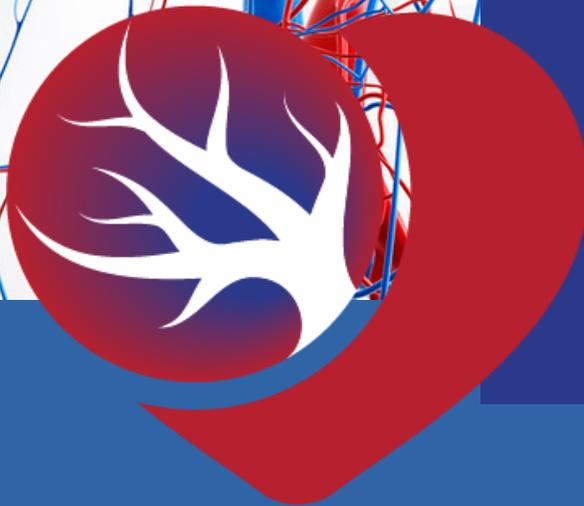


Annual Report 2022

*A collaborative consortium of health
care providers dedicated to improving
quality of care and outcomes for
cardiovascular patients across the
State of Michigan*





A NOTE FROM HITINDER GURM

We accomplished incredible work as a consortium in 2022. The data we collect informed quality initiatives that change how we care for patients, improving both the quality of that care and the outcomes that they experience.

We expanded resources for patients and providers through partnerships with our Patient Advisory Council ([PAC](#)) and fellow Collaborative Quality Initiatives ([CQIs](#)) including the Michigan Value Collaborative ([MVC](#)). In continued partnership with the Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative ([MSTCVS-QC](#)), the Michigan Structural Heart Consortium ([MISHC](#)) began reporting on transcatheter mitral valve procedures.



Consortium data informed 11 [publications](#) featured in 8 journals, and our Best Practice Protocols Task Forces created 12 new best practice protocols. We aimed to share our successes, educate others about the work we do, and expand our reach through communications including our new video, “[What is BMC2?](#)” We met in person to network, share, and learn from expert speakers from across the nation.

It is your support, partnership, and participation that make this work possible. We thank you for your dedication to improving quality of care and outcomes for Michigan patients and look forward to continued collaboration in 2023!

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SUCCESS STORIES

BMC2 Outperforms the National Average on Key Quality Metrics

BMC2 outperforms the national average for many measures that lead to better quality of care and outcomes, making Michigan one of the safest places to undergo PCI.

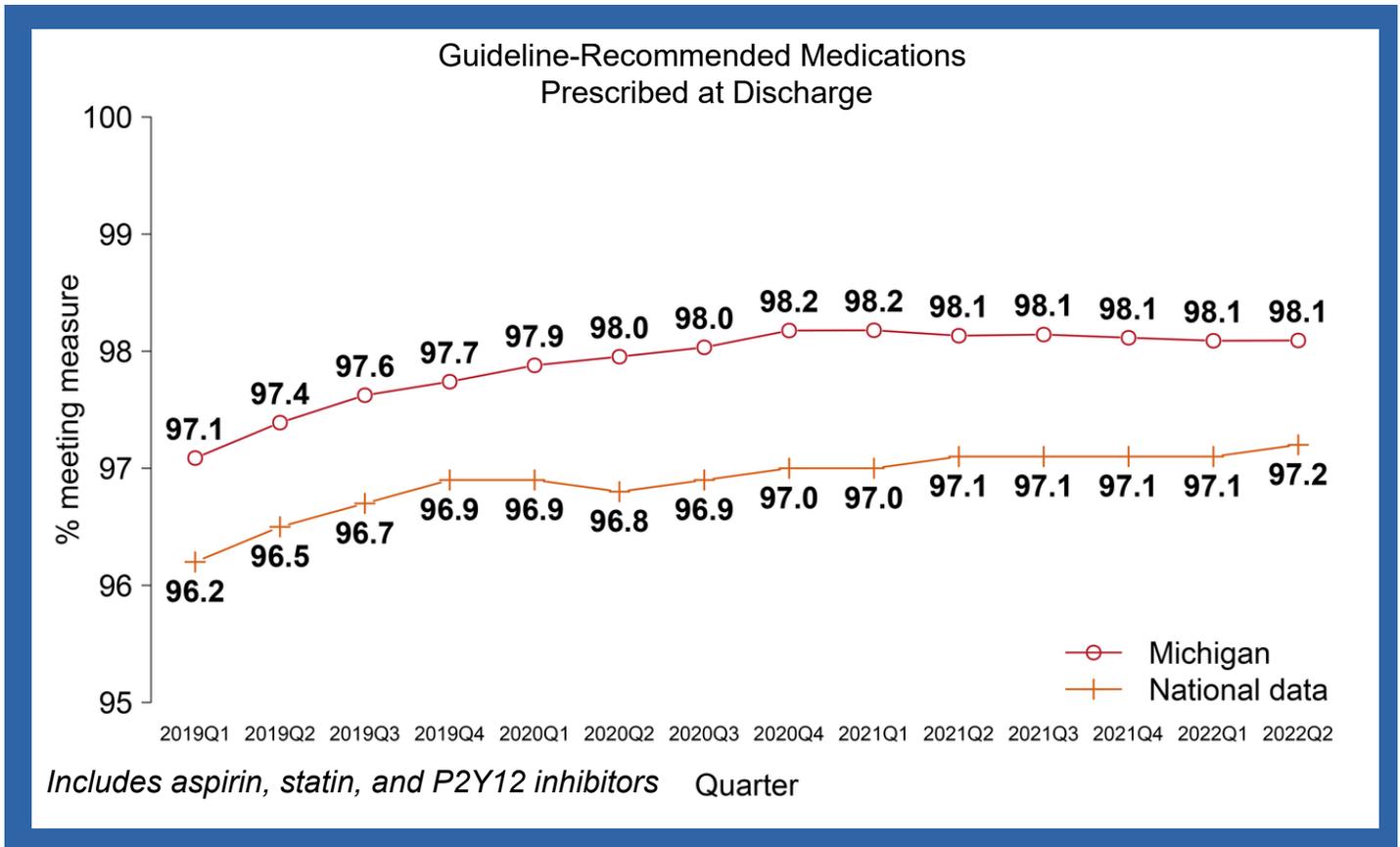


Figure 1. More patients in Michigan are appropriately prescribed guideline-recommended medication at discharge. Specifically, 21,000+ Michigan patients were prescribed aspirin and 20,000+ were prescribed statin therapy, all leading to better outcomes for patients with fewer complications and readmissions.

Goal Spotlight

Documentation of prescribed P2Y12 therapy duration

Goal	Q1 2021	Q2 2022	% change
≥ 70%	47.25%	73.34%	55%



SUCCESS STORIES, CONT.

