Dear Colleagues and Friends:

For the seventh year in a row, the comprehensive stroke program at ProMedica Toledo Hospital and the ProMedica Stroke Network grew in both the number of patients whom we cared for and the range of programs and treatment options available.

We are grateful to the compassionate team of physicians, advanced practice providers, nurses, radiation technologists, emergency medical technicians, pharmacists, therapists, social workers, stroke coordinators and other caregivers who stand ready to be there for our patients and their families when they need us the most. This team’s passion and dedication produce outstanding patient outcomes. Together, we have achieved much in our first seven years as a Stroke Network, including these accomplishments:

**Instituted RACE (Rapid Arterial oCclusion Evaluation)**
Lucas County EMS paramedics have been trained to use RACE to recognize stroke emergencies. First responders evaluate a patient's level of severity. When the scale identifies the patient is experiencing a stroke caused by large vessel occlusion, the patient is taken immediately to an accredited stroke center with neuro interventional capability.

**Launched the tele-stroke program**
Patients outside of Toledo now have access to acute stroke care via tele-health communications technology, expanding the high level of stroke care already provided at our hospitals.

**Earned Comprehensive Stroke Center certification**
In 2016, ProMedica Toledo Hospital became the area’s first hospital to earn Comprehensive Stroke Center Certification from The Joint Commission and the American Heart Association/American Stroke Association. Toledo Hospital is one of 159 in the country to tout this status.

**Started a Stroke and Brain Aneurysm Clinic**
The clinic at Toledo Hospital provides a full range of expert care for stroke and brain aneurysm patients, from testing and diagnosis to treatment and follow-up care.

Again, we are proud of the work our team has done to advance the treatment of stroke in the communities we serve. The ProMedica Stroke Network looks forward to continuing to provide innovative care that transforms patients’ lives every day. This outcomes report provides additional information about our efforts.

Message from the Directors

Mouhammad A. Jumaa, MD
Medical Director, ProMedica Stroke Network
Assistant Professor, Vascular and Interventional Neurology, University of Toledo College of Medicine and Life Sciences

Syed F. Zaidi, MD
Medical Director, Neurointerventional Service
ProMedica Toledo Hospital
Assistant Professor, Vascular and Interventional Neurology, University of Toledo College of Medicine and Life Sciences
As the area’s first Joint Commission Certified Comprehensive Stroke Center, ProMedica Toledo Hospital serves as the hub to the ProMedica Stroke Network, which includes 12 hospitals across northwest Ohio and southeast Michigan. Our stroke network helps insure that our community members have access to safe, evidence-based, high-quality stroke care. The network is comprised of these elements:

- **Interventional vascular neurologists and cerebral vascular neurosurgeons** lead the stroke center and network. These highly trained and specialized physicians treat stroke and other cerebrovascular diseases.

- **Collaborative, multidisciplinary care teams** form the foundation of the stroke network. Our highly specialized teams include ProMedica Access, ProMedica Transportation Network, hospital emergency room staff, neurological surgeons, vascular surgeons, neurologists, neurointerventionalists and critical care physicians.

- **State-of-the-art, 20-bed stroke and 15-bed neuro intensive care units** featuring a neuro-interventional lab, 24-hour MRI service, portable CT scanner, private rooms, and nursing staff specifically trained in caring for people with complex neurological conditions.

- **Tele-stroke network** uses telemedicine to provide rural and suburban hospitals with immediate access to interventional stroke neurologists at Toledo Hospital. Via a webcam, these specially trained physicians diagnose a stroke and collaborate with local emergency room staff to provide life-changing stroke-rescue treatments that prevent permanent disability.

- **RACE (Rapid Arterial occlusion Evaluation)** provides an evidence-based protocol for first responders to use to recognize stroke emergencies. When a RACE alert is identified, the patient is taken immediately to an accredited stroke center with neuro interventional capability.

- **Stroke clinic** at ProMedica Toledo Hospital provides follow-up stroke care, diagnosis of cerebrovascular diseases, risk-factor assessment, second-opinion consultations, and treatment for cerebrovascular diseases.

- **Neurological rehab**, provided by physical, occupational and speech therapists, addresses the physical, emotional and psychological needs of each stroke survivor.

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**Never Ignore the Signs: A Young Stroke Survivor’s Lesson**

An artistic and structural welder, 38-year-old Fraser Phibbs came home from work with a headache on Aug. 11, 2016. “I made dinner and went straight to bed,” he recalled.

