

ARTICLE

QualityImpact: A Data-Driven Quality Improvement Model That Improves Clinical Care and Reduces Cost

Debra R. Simmons, MS, RN, Anna Thomas, Robert M. Carey, MD, MACP, David Carmouche, MD, Edward J. Roccella, PhD, MPH

Vol. 2 No. 11 | November 2021

DOI: 10.1056/CAT.21.0203

The Consortium for Southeast Healthcare Quality (COSEHQ) created QualityImpact, a data-driven clinician performance improvement initiative for managing cardiovascular conditions, and scaled it across the Southeast United States between 2016 and 2019. Under the U.S. Centers for Medicare & Medicaid Services Transforming Clinical Practice Initiative, COSEHQ implemented the model in 735 clinical practices and engaged 4,692 clinicians. The initiative, which was intended to prepare clinicians for value-based alternative payment models, encompassed data transparency, professional education, evidence-based best practices, and peer-to-peer best collaborative learning. Clinicians received assistance with workflow optimization, care management, patient engagement, risk stratification, and revenue enhancement. At completion, 157,215 patients diagnosed with hypertension, diabetes, and other cardiovascular conditions showed clinical improvement. QualityImpact also led to reductions in the number of all-cause hospital and ED visits and achieved estimated cost savings of almost \$200 million.

Heart disease is the leading cause of death in the United States,^{1,2} and the risk varies by region. The Southeastern United States has higher rates of chronic cardiovascular and renal diseases, including ischemic heart disease, stroke, heart failure (HF), and chronic kidney disease, than other parts of the United States.²⁻⁴ Hypertension, a known preventable and modifiable risk factor for these diseases and many others, is more prevalent and severe in the southeast region of the United States,^{3,4} as are obesity, smoking, uncontrolled cholesterol levels, and type 2 diabetes.⁵⁻⁹

Established in 1994, the Consortium for Southeast Healthcare Quality (COSEHQ) specializes in research, professional education, and health care quality advancement with a specific focus on cardiovascular health improvement. This article describes a COSEHQ initiative called QualityImpact, a quality improvement model aligned with the Institute for Healthcare Improvement Quadruple Aim that focuses on optimized clinical care, improved health outcomes, and lower health care costs.

In 2015, COSEHQ was awarded a cooperative agreement under the U.S. Centers for Medicare & Medicaid Services (CMS) Transforming Clinical Practices Initiative (TCPI) to serve as a Practice Transformation Network (PTN). PTNs engaged clinicians to achieve health care transformation, prepare for value-based payment arrangements, and improve the quality of care. COSEHQ collaborated with The Kinetix Group, a care delivery consultancy, to implement QualityImpact across 735 diverse outpatient practice sites between 2016 and 2019, engaging 4,692 clinicians and impacting a patient population from these practices of approximately 2.1 million (Figure 1). COSEHQ leveraged CMS's TCPI change theory framework, consisting of 3 primary drivers and 15 secondary drivers as the basis for assessing a practice's transformation progress once QualityImpact was implemented (Figure 2). We found the TCPI framework to be adaptable to all practice types, especially those seeking success under value-based reimbursement.

Implementing QualityImpact

QualityImpact was implemented to improve clinicians' performance in the clinical management of cardiovascular-related conditions, including hypertension, HF, and type 2 diabetes. A secondary aim was to improve the practice's appropriate utilization of health care resources overall and prepare interested practices for value-based reimbursement models.

Onboarding included having each practice identify a minimum of three staff members, called "champions," to lead the practice's implementation internally and to liaise with our PTN team. The practice-assigned champions typically included a lead physician, a quality improvement lead, and an administrator. A COSEHQ-employed quality improvement advisor (QIA) provided direct technical assistance and collaborated with the broader PTN team to deploy resources based on assessed practice-specific care gaps. QIAs typically worked with more than one practice, with a ratio of 4:1.