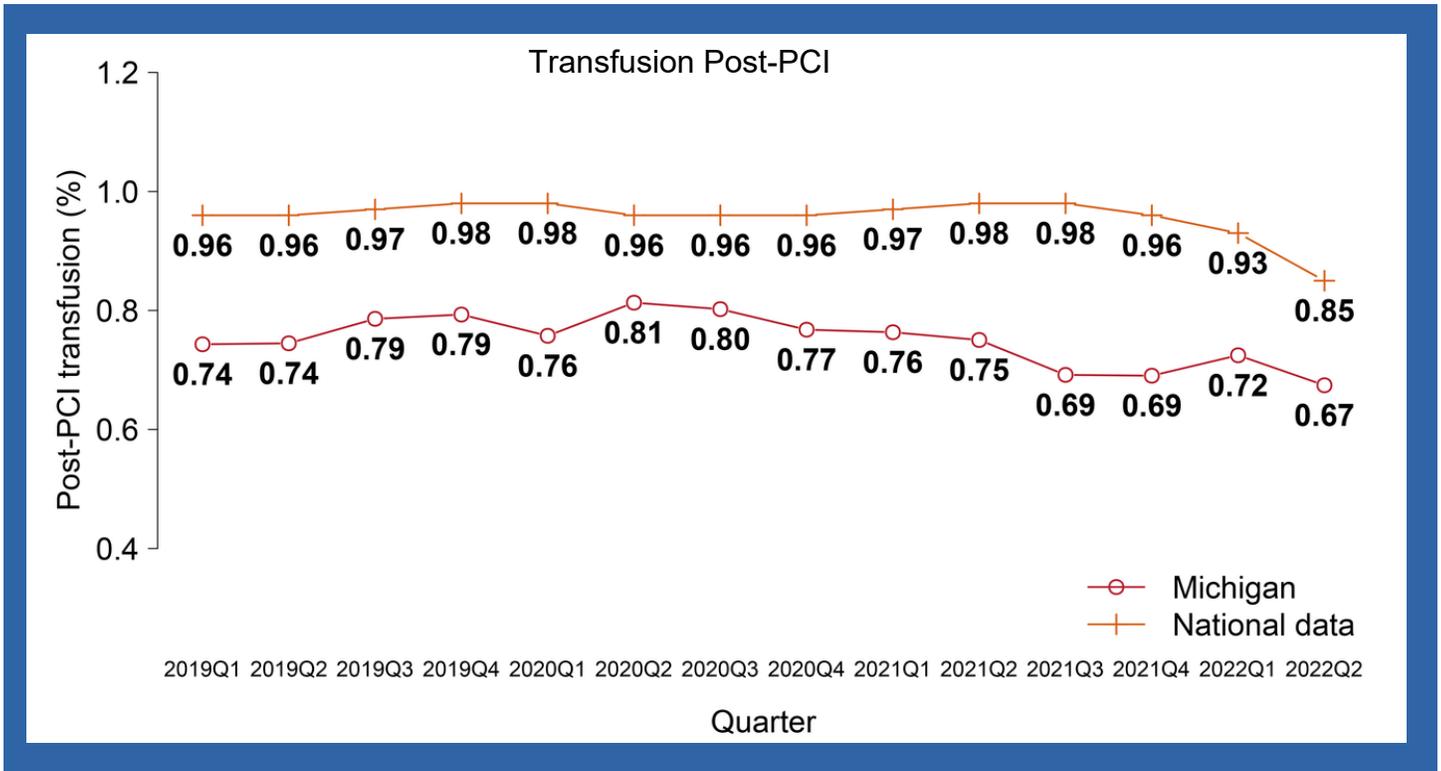


Figure 2. BMC2 facilities have a steadily low rate of blood transfusion over time.

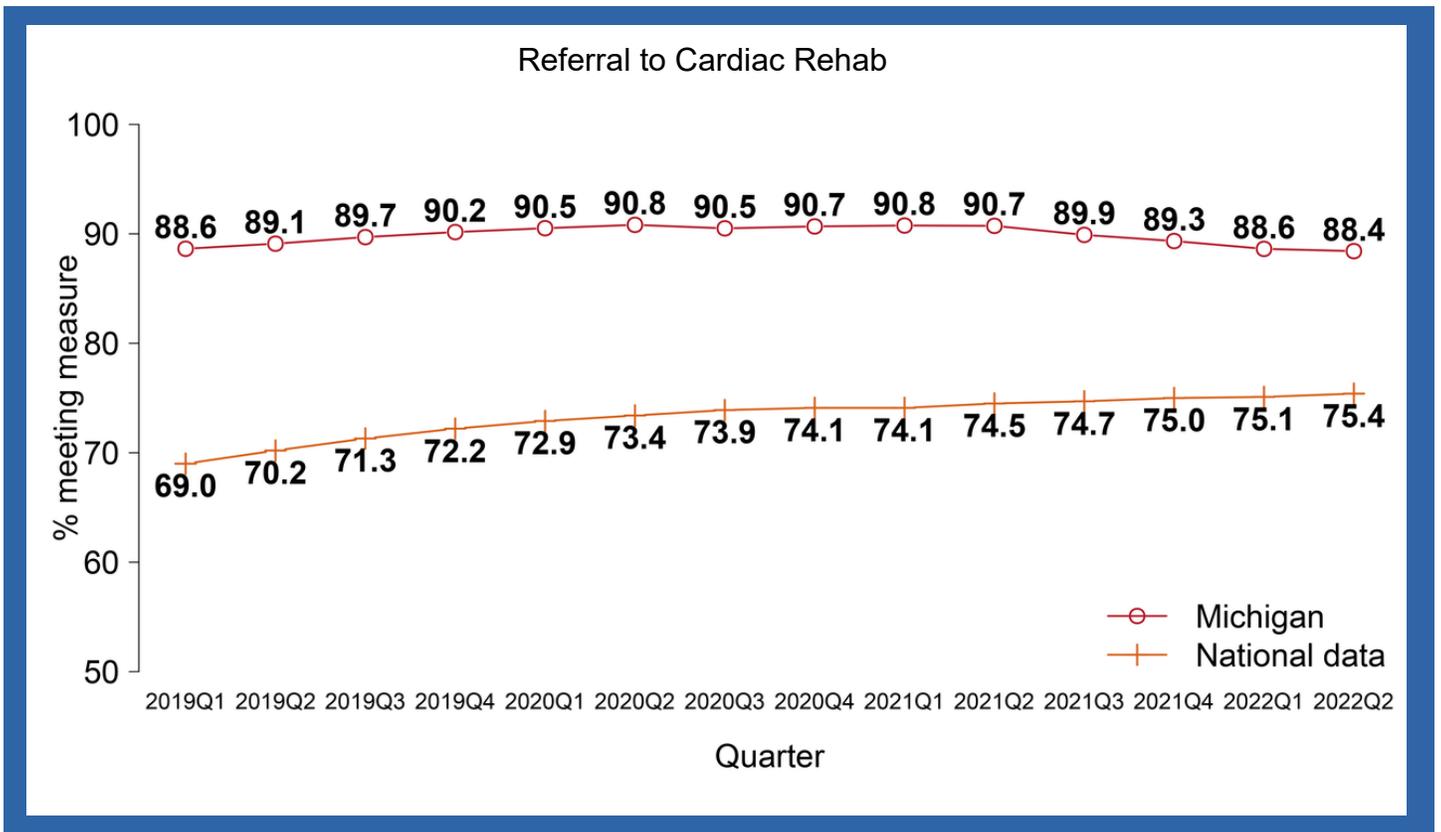


Figure 3. BMC2 physicians more often refer patients to cardiac rehab with 18000+ patients referred in 2021.