The next day Fraser still felt off, but he pushed through another full day at his welding shop, Heavy Metal Welding. That evening, his wife, Maribeth (Mare), noticed that he was slurring his speech. But Fraser assured her that he was fine, just tired, and – for the second night in a row – he headed to bed early.

Later that night, Fraser woke up Mare. He was feeling strange. He could not explain what was wrong, but he had never felt that way before. Mare wanted to call 9-1-1, but Fraser refused. By the time they woke up the next morning, Mare could not understand his speech.

Finally, he agreed to get help after three days of not feeling well. By the time they got to ProMedica Toledo Hospital’s emergency center, Fraser explained, “I couldn’t even recall my own name or touch my nose.”

After a series of tests, including a CT scan, Fraser and Mare learned that he had suffered an ischemic stroke. A large blood clot blocking an artery leading to his brain had caused the stroke. Right away, an interventional vascular neurologist removed the clot by performing a mechanical thrombectomy. Fraser began to feel better right away. Soon he was back to living his life – fortunately without any stroke-caused impairments.

Fraser now understands the risk he took by waiting three days to seek help. With stroke, the more time that passes before receiving treatment, the more likely brain damage will occur.

“Follow your gut. If your body is telling you something, you need to listen. And, if you don’t feel well, just get yourself checked out,” Fraser offered.
• **Monthly stroke support group** creates an opportunity for stroke survivors, caregivers and families to share their experiences with one another, receive guidance from clinical stroke specialists, and connect with community resources.

• **Community outreach efforts** build awareness about stroke risk factors and warning signs. Last year, more than 18,200 community members attended 33 Stroke Network sponsored events. These included:
  - Inaugural ProMedica Stroke Network BE FAST Walk
  - Power to End Stroke Night with the Toledo Mud Hens, our local minor league baseball team
  - Go Purple Day which encouraged ProMedica employees to wear purple on a designated day in recognition of Stroke Awareness Month
  - Stroke Miracle Mile on the route of the American Heart Association/American Lung Association Heart Walk
  - Health fair participation at hospitals, assisted living, senior centers, popular women’s health events, and other community settings

• **Stroke research** in a comprehensive stroke program is essential in developing new stroke therapies and improving outcomes. Toledo Hospital regularly participates in studies and publishes papers. See lists for both on pages 19.

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Proven Performance in Stroke Care

With our unwavering commitment to upholding evidence-based best practices in stroke care, our hospitals earned Get With The Guidelines recognitions from the American Heart Association/American Stroke Association (AHA). The AHA recognition included a Gold Plus award for ProMedica Toledo Hospital. Also, for the fifth year in a row, Healthgrades named ProMedica Toledo Hospital among the Top 5% in the nation for the treatment of stroke.
Acute Ischemic Stroke 30-Day Mortality Rate | July 1, 2015 - June 30, 2016
National average: 14.6%:
Our average: 13.4%
Source: Publicly reported all-cause 30-days mortality for Medicare patients.
www.medicare.gov/hospitalcompare

Acute Ischemic Stroke 30-Day Readmission Rate | July 1, 2015 - June 30, 2016
National average: 12.2%:
Our average: 11.6%
Source: Publicly reported all-cause 30 days readmission rate for Medicare patients.
www.medicare.gov/hospitalcompare
In 2017, the number of stroke alerts that our telestroke team responded to grew by 37.6%. Direct access to stroke experts through ProMedica's stroke telemedicine service enabled 56.9% of patients to receive their care at their local community hospital without needing to be transferred to ProMedica Toledo Hospital.
For patients who experience an ischemic stroke, it is crucial to break up the clot that is blocking the flow of blood to the brain as soon as possible. The gold standard treatment is to provide clot-busting medicine (tPA) via an IV within the first three hours following the onset of symptoms. Several quality improvement projects were implemented between 2013 and 2017 that resulted in our median door to IV tPA decreasing by 58.2% – from 79 minutes to 33 minutes. Initiatives included developing a prehospital notification system, implementing a specialized stroke nurse program, and instituting a stroke severity triage system by EMS that is called Rapid Arterial Occlusion Evaluation (RACE) scale.