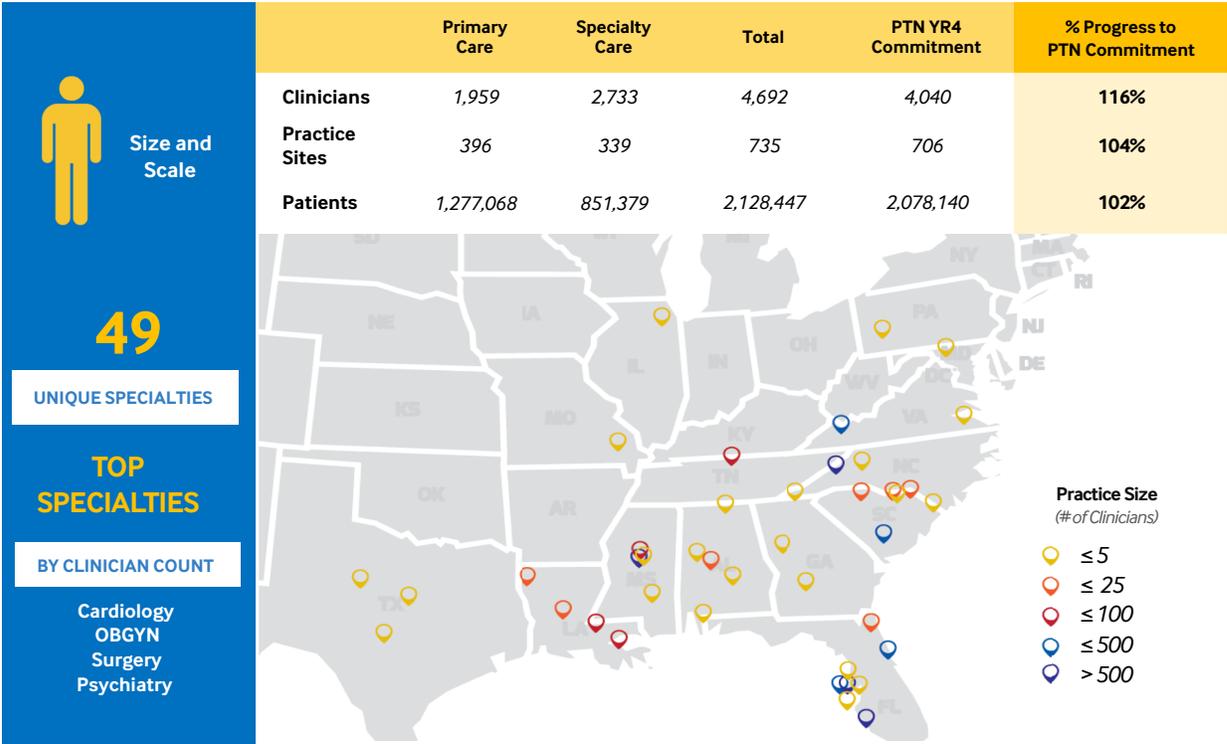
“*COSEHQ leveraged CMS's TCPI change theory framework, consisting of 3 primary drivers and 15 secondary drivers as the basis for assessing a practice's transformation progress.*”

Because managing a busy office leaves little time for physicians and staff to learn skills and integrate new processes, QualityImpact needed to be adaptable and easily incorporated with minimal disruption to the normal workflow. Practice sizes ranged from independent clinicians to multispecialty groups, and we tailored the model to each practice.

FIGURE 1

The Consortium for Southeast Healthcare Quality (COSEHQ) Practice Transformation Network (PTN) Enrolled Over 4,600 Clinicians and 700 Practice Sites

COSEHQ exceeded its original projected clinician enrollment goal by 16%, enrolled practices by 4%, and patient reach by 2%. Enrolled practices varied by size, ranging from independent clinicians and practices with fewer than five clinicians to large integrated networks. OBGYN = obstetrics and gynecology.



Source: Consortium for Southeast Healthcare Quality
 NEJM Catalyst (catalyst.nejm.org) © Massachusetts Medical Society

A practice assessment helped the QIA understand a practice’s capabilities in areas including the following:

- use of evidence-based guidelines;
- patient access (including appointment availability, use of patient portals, and availability of after-hour clinics and telehealth);
- population management;
- coordinated care, referral processes, and patient follow-up;

FIGURE 2

Change Theory Framework

Centers for Medicare & Medicaid Services change theory framework primary and secondary drivers.
 HIT = health IT.

| Primary Drivers | Secondary Drivers |
|--|--|
| <p>Patient/Family Care Design</p> | <ul style="list-style-type: none"> • Patient/family engagement • Team-based relationships • Population management • Community partnerships • Coordinated care delivery • Enhanced access |
| <p>Continuous Data-Driven Quality Improvement</p> | <ul style="list-style-type: none"> • Engaged and committed leadership • Quality improvement strategy supporting a culture of quality and safety • Transparent measurement and monitoring • Optimal use of HIT • Organized evidence-based care |
| <p>Sustainable Business Operations</p> | <ul style="list-style-type: none"> • Strategic use of practice revenue • Staff vitality and joy of work • Capability to analyze and document value • Efficiency of operations |

Source: Centers for Medicare & Medicaid Services
 NEJM Catalyst (catalyst.nejm.org) © Massachusetts Medical Society

- health IT;
- workflows and standardized process protocols; and
- existing data-driven quality improvement strategies.