SUCCESS STORIES, CONT.

Reducing Radiation Exposure in the Cath Lab

Imaging techniques, including X-rays of the heart, are used to guide many PCI procedures. This results in both the patient and health care provider being exposed to radiation, which has the potential to cause health risks at high doses. BMC2 has taken action to decrease patient and provider exposure to radiation during PCI procedures. BMC2 sites strive to document radiation doses more regularly and consistently during PCI and set a goal to decrease the number of cases with high-dose radiation.



Reducing Radiation Exposure in the Cath Lab

Educational opportunities on radiation safety were made available to consortium members and shared broadly, and BMC2 data informed a publication in a high-profile peer-reviewed journal.



[Video - Reducing Radiation Exposure in the Cath Lab](#)

The outcome of these efforts included radiation data being more often documented by BMC2 facilities and patients undergoing PCI at BMC2 facilities are less likely to be exposed to high doses of radiation (Air Kerma \geq 5Gy.) Learn more about these efforts and the positive impacts made to elevate the quality of care and outcomes for patients across Michigan by watching [our video](#).

"BMC2's efforts to champion radiation safety have positively impacted outcomes for patients and providers across our state. The improvements our consortium has achieved in just a short time demonstrate the power of the CQI platform to affect change that benefits us all."

BMC2 PCI Strategic Advisor, Dr. Ryan Madder – Spectrum Health

Goal Spotlight

Cases with Air Kerma dose \geq 5Gy

Goal	Q1 2021	Q2 2022	% change
\leq 1%	1.22%	0.70%	- 43%



BEST PRACTICE PROTOCOLS

BMC2 physicians use national guidelines, current research, and discussion to create easily digestible snapshots of current [best practices](#). In 2022, BMC2 released 5 protocols for PCI, which you will find on bmc2.org:

- Prevention of Contrast-Induced Acute Kidney Injury
- Management of Radial and Ulnar Access Bleeds
- Radiation Safety
- Use of IVUS/OCT
- Vascular Access

PUBLICATIONS

Data from BMC2 PCI were published in 4 peer-reviewed [publications](#) in 2022 ranging in topic from imaging optimization and the importance of [Left Ventricular End-Diastolic Pressure](#) to the impact of the [COVID-19 pandemic on PCI outcomes](#). BMC2 research also shed light on social determinants of health with evidence that readmission and death are more likely after [PCI for Black patients](#). The lessons learned, and further study will help shape guidelines and patient counseling with a positive impact on quality of care. Visit [our website](#) for access to more information on these important publications.

1 Impact of Left Ventricular End-Diastolic Pressure on the Outcomes of Patients Undergoing Percutaneous Coronary Intervention
American Journal of Cardiology

2 Race and Outcomes after Percutaneous Coronary Intervention: Insights from the Michigan Blue Cross Blue Shield Cardiovascular Consortium
American Heart Journal

3 Rates of Intracoronary Imaging Optimization in Contemporary Percutaneous Coronary Intervention: A Report From the BMC2 Registry
Circ. Cardiovascular Catheterizations

4 Trends and Outcomes of Percutaneous Coronary Intervention During the COVID-19 Pandemic in Michigan
PLOS ONE

PRESENTATIONS

Consortium members presented the outcomes and impact of BMC2's work at several conferences in 2022 including the American Heart Association Scientific Sessions, Transcatheter Cardiovascular Therapeutics, the American College of Cardiology (ACC) Quality Summit, and ACC 2022. While BMC2 is a Michigan-focused consortium, our reach is global. Topics reflected the knowledge gained from our data and included the correlation between survival of cardiac arrest and neurologic status, heparin management during cardiac catheterization, variation in the utilization of coronary physiology in those undergoing PCI in Michigan, and merging machine learning and patient preference. Learning and sharing have led to improvements in quality of care and outcomes such as fewer transfusions and shared decision-making for patients across the state. The [full list of presentations](#) can be found on our website.



PATIENT ADVISORY COUNCIL (PAC)

We benefited from our first full year of working with patient advisors in 2022. We are grateful to have a passionate and committed group of patients who are willing to share their experiences and perspectives with us. Patient advisors collaborated on a project to create tools for physicians and patients to participate in shared decision-making. They have also provided feedback as we work to create a cardiac rehab toolkit. You can learn more about the [PAC](#), our advisors, projects, and how your own patients can join by visiting our website. We look forward to more opportunities to work with our advisors in 2023.



Goal Spotlight			
Cases with Major Bleeding			
Goal	Q1 2021	Q2 2022	% change
≤ 1%	1.00%	0.83%	- 17%

Goal Spotlight			
Pre PCI hydration (oral and/or IV) (volume/3ML/Kg) on PCI patients with eGFR <60			
Goal	Q1 2021	Q2 2022	% change
≥ 50%	45.13%	60.97%	35%



VASCULAR SURGERY

A FOND FAREWELL TO DR. PETER HENKE

For over a decade, Dr. Peter Henke has served as a champion of quality improvement, and the vascular surgery registry has thrived under his directorship. We are grateful for all he has contributed and look forward to continued partnership with him as he serves in an ex officio capacity. We welcomed our new Director of Vascular Surgery, [Dr. Nicholas Osborne](#), in January of 2023.



SUCCESS STORIES

Lessons Learned from Vascular Surgery Peer Review

Increasing concern that physicians are prescribing surgery before exploring evidence-based pre-operative methods for treating claudication inspired BMC2 participants to look at data to determine appropriateness of care.

Using BMC2's unique peer-review process, vascular surgeons evaluated 139 anonymized cross-site cases of elective, open, infrainguinal bypass performed for claudication using prosthetic grafts, submitting a total of 325 reviews.

“BMC2 has developed a novel way to help guide care. The cross-site peer review allows physicians to share, learn, and improve together. It is the foundation of what a great consortium is built on.”

BMC2 Vascular Surgery Strategic Advisor, Dr. Loay Kabbani – Henry Ford Health

In 41% of the cases reviewed, surgeons stated that they would not have recommended bypass. 38% of the procedures were deemed inappropriate. Most commonly, the reason for inappropriateness was a lack of preoperative medical and lifestyle therapy.

Approximately \$4 million in potentially avoidable costs were associated with procedures deemed inappropriate. (Cont.)