Rate of Symptomatic Intracranial Hemorrhage in Patients who Received IV tPA at ProMedica Toledo Hospital Emergency Department | 2017

National average: 6.4%
Our average: 0%

Note: The National Institute of Neurological Disorders and Stroke Trial had a 6.4% incidence of symptomatic intracranial hemorrhage rate. This is the rate of bleeding in patients who received IV tPA and whose symptoms then worsened. It is defined by a worsening of the National Institutes of Health Stroke Scale (NIHSS) by 4 points. The NIHSS is a clinical stroke assessment tool to evaluate and document neurological status in stroke patients.
## RACE (Rapid Arterial oCclusion Evaluation) 2015 – 2017

<table>
<thead>
<tr>
<th>Times in Minutes</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median EMS dispatched to arrival</td>
<td>31</td>
<td>28.5</td>
<td>30</td>
</tr>
<tr>
<td>Median door to CT scan</td>
<td>7</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Median door to IV tPA</td>
<td>42</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>Median door to groin puncture</td>
<td>73</td>
<td>68</td>
<td>50</td>
</tr>
<tr>
<td>Median door to recanalization</td>
<td>94</td>
<td>97.5</td>
<td>85</td>
</tr>
<tr>
<td>Median EMS dispatch to IV tPA</td>
<td>59</td>
<td>56</td>
<td>58</td>
</tr>
<tr>
<td>Median EMS dispatch to groin puncture</td>
<td>104</td>
<td>94</td>
<td>90</td>
</tr>
</tbody>
</table>
A mechanical neurothrombectomy, a treatment for acute ischemic stroke, removes a blood clot from a blood vessel in brain by using a stent retriever. An interventional vascular neurologist uses a catheter to maneuver the retriever to the blocked blood vessel. Then, the physician traps and removes the blood clot.

## Baseline Characteristics of Ischemic Stroke Patients Undergoing Mechanical Thrombectomy 2013 – 2017

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age</td>
<td>68.4 years</td>
<td>69.1 years</td>
<td>70.6 years</td>
<td>71.5 years</td>
<td>73 years</td>
</tr>
<tr>
<td>National Institute of Health Stroke Scale</td>
<td>17.2</td>
<td>19.5</td>
<td>17</td>
<td>17.1</td>
<td>16.9</td>
</tr>
<tr>
<td>Median onset to arrival in minutes</td>
<td>119.5 minutes</td>
<td>223 minutes</td>
<td>200.5 minutes</td>
<td>269 minutes</td>
<td>171 minutes</td>
</tr>
<tr>
<td>Percentage of patients treated within six hours of onset of symptoms</td>
<td>75%</td>
<td>64%</td>
<td>72%</td>
<td>58%</td>
<td>69.9%</td>
</tr>
<tr>
<td>Percentage of patients treated between six and 24 hours of onset of symptoms</td>
<td>25%</td>
<td>33%</td>
<td>26%</td>
<td>41%</td>
<td>30.1%</td>
</tr>
</tbody>
</table>
This graph illustrates the time efficiencies achieved for patients presenting at ProMedica Toledo Hospital Emergency Department with ischemic stroke and requiring mechanical thrombectomy. The Joint Commission recommends door-to-groin puncture times of less than 90 minutes. In 2017, our median time was 64 minutes, a decrease of 18.9% from 2016. Note: This graph only includes patients who came directly through the emergency department.
This graph illustrates the time efficiencies achieved for all ischemic stroke patients who underwent a mechanical neurothrombectomy. The Joint Commission recommends door-to-groin puncture times of less than 90 minutes and puncture times to recanalization (TICI 2b/3) of less than 60 minutes. In 2017, our median door-to-groin puncture time was 48 minutes, a decrease of 28.4% from 2016. Our puncture times to recanalization was 22 minutes, a decrease of 3.8%.
The modified Rankin Scale (mRS) measures the degree of disability experienced by patients who have survived a stroke. The scale runs from 0 to 6. Patients with an mRS score of 0 – 2 have recovered to the level that they are able to carry out their daily activities, regaining their independence. Clinicians certified in using the mRS evaluates patients three months after their stroke during a clinic encounter or phone interview. Note: We began tracking baseline mRS in mid 2016. Also, the rate of symptomatic intracranial hemorrhage per ECASS III criteria was 1.1% in 2016 and 2.2% in 2017.
Thrombolysis in cerebral infarction (TICI) is a grading system to score reperfusion after a mechanical thrombectomy. Reperfusion is the restoration of the flow of blood to the brain after a stroke. The degree of reperfusion achieved has been shown to be related to clinical outcomes. A TICI score of 2b/3 suggests successful reperfusion. TICI scores range from grade 0 to grade 3.