Data transparency and goal-oriented gap closure, important under value-based care, were promoted across the PTN. Azara Healthcare (formerly a part of SPH Analytics Inc.) was contracted to deploy its population health platform to each practice. Our focus was on improving cardiovascular measures; however, the platform provided a practice access to real-time reports detailing individual patients’ clinical status, care gaps, and risk level on multiple health care conditions (Figure 3). The platform also aggregated the clinical values of a physician’s total population and illustrated both clinical measure control rates and a clinician’s progress toward achieving those. This information could also be presented at the practice level, illustrating all physicians’ performance in aggregate. The cardiovascular clinical information enabled the PTN team to codevelop a goal-oriented action plan with each practice to address the practice’s care gaps.

FIGURE 3

Sample Patient-Focused Dashboard

Patient dashboard from the Azara Healthcare Population Health Platform, alerting clinicians to patient-specific care gaps and historical visit data care opportunities to close care gaps.



ACEI = angiotensin-converting enzyme inhibitor, ALT = alanine aminotransferase, ARB = angiotensin receptor blocker, AST = aspartate aminotransferase, BMI = body mass index, CHF = congestive heart failure, CRCS = colorectal cancer screening, DM = diabetes mellitus, EF = ejection fraction, eGFR = estimated glomerular filtration rate, GFR = glomerular filtration rate, HTN = hypertension, LVSD = left ventricular systolic dysfunction, PW = postmenopausal woman.

Source: Azara Healthcare and Symphony Performance Health Inc.

NEJM Catalyst (catalyst.nejm.org) © Massachusetts Medical Society

Technical assistance was tailored to each individual practice, consisting of a variety of PTN strategies and resources to improve clinical performance and, where needed, reduce variation to enhance care delivery processes (Table 1).

Practice groups set attainable short-term clinical improvement goals based on population-based clinical gaps identified through the Azara Healthcare platform. Performance improvement was promoted using a “tight-loose-tight” methodology. Our PTN leadership established key quality measures and achievable expectations for practices (tight). The QIAs gave practices autonomy to implement creative solutions to meet their quality and utilization improvement goals, but they remained available to assist in monitoring progress and providing needs-based support (loose) to

Table 1. Select QualityImpact Resources

| Resource | Aim |
|--------------------------------|--|
| Getting started guidelines | To assist practices in the design of processes, such as risk stratification or a care management program |
| Boot camp | Intense consultation by subject matter experts for practice cohorts with similar care gaps |
| Guidelines | Education and simplified algorithmic translations of evidence-based therapies |
| Best practices | How to scale proven therapeutic interventions |
| Patient engagement processes | Tools to engage patients and establish joint clinician/patient decision-making |
| Billing and coding enhancement | Severity of illness capture and new/evolving reimbursement codes |
| Increase revenue flow | How to establish processes for annual wellness examination, proper coding, care management, etc. |
| Workflow streams | How to enhance processes to ensure efficiencies |
| Team roles/responsibilities | How to empower each clinician to operate at the highest level allowed by their license and clearly delineate matrix responsibilities |
| Actionable data | Educating practices in the interpretation and effective use of their data |

Source: Consortium for Southeast Healthcare Quality.

ensure practices' accountability. PTN leadership monitored practices' attainment of goals and intervened as necessary to ensure targeted goals would be met (tight).

The selection and implementation of a specific strategy was driven by the initial and recurring practice assessments, a practice's progress on its action plan, and the ongoing evaluation of clinical performance analyzed via the Azara Healthcare platform. For example, many clinicians were insufficiently using Hierarchical Condition Category coding to risk-stratify their patients. Our certified coding physician expert provided live lectures and designed on-demand modules that improved compliance in these practices, which often led to better reimbursement to the practice. If blood pressure control rates were below evidence-based target goals, our subject matter experts provided education through live collaborative meetings, webinars, and/or tools/resources distributed to the entire network. Our experts also provided one-on-one consultation to the practice champions or facilitated group discussions with the practice care team. Many clinicians needed assistance with translating new or evolving evidence-based research into their everyday practice.

Each practice received a quarterly performance report benchmarking it against established target goals. The QIAs reviewed this report with the practices during monthly calls. If a practice was not making progress, the PTN team increased its interaction, reviewing and revising the action plan where needed. Our physician subject matter experts engaged the clinicians through onsite visits and peer-peer consultation, which often brought the practices back on track. Rapid-cycle PDSA (Plan, Do, Study, Act) "performance sprints" propelled practices toward goal achievement. A practice would implement one or more interventions, over a 3-month or 6-month period as appropriate, to improve an identified care gap or a delay in meeting their goals. If performance improved by the end of the period, the practice adopted the intervention.