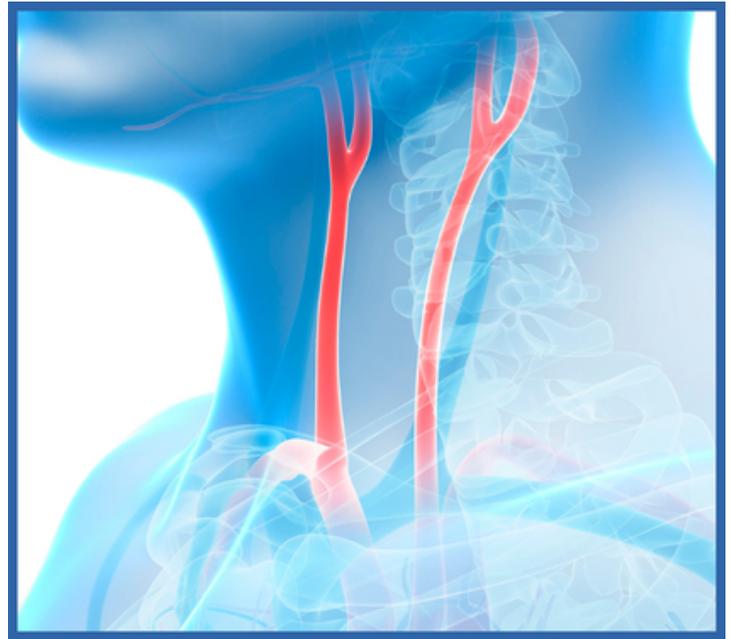
SUCCESS STORIES, CONT.

Lessons Learned from Vascular Surgery Peer Review, Cont.

Treating claudication surgically has the potential to lead to both significant costs and surgical complications. Lessons learned from this study's results could help align clinical practice to preoperative medical management approaches before turning to surgery, resulting in better outcomes for both patients and payers. You can learn more about this success story by visiting [our website](#).

Carotid Endarterectomy

An assessment of determinants of value in carotid endarterectomy was performed by a group of BMC2 participants. The team found that there is tremendous variation in both quality and payments across hospitals included for Carotid Endarterectomy (CEA). Importantly, costs were higher at low-value hospitals independent of postoperative complication. There appears to be little to no relationship between total episode spending and surgical quality, suggesting that improvements in value may be possible by decreasing total episode cost without affecting surgical outcomes. Read more about this finding on [pubmed.gov](#).



Goal Spotlight

Adherence to CEA opioid prescribing recommendation, no more than 4 pills

Goal	Q1 2021	Q2 2022	% change
≥ 70%	61.93%	80.31%	30%

Goal Spotlight

Adherence to EVAR opioid prescribing recommendation, no more than 4 pills

Goal	Q1 2021	Q2 2022	% change
≥ 70%	58.41%	87.20%	49%



PUBLICATIONS

Data from BMC2 vascular surgery were published in 5 peer-reviewed publications in 2022 ranging in topic from [smoking cessation](#), determinants of value in carotid endarterectomy, the [impact of cannabis](#) use on vascular surgery patients, underutilization of medical management of [peripheral artery disease](#), and the lessons learned from cross-site blinded peer review.

1 Assessment of Determinants of Value in Carotid Endarterectomy
American Journal of Cardiology

2 Identifying Potentially Avoidable Femoral to Popliteal ePTFE Bypass for Claudication Using Cross Site Blinded Peer Review
Journal of Vascular Surgery

3 Impact of Cannabis Use on Outcomes after Lower Extremity Bypass
Annals of Vascular Surgery

4 Impact of a Regional Smoking Cessation Intervention for Vascular Surgery Patients
Journal of Vascular Surgery

5 Underutilization of Medical Management of Peripheral Artery Disease Among Patients with Claudication Undergoing Lower Extremity Bypass
Journal of Vascular Surgery

Goal Spotlight

Documentation of EVAR imaging performed on the 1-year follow up form

Goal	Q1 2021	Q2 2022	% change
70%	47.80%	64.14%	34%

PRESENTATIONS

In 2022, BMC2 Vascular Surgery abstracts explored many important issues that impact the health and safety of patients in Michigan.

One study from 2022 looked at the impact of marijuana use on vascular surgery outcomes while another provided evidence that patients might benefit from more lifestyle management efforts before being referred for lower extremity bypass. (Cont.)



PRESENTATIONS, CONT.

Consortium members presented at Midwestern Vascular 2022, the Society for Vascular Surgery/Vascular Annual Meeting 2022, the Society for Clinical Vascular Surgery's 49th Annual Symposium, and the Southern Association for Vascular Surgery 46th Annual Meeting.

Utilization of preoperative vein mapping, the use of beta blockers and stroke risk for patients with hypertension, opioid prescription and usage patterns after open abdominal aortic aneurysm repair, how delays to surgery impact mortality and limb loss in patients with acute limb ischemia who are treated with open thrombectomy, and a novel risk calculator for identifying patients at risk of kidney injury rounded out the presentations. A full list can be found on bmc2.org.



SUCCESS STORIES

MISHC Outperforms the National Average on Key Metrics in Structural Heart Care

Tracking State of Michigan and national data on mortality, major complications, and quality of life over the past 7 years reveals that Michigan outpaces the nation when it comes to key metrics that improve patient outcomes.

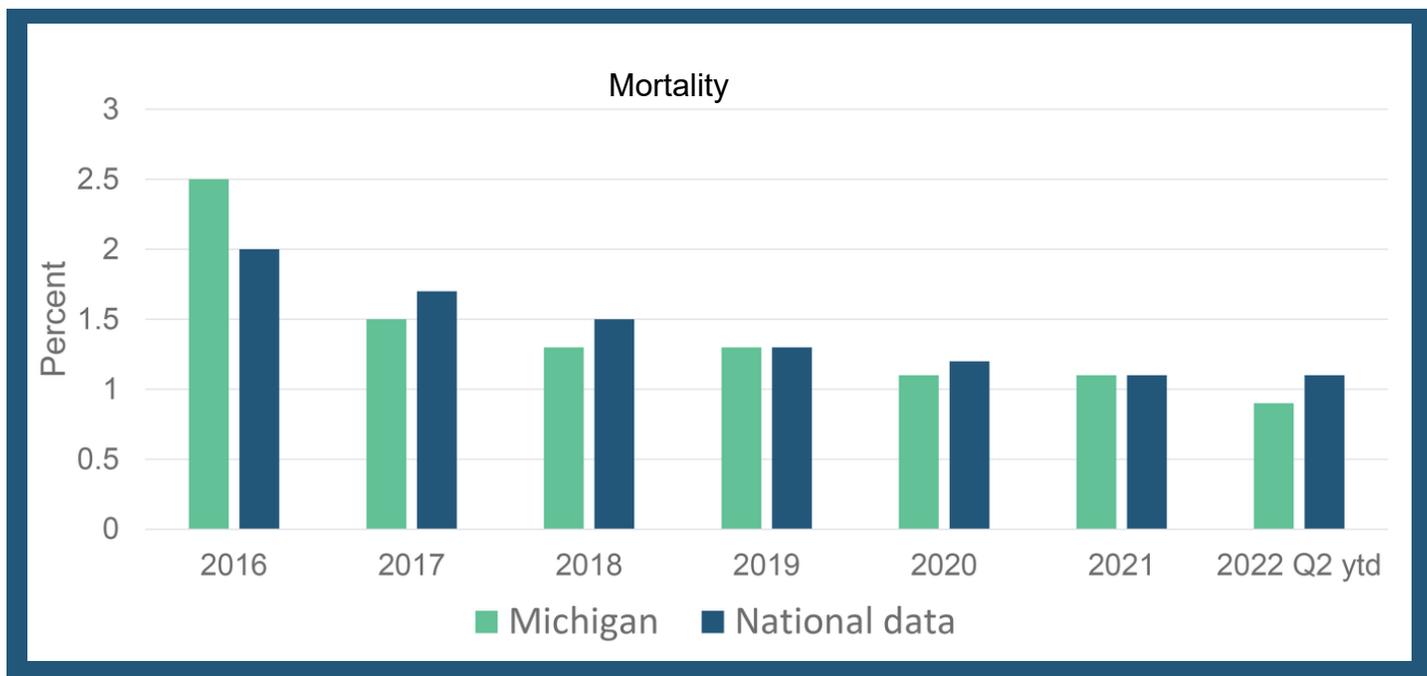


Figure 4. Michigan has seen a 64% decrease in mortality since 2016. (Cont.)



