care Manag Sci*. 2009;12(3):201-216.
9. Coughlin TA, Zuckerman S. State responses to new flexibility in Medicaid. *Milbank Q*. 2008;86(2):209-240. doi: 10.1111/j.1468-0009.2008.00520.x.
10. Coughlin TA, Zuckerman S. States' use of Medicaid maximization strategies to tap federal revenues: program implications and consequences. Urban Institute website. http://www.urban.org/sites/default/files/alfresco/publication-pdfs/310525-States-Use-of-Medicaid-Maximization-Strategies-to-Tap-Federal-Revenues.PDF. Published June 2002. Accessed May 6, 2012.
11. Momany ET, Flach SD, Nelson FD, Damiano PC. A cost analysis of the Iowa Medicaid primary care case management program. *Health Serv Res*. 2006;41(4, pt 1):1357-1371.
12. Total Medicaid and CHIP enrollment [February-July 2014]. Kaiser Family Foundation website. http://www.kff.org/health-reform/state-indicator/total-monthly-medicaid-and-chip-enrollment/. Accessed October 20, 2014.
13. Ettner SL, Thompson TJ, Stevens MR, et al; TRIAD Study Group. Are physician reimbursement strategies associated with process of care and patient satisfaction for patients with diabetes in managed care? *Health Serv Res*. 2006;41(4, pt 1):1221-1241.
14. Greene SB, Reiter KL, Kilpatrick E, Leatherman S, Somers SA, Hamblin A. Searching for a business case for quality in Medicaid managed care. *Health Care Manage Rev*. 2008;33(4):350-360. doi: 10.1097/01.HCM.0000318772.59771.b2.
15. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *N Engl J Med*. 2009;360(14):1418-1428. doi: 10.1056/NEJMsa0803563.
16. Cassidy A. Enrolling more kids in Medicaid and CHIP. The federal government wants states to find and enroll about 5 million eligible, uninsured children. What actions are being taken? Will they work? *Health Affairs (Project Hope)* website. http://healthaffairs.org/healthpolicybriefs/brief_pdfs/healthpolicybrief_39.pdf. Published January 27, 2011. Accessed May 6, 2012.
17. Selden TM, Kenney GM, Pantell MS, Ruhter J. Cost sharing in Medicaid and CHIP: how does it affect out-of-pocket spending? *Health Aff (Millwood)*. 2009;28(4):w607-w619. doi: 10.1377/hlthaff.28.4.w607.

18. Lee JM, Davis MM, Menon RK, Freed GL. Geographic distribution of childhood diabetes and obesity relative to the supply of pediatric endocrinologists in the United States. *J Pediatr*. 2008;152(3):331-336. doi: 10.1016/j.jpeds.2007.08.037.

19. Wintergerst KA, Hinkle KM, Barnes CN, Omoruyi AO, Foster MB. The impact of health insurance coverage on pediatric diabetes management. *Diabetes Res Clin Pract*. 2010;90(1):40-44. doi: 10.1016/j.diabres.2010.06.013.

20. Todd J, Armon C, Griggs A, Poole S, Berman S. Increased rates of morbidity, mortality, and charges for hospitalized children with public or no health insurance as compared with children with private insurance in Colorado and the United States. *Pediatrics*. 2006;118(2):577-585.

21. Pasquali SK, Hall M, Li JS, et al. Corticosteroids and outcome in children undergoing congenital heart surgery: analysis of the Pediatric Health Information Systems database. *Circulation*. 2010;122(21):2123-2130. doi: 10.1161/CIRCULATIONAHA.110.948737.

22. Franklin BE, Crisler SC Jr, Shappley R, Armour MM, McCommon DT, Ferry RJ Jr. Real-time support of pediatric diabetes self-care by a transport team. *Diabetes Care*. 2014;37(1):81-87. doi: 10.2337/dc13-1041.

23. Dagogo-Jack S. Pitfalls in the use of HbA1(c) as a diagnostic test: the ethnic conundrum. *Nat Rev Endocrinol*. 2010;6(10):589-593. doi: 10.1038/nrendo.2010.126.

24. Wickizer TM, Lessler D, Boyd-Wickizer J. Effects of health care cost-containment programs on patterns of care and readmissions among children and adolescents. *Am J Public Health*. 1999;89(9):1353-1358.

25. Berry JG, Hall DE, Kuo DZ, et al. Hospital utilization and characteristics of patients experiencing recurrent readmissions within children's hospitals. *JAMA*. 2011;305(7):682-690. doi: 10.1001/jama.2011.122.

26. Holmes-Walker DJ, Llewellyn AC, Farrell K. A transition care programme which improves diabetes control and reduces hospital admission rates in young adults with type 1 diabetes aged 15-25 years. *Diabet Med*. 2007;24(7):764-769.

27. Ying AK, Lairson DR, Giardino AP, et al. Predictors of direct costs of diabetes care in pediatric patients with type 1 diabetes. *Pediatr Diabetes*. 2011;12(3, pt 1):177-182. doi: 10.1111/j.1399-5448.2010.00680.x.