If it did not, other strategies were considered. Sprints led to sustainable performance improvements.

“

Because managing a busy office leaves little time for physicians and staff to learn skills and integrate new processes, QualityImpact needed to be adaptable and easily incorporated with minimal disruption to the normal workflow.

The PTN team offered additional training opportunities to ensure that practices had the knowledge needed to implement the strategies and to further hone their skills in managing their patient populations. We offered on-demand learning activities on diverse topics, including clinical guidelines, telehealth, patient decision-making, and team-based care. We hosted live webinar-based collaborative meetings where practice “champions” from all of the enrolled PTN sites participated and discussed best practices, solved problems, and led learning sessions. Many of the educational offerings provided physicians with continuing medical education credits.

The PTN team fostered peer-to-peer modeling, a significant quality improvement factor. Performance data dashboards showed individual providers’ relative clinical management proficiency. These comparative measures were shared with lower-performing providers to encourage them to emulate their higher-performing peers. Where practices did not have a high-performing physician, we found role models for them among other practices that were performing well.

Results

To analyze performance change, we compared clinical data with baseline data abstracted by Azara Healthcare looking back 1 year prior to introducing the QualityImpact model. We also acquired context around the successes, challenges, and lessons learned in the “touchpoint calls” between the QIAs and the champions. The insights gleaned from these communications were shared with the full network through peer-to-peer briefings and educational forums highlighting best practices.

Because practices were enrolled on a rolling basis, there were insufficient network-wide data to aggregate and analyze baseline population-based clinical control rates until January 2017. Over that 3-year period (2017–2019), clinicians in networked practices showed population-based clinical improvement in the prevention and management of cardiovascular disease. Clinical improvement was defined as a positive change in patients’ clinical values and evidence-based therapeutic drug management for cardiovascular conditions such as congestive HF. For the purposes of this article, we focused on blood pressure and glucose measures. We used clinical targets from the National Quality Forum: an increase in the percentage of patients with controlled hypertension (blood pressure lower than 140/90 mmHg), an increase in the percentage of patients with diabetes with glycated hemoglobin (HbA_{1c}) levels lower than 8%

(indicating good control), and a decrease in the percentage of patients with HbA_{1c} levels greater than 9% (indicating poor control).

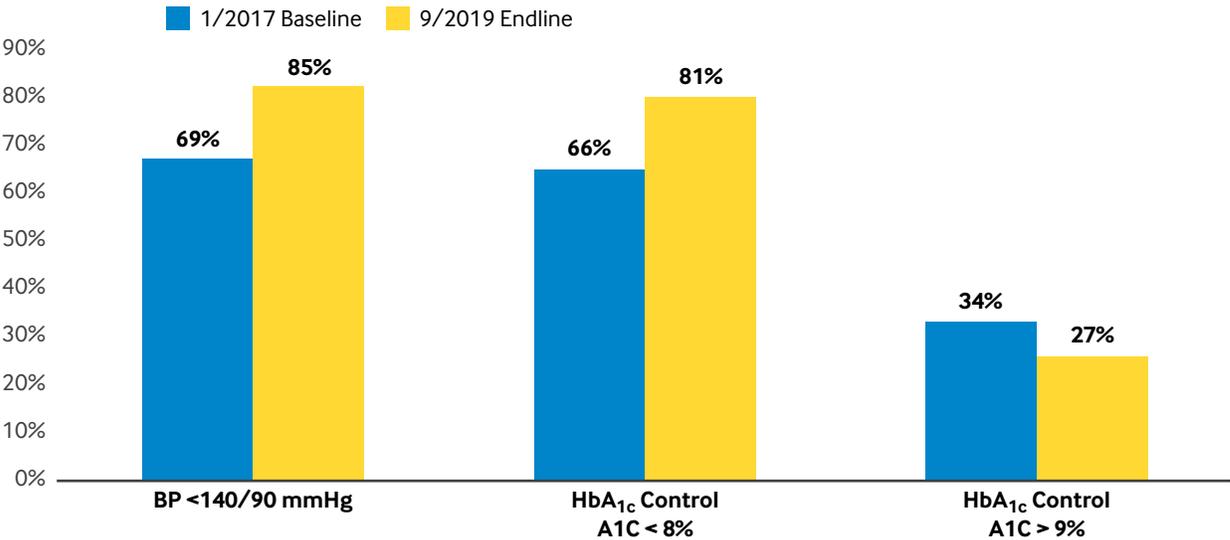
Cumulatively, by the end of the initiative, 157,215 patients showed improvement in at least one of the clinical metrics. Changes from baseline to endline for the three clinical measures, as demonstrated by population-based control levels, show overall improvement (Figure 4).