SUCCESS STORIES, CONT.

MISHC Outperforms the National Average on Key Metrics in Structural Heart Care, Cont.

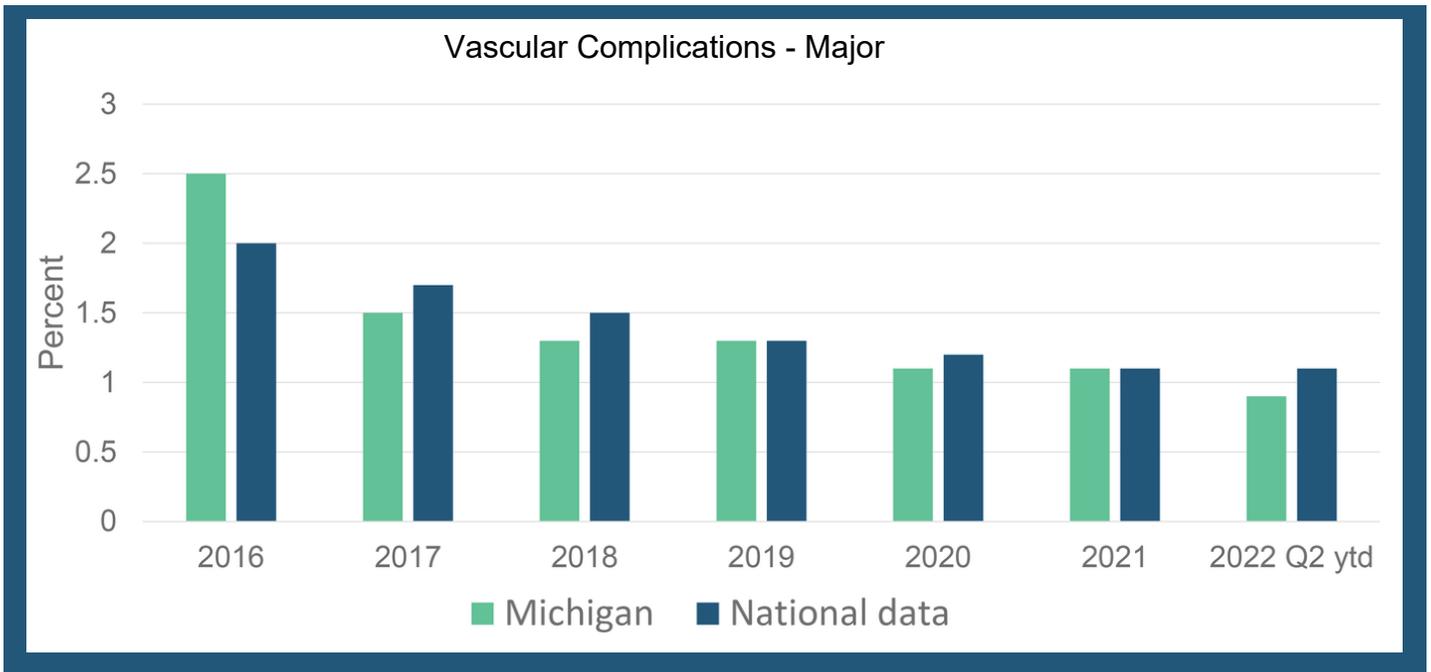


Figure 5. A 38% decrease in major vascular complications is aligned with MISHC efforts to reduce the need for transfusion and supported by the MISHC-developed vascular access best practice protocol.

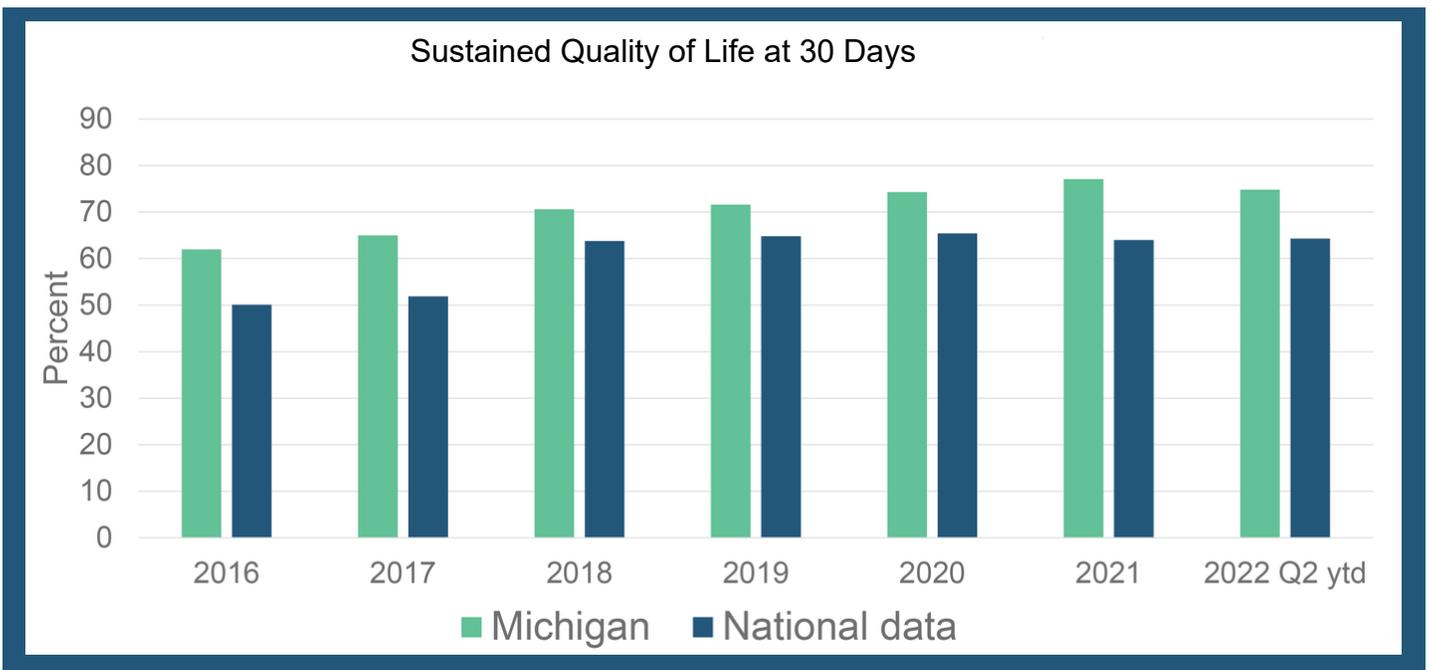


Figure 6. A 21% increase in sustained quality of life at 30 days since 2016 has been driven by robust data collection and performance monitoring related to KCCQ documentation and follow-up.