**Before and After: Mechanical Thrombectomy**

The angiograph on the left shows a blocked internal carotid artery. Note the lack of blood flow occurring above the blocked artery. The angiograph on the right shows how quickly blood flow is restored after a mechanical thrombectomy.
Patients who experience an ischemic stroke often have carotid stenosis that requires surgical treatment to clean out the blocked artery in the neck and restore normal blood flow to the brain. The ProMedica Toledo Hospital Stroke Center collaborates with Jobst Vascular Institute – also on the campus of Toledo Hospital – to coordinate this care for patients.

The highly experienced Jobst vascular surgeons perform two types of procedures to restore blood flow – carotid endarterectomy and carotid stenting. Each year, they perform more than 100 of these procedures.

**Carotid Artery Surgery Outcomes**

**Total Number of Carotid Endarterectomies (CEA) and Carotid Artery Stenting (CAS) Performed by Jobst Vascular Surgeons at ProMedica Toledo Hospital 2015 – 2017**

- **CEA (2015):** 11 (Elective), 35 (Emergent), 94 (CEA combined with other procedure)
- **CAS (2015):** 4 (Elective), 3 (Emergent), 4 (CEA combined with other procedure)
- **CEA (2016):** 3 (Elective), 33 (Emergent), 128 (CEA combined with other procedure)
- **CAS (2016):** 6 (Elective), 8 (Emergent), 125 (CEA combined with other procedure)
- **CEA (2017):** 11 (Elective), 35 (Emergent), 125 (CEA combined with other procedure)
- **CAS (2017):** 7 (Elective), 4 (Emergent), 7 (CEA combined with other procedure)
### Complication Rates for Post Carotid Artery Surgery 2015 – 2017

<table>
<thead>
<tr>
<th></th>
<th>Death Prior to DC</th>
<th>Post-Op Stroke</th>
<th>Post-Op MI</th>
<th>Aggregate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2015 CEA/CAS</strong></td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>5.1</td>
</tr>
<tr>
<td><em>(n=136)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2016 CEA/CAS</strong></td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1.7</td>
</tr>
<tr>
<td><em>(n=175)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2017 CEA/CAS</strong></td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td><em>(n=182)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Joint Commission sets the standard for an aggregate complication rate of less than 6% for carotid endarterectomy (CEA) and carotid stenting (CAS). For the past three years, Jobst Vascular Institute rates have been lower than the standard.
Brain Aneurysm Clinic

In 2017, we established a brain aneurysm clinic at ProMedica Toledo Hospital. Based on a patient-centered and multi-disciplinary approach, the clinic provides patients with access to both a cerebrovascular neurosurgeon and an interventional vascular neurologist during the same clinic encounter. This offers an opportunity for patients and their families to talk with both doctors about the jointly developed plan to manage the patient’s brain aneurysm. We offer a wide range of treatment options including surgical clipping, endovascular coiling, and observation with follow-up imaging.

Surviving a Brain Aneurysm: One Woman’s Story

Late one night, Frank Buchanan heard his wife Carol making strange noises in her sleep. When he realized she was not breathing, he called 9-1-1 immediately. Within minutes, the ambulance arrived and paramedics administered CPR. Carol was rushed to ProMedica Toledo Hospital’s emergency room. There, on Nov. 28, 2015, she was diagnosed with a ruptured brain aneurysm.

An interventional vascular neurologist performed an emergency endovascular coiling procedure. The physician guided a catheter through Carol’s groin to reach the affected blood vessel in her brain where aneurysm was located. Then, small metal coils were inserted into the aneurysm. They conform to the shape of aneurysm, stopping the bleeding.

Although Carol made it through the procedure, the neurologist shared with the family that she would be fortunate to make it through the night. Moreover, if she did, she likely would not function like before. Three days later, she woke up in the hospital – alive but facing a great deal of physical rehabilitation.

Carol’s recovery progressed over six months. While in the hospital, she began speech, physical, and occupational therapy. Then, she was transferred to ProMedica Flower Hospital for intense inpatient rehab. Once she left the hospital, she completed three more months of outpatient rehab. She also began regular follow-up visits at Toledo Hospital’s brain aneurysm clinic to monitor her aneurysm.