We observed a reduction in the utilization of ED visits and all-cause hospitalizations. Due to the unavailability of CMS data specific to the initiative, we were not able to measure utilization improvements specific to cardiovascular measures. We did have access to utilization data for the period of June 2018–2019 from a large regional commercial payer that had multiple practices enrolled in our PTN. ED visits and all-cause hospital admission data showed reduced utilization during QualityImpact implementation (Figure 5). Our estimated savings from these reductions were calculated by using the data from these clinics and applying publicly available cost averages for hospital admissions and ED visits.^{10,11} These calculated savings were extrapolated across the PTN for a total estimated network savings of \$192,266,889.

FIGURE 4

Improvements in Clinical Metrics: Control Rates

National Quality Forum (NQF) inclusion/exclusion criteria were used to define outcome measures. For blood pressure (BP) control (NQF 0018), 360,607 of 524,221 patients had controlled BP at baseline compared with 446,386 patients with controlled BP at the end of the Transforming Clinical Practice Initiative (endline). For diabetes control (NQF 0575), 46,907 of 71,071 patients had an A1C lower than 8% at baseline compared with 57,798 patients at endline. For diabetes control (NQF 0059), 3,753 of 11,038 patients had an A1C higher than 9% at baseline compared with 2,980 patients at endline. HbA_{1c} = glycated hemoglobin.

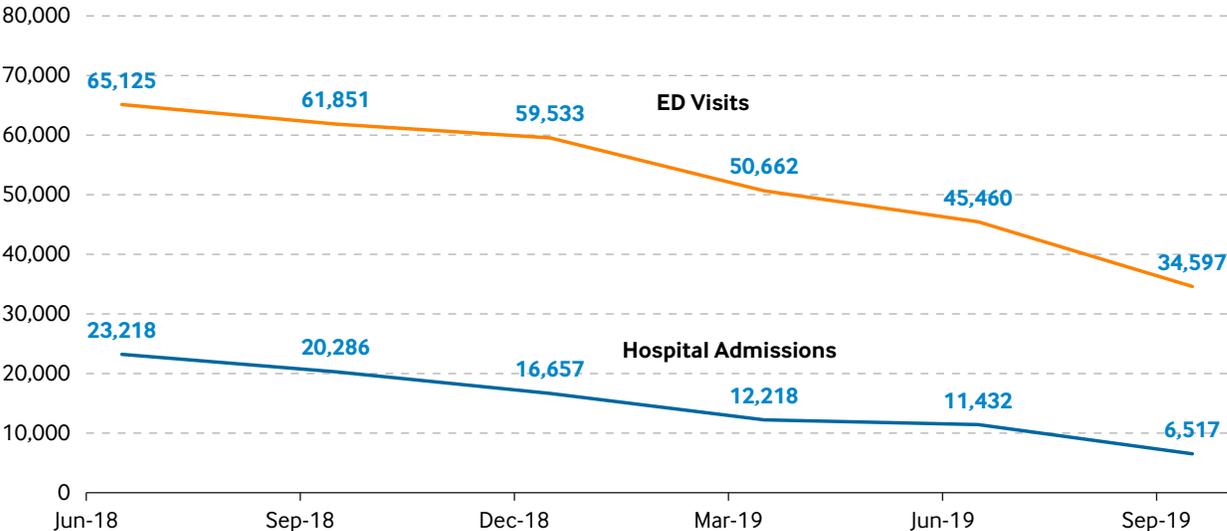


Source: Consortium for Southeast Healthcare Quality
NEJM Catalyst (catalyst.nejm.org) © Massachusetts Medical Society

FIGURE 5

Number of ED Visits and Hospital Admissions

Reductions measured during the last 15 months of the initiative when utilization reports from the commercial payer were available. Each data point represents the previous 3-month period of usage. The larger decreases shown in the last quarter (September 2019) reflect the summer months, when historically, utilization of services tends to decrease.



Source: Consortium for Southeast Healthcare Quality
NEJM Catalyst (catalyst.nejm.org) © Massachusetts Medical Society