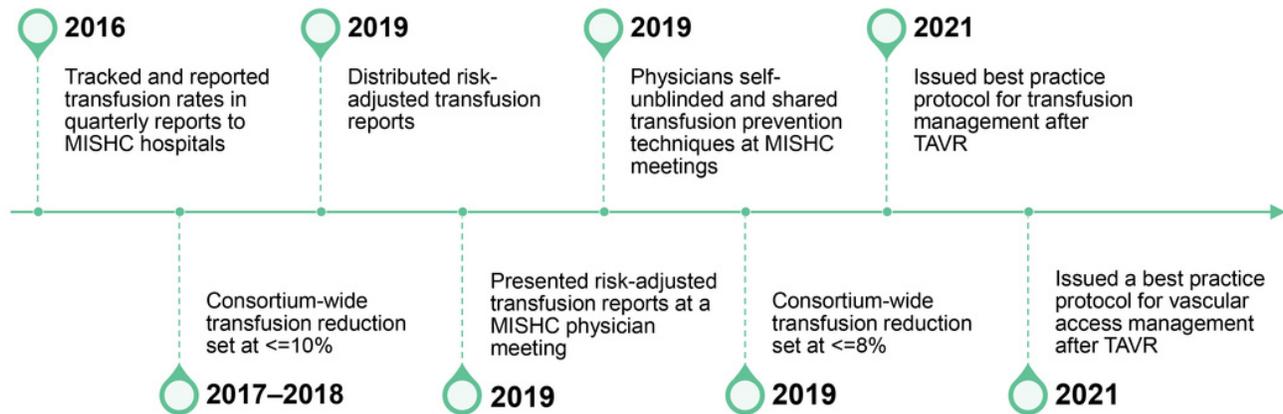


SUCCESS STORIES, CONT.

MISHC Efforts to Decrease Transfusions Lead to Improved Outcomes for Patients

Periprocedural bleeding and anemia can be unintended outcomes among TAVR patients. While blood transfusion can help mitigate the effects, transfusion is independently associated with patients experiencing worse outcomes, including death.

MISHC Collaborates to Decrease Rates of Transfusion



Collaborative efforts across the consortium have led to an 80% decrease in transfusion since 2016, translating to 2,275 transfusions avoided and \$34 million saved. Michigan consistently outperforms the nation in transfusion rates.

BEST PRACTICE PROTOCOLS

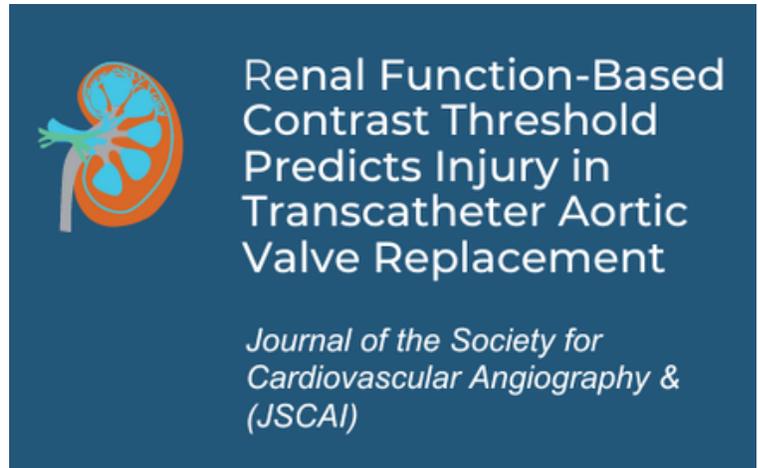
MISHC physicians use national guidelines, current research, and discussion to create easily digestible snapshots of current best practices. In 2022, MISHC released 7 protocols, which you will find on mishc.org:

- Nephropathy Post-TAVR
- Groin Bleed
- Radial and Ulnar Bleed
- Management of Blood Loss and Transfusions Following TAVR
- Timeout for TAVR
- TAVR Nephropathy
- Vascular Access Management in Percutaneous Transcatheter Aortic Valve Replacement



PUBLICATIONS

MISHC data revealed that a patient-specific volume threshold based on the patient's kidney function is a practical way to avoid the risk of kidney damage. Specifically, the incorporation of thresholds of $>2x$ and $>3x$ eGFR into procedural planning should be considered as a quality initiative. The resulting manuscript, "[Renal Function-Based Contrast Threshold Predicts Injury in Transcatheter Aortic Valve Replacement](#)" was featured in *JSCAI* .



PRESENTATIONS

During the ACC Quality Summit, a multi-disciplinary team of MISHC members [presented their collaborative work](#) addressing the data extract formatting change in the STS/ACC TVT Registry version 3.0. Their inclusion of the "TVT Procedure Pathway" identifier on every spreadsheet in the extract, reduced the potential misalignment of 743 data elements to 34 ultimately adding value to all transcatheter valve programs participating in the STS/ACC TVT Registry by improving efficiency and accuracy of data analysis. This will allow teams more time to focus on improvement projects and best practice implementation.

"Valve Reoperation after Native and Valve-in-Valve Transcatheter Aortic Valve Replacement: A Statewide Experience," was presented at the American Association for Thoracic Surgery's 102nd Annual Meeting. This look at MISHC data revealed that approximately one-third of reoperations were VIV-TAVR cases, which demonstrated an exceedingly higher rate of reoperation compared with native TAVR. This fact challenges the worldwide trend of favoring bioprosthetic SAVR and presumptive future TAVR-in-SAVR concept. The frequent aortic repair during TAVR-explant in VIV-TAVR group appears mostly unrelated to TAVR explant trauma.