Carol feels extremely lucky. Of those who survive a ruptured brain aneurysm, 66% suffer permanent neurological deficits. “Everything is back to normal now, including the fact that I still don’t like to cook.”
Emergent aneurysm treatments include patients treated after subarachnoid hemorrhage and unruptured symptomatic intracranial aneurysms.

**Clinical Outcomes of Patients with Subarachnoid Hemorrhage**

2016 - 2017

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of procedures</td>
<td>27</td>
<td>30*</td>
</tr>
<tr>
<td>3-month modified Rankin Scale score of 0 – 2</td>
<td>17 (63.0%)</td>
<td>21 (70%)</td>
</tr>
<tr>
<td>Deceased at 3 months</td>
<td>9 (33.3%)</td>
<td>5 (17.2%)</td>
</tr>
</tbody>
</table>

*One patient lost to follow up

Since 2014, 31 elective pipeline embolizations resulted in 3.2% patients experiencing minor neurologic deficit. Ninety-three elective coil embolizations resulted in 2.2% patients having minor neurologic deficit. All patients returned to independent living within 30 days.
As ProMedica’s focus on neurosciences continues to grow, so does the need for convenient and efficient treatment facilities. To address this, ProMedica and The University of Toledo College of Medicine and Life Sciences (UT) are collaborating on care in the new Neurosciences Center on the campus of ProMedica Toledo Hospital. Much more than a building, this is an investment in neurosciences care, academics and research for the entire region.

The three-story, 122,000-square-foot neurosciences center opened in April 2018. Here patients find convenient access to outpatient care for a wide range of neurological conditions, including:

- Alzheimer’s disease and dementia
- Brain aneurysms and tumors
- Epilepsy
- Migraine headaches
- Movement disorders including Parkinson’s disease
- Multiple sclerosis
- Spinal conditions
- Stroke

Everything from diagnostics, disease management and treatment to physical rehabilitation is now available under one roof.

As an expansion of the Academic Affiliation, ProMedica and UT neurologists, neurosurgeons and faculty practice together in a single location. This innovative partnership provides the opportunity to combine the best of clinical practice and academia to enhance patient care and meet the growing needs of our community.

**BrightMatter™ Technology**

ProMedica Toledo Hospital became home to Ohio’s first BrightMatter™ technology, an innovative solution that combines advanced imaging, planning, navigation and robotics for complex brain and spine surgeries.

BrightMatter provides our experienced team of neurosurgeons with the latest advancements in visualization tools to perform minimally invasive, patient-specific brain and spine procedures. It uses an advanced MRI brain-imaging method called diffusion tensor imaging, or DTI, to create a highly detailed map of the brain’s white matter pathways. This functionality allows surgeons to see details that can’t be seen with the naked eye and may allow access to brain locations previously deemed inoperable.
Thanks to research, neurosciences is one of the fastest growing specialties in medicine. Our physicians play a role in that research by serving as site primary investigators for national studies and co-authors in articles presented in leading neurosciences publications.

**Studies**

*Solitaire with the Intention for Thrombectomy as PRIMary Endovascular Treatment (SWIFT PRIME) Trial. Study primary investigator: Jeffrey L. Saver, MD. Site primary investigator: Mouhammad A. Jumaa, MD.*

*Systematic Evaluation of Patients Treated with Stroke Devices for Acute Ischemic Stroke (STRATIS) Registry. Study primary investigator: Nils Mueller-Kronast, MD. Site primary investigator: Mouhammad A. Jumaa, MD.*

*IMPACT: 24col Collateral Blood Flow Assessment Following SPG Stimulation in Acute Ischemic Stroke (ImpACT-24B Sub-Study). Study primary investigator: Yoram Solberg, MD. Site primary investigator: Syed F. Zaidi, MD.*

*A Multicenter Prospective Registry for Outcomes and Practice Patterns for Hemispheric Infarcts with Malignant Edema (OPHELIA). Site primary investigator: Syed F. Zaidi, MD.*


*A Phase 2a, Randomized, Double-Blind, Placebo-Controlled 21-Day Treatment Study, Including an fMRI Sub-Study, to Evaluate the Effect of HT-3951 on Upper Extremity Motor Function Following Ischemic Stroke. Study primary investigator: Philip Perera, MD. Site primary investigator: Syed F. Zaidi, MD.*

**Publications**