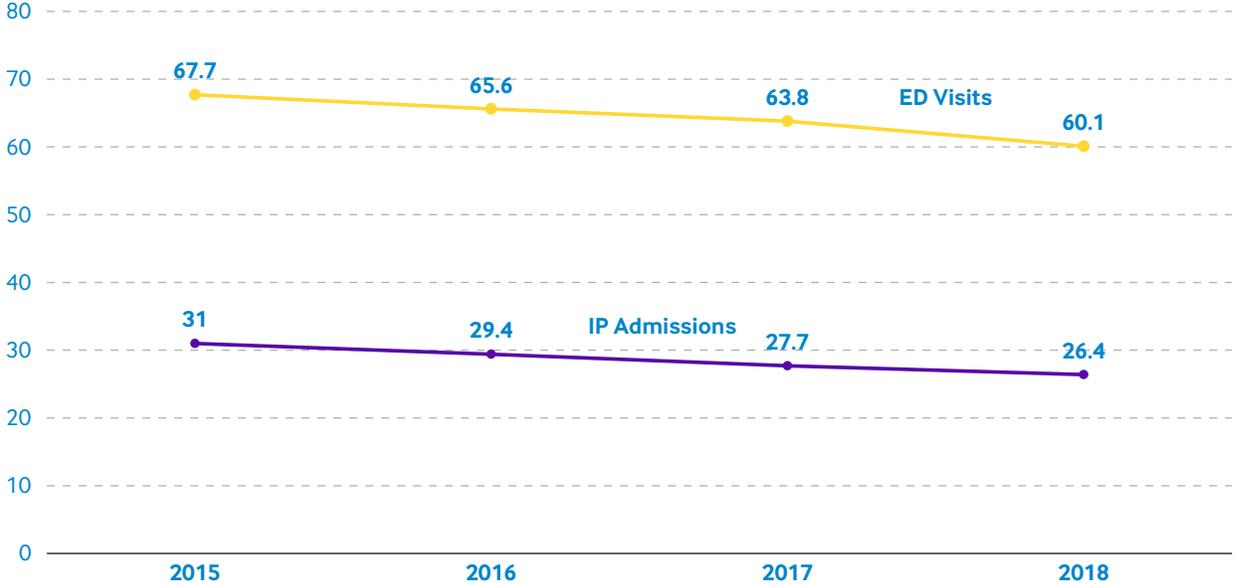
To confirm QualityImpact’s influence on reduced health care costs, we contracted with an independent firm (Avalere Health LLC, a health care-focused data consultancy firm) to conduct a post-TCPI assessment of Medicare fee-for-service (FFS) costs and utilization for beneficiaries attributed to COSEHQ PTN enrolled providers. Under a research-focused data user agreement with CMS, Avalere Health through its parent, Inovalon, Inc. receives Medicare FFS claims data including a 100% sample of Medicare Parts A, B, and D. Avalere used attribution and statistical benchmarking models from other CMS/Center for Medicare & Medicaid Innovation programs and demonstrations to analyze patterns of care among a defined comparison population of all Medicare FFS beneficiaries not attributed to COSEHQ PTN practices. Avalere evaluated COSEHQ PTN performance on two utilization metrics (inpatient admissions and ED visits) and two cost metrics (average per beneficiary per month, Parts A and B [2015–2018] and Parts A, B, and D [2015–2017]) and compared those results against the benchmark population (patients in the same geographic region not participating in the program) stratified by year to account for underlying trends in outcomes among the comparison population over time.

The analysis estimated that total costs associated with only Medicare FFS patients treated by clinicians in participating practices using the QualityImpact model were \$54 million lower over a

FIGURE 6

Inpatient Admissions and ED Visits per 100 Medicare Fee-for-Service (FFS) Beneficiaries: Preparticipation versus QualityImpact Participation Years

Avalere analysis based on a 100% sample of FFS Medicare patient data from participating practices. Preparticipation is for 2015. QualityImpact years 1–3 are for 2016–2018. IP = inpatient.



Source: Avalere
NEJM Catalyst (catalyst.nejm.org) © Massachusetts Medical Society

3-year period (2016–2018) compared with patients treated by clinicians in practices not enrolled in TCPI and thus not using this model. This analysis, which focused on a smaller segment of our patient population than the ED and hospital utilization analysis mentioned earlier and differed in its methodology, did show lower costs following the implementation of the QualityImpact model (Figure 6, Figure 7).

Limitations

CMS Medicare claims data were not provided for this project, as the primary aim was quality improvement, and analyzing claims data was beyond the scope of the initiative. The majority of our enrolled patients, 60%, were insured by commercial plans, 35% by Medicare, and 5% by Medicaid. We therefore considered it reasonable to compare our practices with others using the commercial data to which we had access.

FIGURE 7

Cost-Reduction Insights

Per-ED visit program expenditures (including physician visits during visit) from a Medicare Payment Advisory Commission (MedPAC) analysis of 2019 hospital outpatient and physician claims, adjusted to 2015–2018 with Outpatient Prospective Payment System (OPPS) annual update factors (http://medpac.gov/docs/default-source/reports/jun19_medpac_reporttocongress_sec.pdf). COSEHQ = Consortium for Southeast Healthcare Quality.