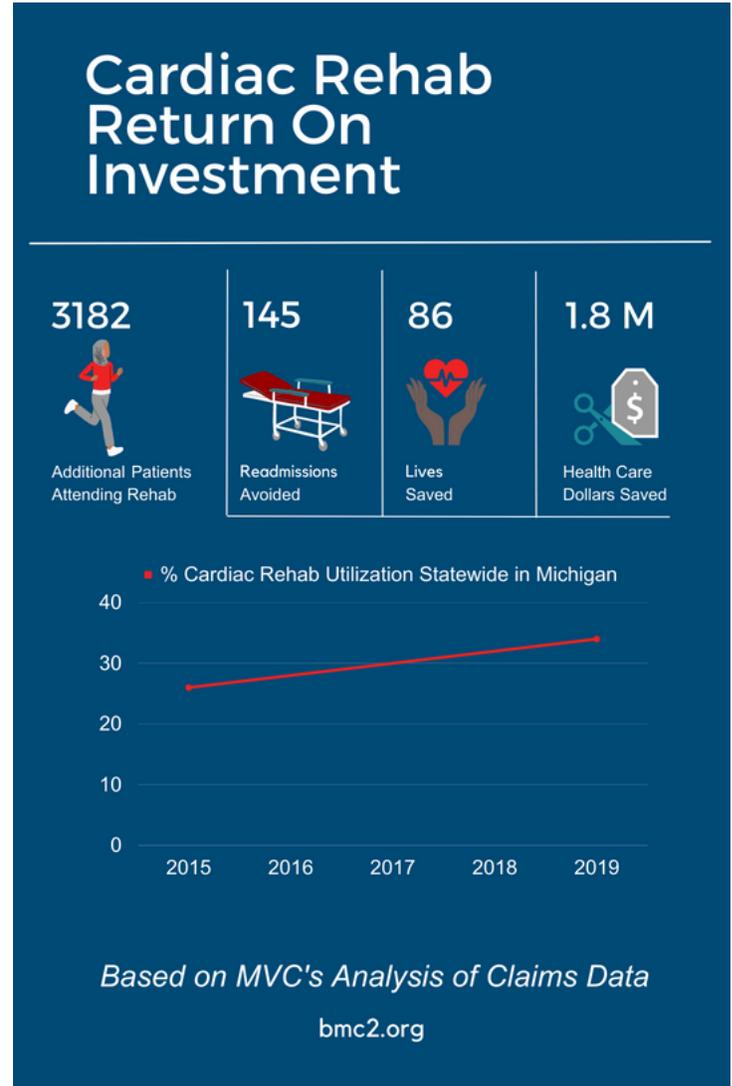


Despite the prominence of cardiovascular disease, too few patients and their families are familiar with cardiac rehabilitation (CR), a life-changing program available to our cardiac patients.

The Michigan Cardiac Rehab Network ([MiCR](#)), a partnership formalized between BMC2 and the Michigan Value Collaborative in 2022, is co-directed by Dr. Devraj Sukul of BMC2 and Dr. Michael Thompson of MVC and supported by an advisory committee of 15 non-CQI members.

MiCR brings together cardiac rehab professionals, cardiology health care providers, payors, and patients to address current issues in CR and create resources to help optimize CR utilization. The network has set a goal of increasing enrollment in CR from

30% to 40% by 2024 for all eligible conditions and is sharing best practices to improve cardiac rehabilitation use after PCI, TAVR, and cardiac surgery across sites in Michigan. Find resources for patients and providers in the [Cardiac Rehab Best Practices Toolkit](#).



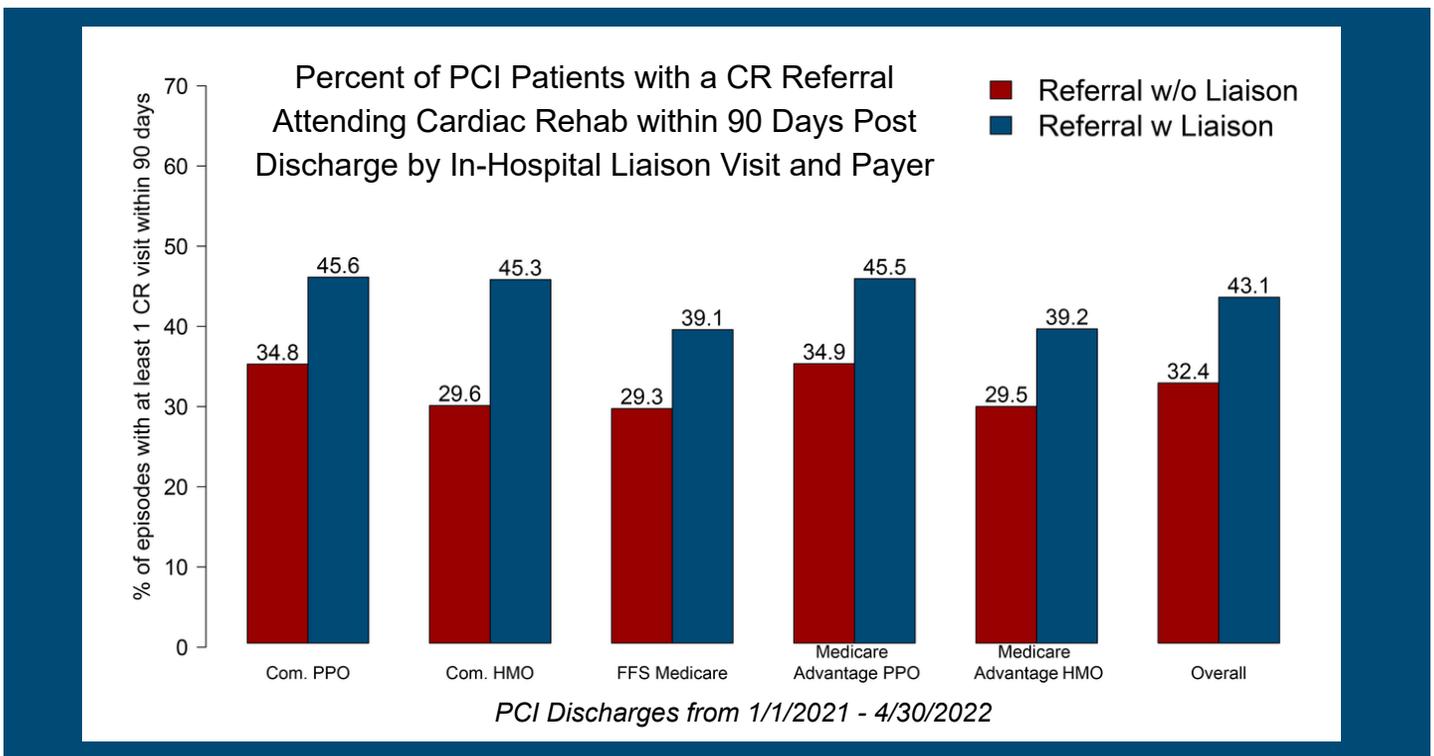
SUCCESS STORIES

Cardiac Rehab Liaison

Patient readiness to attend CR is affected by multiple conversations about CR before enrolling, including a CR liaison, dedicated to patient recruitment and enrollment. BMC2 PCI developed an intervention that:

<ul style="list-style-type: none">• Identified the value of employing a cardiac rehab liaison to advocate for cardiac rehab attendance	<ul style="list-style-type: none">• Published data demonstrating that CR referral alone was not sufficient to drive CR utilization
<ul style="list-style-type: none">• Promoted the opportunity to BMC2 sites at consortium-wide meetings	<ul style="list-style-type: none">• Developed resources to provide hospitals with guidance on implementing a CR liaison program

Data from Michigan hospitals demonstrate that patients with a liaison encounter were significantly more likely to attend cardiac rehab within 90 days post-discharge from a PCI across all payer types (43.1% vs. 32.4%, $p < 0.0001$.) The MiCR and BMC2 will continue to promote this valuable and impactful practice.