28. Chang HY, Weiner JP, Richards TM, Bleich SN, Segal JB. Predicting costs with diabetes complications severity index in claims data. *Am J Manag Care*. 2012;18(4):213-219.

29. National Health Expenditure Data: CMS-0033-P. CMS website. https://www.cms.gov/Research-Statistics-Data-and-systems/Statistics-Trends-and-reports/NationalHealthExpendData/index.html. Accessed May 20, 2012.

30. Ottoson J, Rivera M, DeGroff A, Hackley S, Clark C. On the road to the national objectives: a case study of Diabetes Prevention and Control Programs. *J Public Health Manag Pract*. 2007;13(3):287-295.

31. Berry JG, Bloom S, Foley S, Palfrey JS. Health inequity in children and youth with chronic health conditions. *Pediatrics*. 2010;126(suppl 3):S111-S119. doi: 10.1542/peds.2010-1466D.

32. Chang C, Pope R, Gnuschke J, et al; Methodist Le Bonheur Center for Healthcare Economics; Sparks Bureau of Business and Economic Research. Impacts of health reform in Shelby County, Tennessee: an examination of changes in health insurance coverage, use of health care resources, and the economic contribution of health care presented. University of Memphis website. http://www.memphis.edu/mlche/pdfs/other_studies/impacts_of_health_reform_in_shelby_county__tn_2010_february_1_2011.pdf. Published December 2010. Accessed June 9, 2012.

33. Gross R, Tabenkin H, Heymann AD et al. The effect of commitment to the organization on physicians' familiarity with guidelines for diabetes in managed care organizations. *J Ambul Care Manag*. 2007;30(3):231-240.

34. Bui TP, Werther GA, Cameron FJ. Trends in diabetic ketoacidosis in childhood and adolescence: a 15-yr experience. *Pediatr Diabetes*. 2002;3(2):82-88.

35. Stone ML, LaPar DJ, Mulloy DP, et al. Primary payer status is significantly associated with postoperative mortality, morbidity, and hospital resource utilization in pediatric surgical patients within the United States. *J Pediatr Surg*. 2013;48(1):81-87. doi: 10.1016/j.jpedsurg.2012.10.021.

36. Valenzuela JM, Seid M, Waitzfelder B, et al; SEARCH for Diabetes in Youth Study Group. Prevalence of and disparities in barriers to care experienced by youth with type 1 diabetes. *J Pediatr*. 2014;164(6):1369-1375.e1. doi: 10.1016/j.jpeds.2014.01.035.

37. Garrison MM, Katon WJ, Richardson LP. The impact of psychiatric comorbidities on readmissions for diabetes in youth. *Diabetes Care*. 2005;28(9):2150-2154.

38. Gold R, DeVoe J, Shah A, Chauvie S. Insurance continuity and receipt of diabetes preventative care in a network of Federally Qualified Health Centers. *Med Care*. 2009;47(4):431-439.

39. Hansson K, Rydén O, Johnsson P. Parent-related family climate: a concomitant to metabolic control in juvenile IDDM. *Fam Syst Med*. 1994;12(4):405-413.

40. Hudson JL. Families with mixed eligibility for public coverage: navigating Medicaid, CHIP, and uninsurance. *Health Aff (Millwood)*. 2009;28(4):w697-w709. doi: 10.1377/hlthaff.28.4.w697.

41. Lange K, Jackson C, Deeb L. Diabetes care in schools—the disturbing facts. *Pediatr Diabetes*. 2009;10(suppl 13):28-36. doi: 10.1111/j.1399-5448.2009.00613.x.

42. Jones K, Flores G. The potential impact of Medicaid reform on the health care-seeking behavior of Medicaid-covered children: a qualitative analysis of parental perspectives. *J Natl Med Assoc*. 2009;101(3):213-222.

43. Kaufman FR. Medicaid cuts and attempts to eliminate insurance coverage for diabetes needs threaten the lives of our patients. *Clin Diabetes*. 2003;21(2):76-77. doi: 10.2337/diaclin.21.2.76

44. Roski J, Turbyville S, Dunn D, Krushat M, Scholle SH. Resource use and associated care effectiveness results for people with diabetes in managed care organizations. *Am J Med Qual*. 2008;23(5):365-374. doi: 10.1177/1062860608316180.

45. Feudtner C, Pati S, Goodman DM, et al. State-level child health system performance and the likelihood of readmission to children's hospitals. *J Pediatr*. 2010;157(1):98-102.e1. doi: 10.1016/j.jpeds.2010.01.049.

46. Saha S, Solotaroff R, Oster A, Bindman AB. Are preventable hospitalizations sensitive to changes in access to primary care? the case of the Oregon Health Plan. *Med Care*. 2007;45(8):712-719. ■

www.ajmc.com Full text and PDF