Summary of Measures: Takeaways

Insights & Takeaways

- Over Time, COSEHQ Practices Succeeded in Slowing Cost Increases** / COSEHQ was able to slow the growth of total cost of care, relative to the patient population absent program participation, which saw a notable increase over the performance period.
- Largest Improvements in Care Efficiency Realized Amongst 4 Top States** / The four states with the largest number of beneficiaries—South Carolina, Louisiana, Florida, and Virginia—experienced reductions in ED visits and inpatient admissions.
- Avalere Findings Suggest That COSEHQ Succeeded on Cost and Utilization Improvement** / Generally speaking, utilization for COSEHQ practices trended downward, and Medicare spending increased but at a lower rate than practices not participating in the COSEHQ initiative. Avalere estimates that savings totaled **\$54 million** over the performance period.

Source: Avalere
NEJM Catalyst (catalyst.nejm.org) © Massachusetts Medical Society

“ *Data transparency and goal-oriented gap closure, important under value-based care, were promoted across the PTN.* ”

The PTN estimated cost savings of \$192,266,889 was based on the 15 months of available commercial payer utilization data and may not represent the entire project period. However, because of the rolling enrollment during the first 2 years in which utilization trends did not include the entire network, we feel this estimate is representative.

We did not track the implementation cost for each practice, as that calculation was outside of the scope of the initiative, and practices varied in size, resource needs, and number of clinicians. Based on the total funding received, an average cost per enrolled practice was about \$20,000.

Certain practice electronic health records (EHRs) had limitations to aggregate patient data into a population health analytics platform. Azara Healthcare provided a network-wide EHR agnostic platform for retrieving clinical data from practices and was vital to normalizing and identifying overall care gaps across providers and sites of care.

This initiative was implemented only in the United States, primarily in the southeast region, at the request of CMS. Although the principles of the model have been replicated successfully in other subsequent initiatives, the complete architecture has not been applied broadly in other geographic regions or countries.

Patient satisfaction was not a measure we evaluated in this initiative, as our focus was on improving clinician and practice performance. However, after implementing QualityImpact patient engagement resources, many practices executed their own patient satisfaction surveys.

Lessons Learned

- **Recruitment capacity.** With an initiative this large, we expected to encounter a range of problems. Surprisingly, one of the biggest hurdles we met was having a higher-than-expected enrollment. This stretched the COSEHQ resources initially but motivated us to build remote capabilities to scale the model, including mentoring and peer-to-peer learning sessions, archived on-demand clinical training modules, and an inventory of self-teaching tools that made it possible to reach a broad group of clinicians.
- **Scaling recruitment.** Ideally, onsite visits to recruit clinicians were imperative to gaining buy-in. However, due to constraints on the PTN staff's travel availability and a practice's available nonpatient time, we consolidated some of our recruitment efforts by presenting at professional society meetings and conferences and visiting each practice that expressed interest.
- **Reducing practice burden.** The user-friendly population health platform allowed users to conduct quick reviews of patient care gaps and clinician performance on their own, when convenient.
- **Actionable, concise reporting.** Clinicians do not have the time or interest to review lengthy reports. Making data actionable through brief two-page "at a glance" reports with recommendations for improvement kept clinicians informed and engaged without overburdening them.
- **Leadership buy-in.** Getting buy-in from leadership made engagement of clinicians easier, improving both participation levels and outcomes, especially from clinicians who were reluctant to participate. Leadership was especially interested if the practice engaged in pay-for-value contracts.

- Practice alignment with the initiative. A data-driven practice-specific action plan with identified target goals and timelines ensured that practices stayed on course and achieved goals.
- Regular communication and accountability. We used monthly accountability calls to cultivate trust, discuss and revise strategies for practices that were lagging in their progress, and encourage those who were on track.
- Transparency and feedback. Quarterly dashboard reports, distributed to practices throughout the initiative, illustrated their progress toward target goals. Pauses in progress triggered updates to the practice's action plan.
- Peer-driven improvement. Peer-to-peer learning, promoted throughout the 4-year project period among physicians across the PTN, revealed best practices and improved individual physicians' clinical performance.
- Enrolled physicians expressed the value of having our PTN physician experts, who understand the life and knowledge of physicians, engage them as peers.
- Operational alignment. Standardizing operational processes where appropriate to eliminate variation led to improved efficiency and effectiveness and reduced costs for both the patient and practice staff.

QualityImpact was a catalyst for continued improvement. All 735 participating practice sites showed evidence of improved clinical performance. Of these practices, 456 were recognized by CMS as exemplary practice sites. Additionally, 79% (583 of our enrolled practice sites) successfully transitioned to value-based payment models, meeting another goal of the CMS TCPI.