PUBLICATIONS

The paper, "[Evaluating the Feasibility of a Statewide Collaboration to Improve Cardiac Rehabilitation Participation](#)" was published in the *Journal of Cardiopulmonary Rehabilitation and Prevention* and demonstrated the feasibility of creating a statewide collaboration of hospitals and CR facilities centered around the goal of equitably improving CR enrollment for all eligible patients in Michigan. Lessons learned in this study helped to result in the Michigan Cardiac Rehab (MiCR) Network.



Evaluating the Feasibility of a Statewide Collaboration to Improve Cardiac Rehabilitation Participation

Journal of Cardiopulmonary Rehabilitation and Prevention



MEETING HIGHLIGHTS

We enjoyed a return to in-person meetings again in 2022. A mix of in-person and virtual meetings allowed us to combine the advantages of both platforms. We were fortunate to draw knowledge from many expert speakers.

During the PCI Collaborative Meeting in May, Henry Ford Health's Dr. David Nerenz presented "Actionable Things Health Systems or Care Teams do to Reduce Disparities in Care." Dr. Nerenz stated that Michigan CQIs, including BMC2, are an ideal setting for disparity reduction. Our Vascular Surgery registry welcomed the University of Arizona's Dr. Wei Zhao to present on the impact of carotid intervention on cognitive function during its Collaborative Meeting in November. Dr. Zhao shared that carotid disease is associated with cognitive impairment. Carotid intervention has an overall positive impact on cognitive function, but the effect is moderate to small and a subset of patients experience procedure-related cognitive decline.

During our MISHC Collaborative Meeting in October, we welcomed Dr. João L. Cavalcante of the Minneapolis Heart Institute who shared "CT Planning to Optimize Aortic Valve Replacement Strategies and Implications for TAV in TAV and TAV in SAV." Dr. Cavalcante outlined CT planning for index SAVR, TAVR in SAVR (ViV), TAVR in TAVR (Redo TAVR), and CT evaluation post-TAVR.

In partnership with MVC, we hosted the inaugural MiCR Annual Meeting in Ann Arbor in October. Cardiac rehabilitation professionals from around the state were invited for networking and learning. Attendees benefitted from enriching presentations by our speakers, including consortium members, colleagues from Healthy Behavior Optimization for Michigan ([HBOM](#)), and a member of our Patient Advisory Council.

Our [YouTube channel](#) is the home of many of the presentations that were shared at meetings throughout the year. You can also learn more about our meetings, topics, and presenters by visiting the [events section](#) of [bmc2.org](#).

The opportunities for learning and networking, and innovating provided by BMC2 contribute to projects that consistently advance quality, leading to improved outcomes for patients not only across the State but nationally and internationally. We look forward to offering you many more opportunities for education and collaboration, both in person and virtually, in 2023.

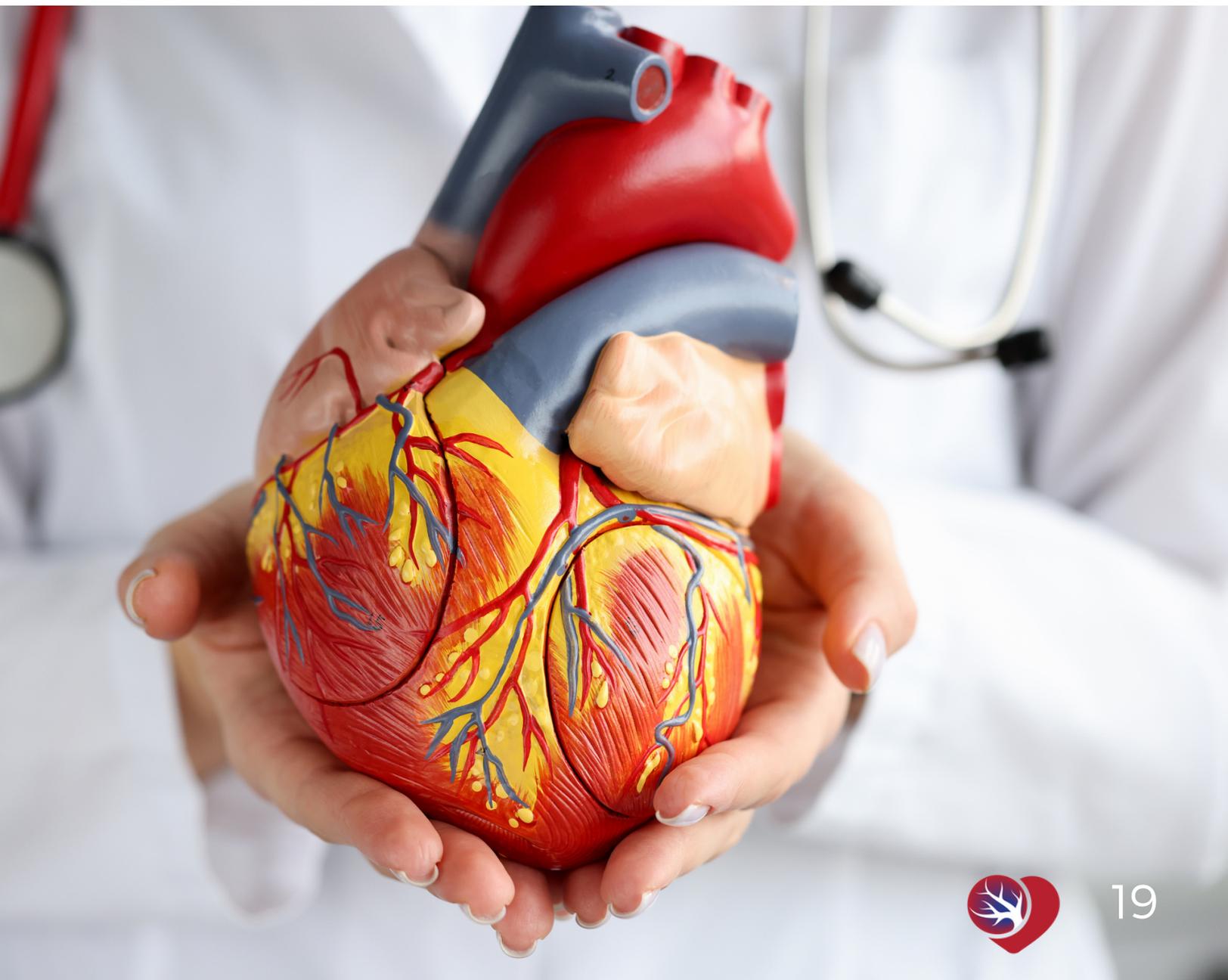


LOOKING TO THE FUTURE

Our work is not possible without the physicians, nurses, administrators, and other professionals who are committed to improving outcomes for the patients in their care. It is also not possible without sound infrastructure.

We have been working behind the scenes to create a new database using Research Electronic Data Capture (REDCap.) REDCap is a secure web-based research management tool and we are excited for the improvements this will offer to our partners as they enter their data. The new database will launch in the spring of 2023.

Quality Improvement is our mission. The data provided by our hospitals and facilities inform projects and protocols that advance the care that health care providers can provide not only in Michigan but nationally and internationally.





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