Although the final CMS evaluation of the TCPI program is still underway, CMS recognizes COSEHQ as a top-performing PTN, with 90% of practices enrolled demonstrating clear and consistent progress toward target goals. Achieving target goals validated that a practice had implemented the QualityImpact clinical improvement and transformation tools and resources and had internally built the business acumen to succeed. Behavior even changed among clinicians and patients who are typically difficult to engage. COSEHQ continues to build on its QualityImpact success and is working with practices considering or already engaged in value-based payment models.

Debra R. Simmons, MS, RN

Executive Director, Consortium for Southeast Healthcare Quality, Winston-Salem, North Carolina, USA

Anna Thomas

Senior Vice President, Care Delivery Consultation, The Kinetix Group, New York, New York, USA

Robert M. Carey, MD, MACP

Professor of Medicine and Dean Emeritus, University of Virginia School of Medicine, Charlottesville, Virginia, USA

David Carmouche, MD

Executive Vice President, Value-Based Care and Network Operations and President, Ochsner Health Network, Ochsner Health, New Orleans, Louisiana, USA

Edward J. Roccella, PhD, MPH

Former Coordinator, U.S. National High Blood Pressure Program, National Heart, Lung, and Blood Institute Cardiovascular Branch, Bethesda, Maryland, USA

Disclosures: Debra R. Simmons, Anna Thomas, Robert M. Carey, David Carmouche, and Edward J Roccella have nothing to disclose. Funding of TCPI was provided by the U.S. Department of Health and Human Services (HHS), CMS, under grant CMS-1L1-15-002. The contents of this report are the sole responsibility of the COSEHQ and do not represent the official views of HHS or any of its agencies. The results presented in this report were self-reported by clinicians and practices and have not been validated and verified by HHS or any of its agencies.

References

1. Heron M, Anderson RN. Changes in the leading cause of death: recent patterns in heart disease and cancer mortality. NCHS Data Brief 2016;254:1-8.
2. Go AS, Mozaffarian D, Roger VL, et al.; American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Executive summary: heart disease and stroke statistics—2014 update: a report from the American Heart Association. Circulation 2014;129:399-410 <https://doi.org/10.1161/01.cir.0000442015.53336.12>.
3. Centers for Disease Control and Prevention. Hypertension cascade: hypertension prevalence, treatment and control estimates among US adults aged 18 years and older applying the criteria from the American College of Cardiology and American Heart Association's 2017 hypertension guideline. NHANES 2015–2018. U.S. Department of Health and Human Services. 2021. Accessed May 24, 2021. <https://millionhearts.hhs.gov/data-reports/hypertension-prevalence.html>.
4. Olives C, Myerson R, Mokdad AH, Murray CJ, Lim SS. Prevalence, awareness, treatment, and control of hypertension in United States counties, 2001-2009. PLoS One 2013;8:e60308 <https://doi.org/10.1371/journal.pone.0060308>.
5. Loop MS, Howard G, de Los Campos G, et al. Heat maps of hypertension, diabetes mellitus, and smoking in the continental United States. Circ Cardiovasc Qual Outcomes 2017;10:e003350 <https://doi.org/10.1161/CIRCOUTCOMES.116.003350>.
6. Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention. Adult Obesity

Prevalence Maps, Overweight & Obesity. Updated March 31, 2021. Accessed May 24, 2021. <https://www.cdc.gov/obesity/data/prevalence-maps.html>.

7. Centers for Disease Control and Prevention. Diabetes Report Card 2019. U.S. Department of Health and Human Services. 2020. Accessed May 24, 2021. <https://www.cdc.gov/diabetes/pdfs/library/Diabetes-Report-Card-2019-508.pdf>.
8. Schultz WM, Kelli HM, Lisko JC, et al. Socioeconomic status and cardiovascular outcomes: challenges and interventions. *Circulation* 2018;137:2166-78 <https://doi.org/10.1161/CIRCULATIONAHA.117.029652>.
9. Frieden TR, Jaffe MG. Saving 100 million lives by improving global treatment of hypertension and reducing cardiovascular disease risk factors. *J Clin Hypertens (Greenwich)* 2018;20:208-11 <https://doi.org/10.1111/jch.13195>.
10. Liang L, Moore B, Soni A. National inpatient hospital costs: the most expensive conditions by payer, 2017: Statistical Brief #261. Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville, MD: Agency for Healthcare Research and Quality, 2020.
11. Moore BJ, Liang L. Costs of emergency department visits in the United States, 2017: Statistical Brief #268. Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville, MD: Agency for Healthcare Research and Quality, 2020.