

Enhancing Abdominal Aortic Aneurysm Care Through Efficient Coordination of Vascular Programs With Endovascular Offerings

Enhancing Aortic Aneurysm Care

Cardiovascular disease (CVD) continues to be the leading cause of death for the US population. The prevalence of CVD increases with age, regardless of sex, with CVD including atherosclerosis, coronary artery disease and aortic disease, such as abdominal aortic aneurysm (AAA). Treatment of aortic disease including AAA has progressed from primarily invasive open surgical repair to less invasive approaches like abdominal endovascular aneurysm repair (EVAR) and thoracic endovascular aneurysm repair (TEVAR). Timely screening, diagnosis and follow-up of AAA is essential to positive health outcomes. Without proper identification and intervention, mortality rates for those who experience a ruptured AAA and arrive at the hospital exceeds 80% compared to a 3% postoperative mortality rate for those who undergo elective surgery. Effective coordination of services across the vascular System of CARE (Clinical Alignment and Resource Effectiveness) to manage and treat aortic disease is critical to achieve high-quality outcomes for patients and hospital systems.

With the increasing aging US population, endovascular procedures are forecasted to grow over the next decade. Vascular service line leaders need to take a system-level approach to examine their screening, follow-up and surgical intervention offerings to align with the needs of the patient population. The variation of available hospital resources, subspecialty involvement, surgical experience and type of offerings among vascular services lines means that endovascular surgical programs will differ from organization to organization and often from site to site. Vascular program leaders should aim to involve multiple stakeholders and align with patient-centric goals as they develop endovascular treatment and surgical programs that encompass technology, workforce and growth trends.



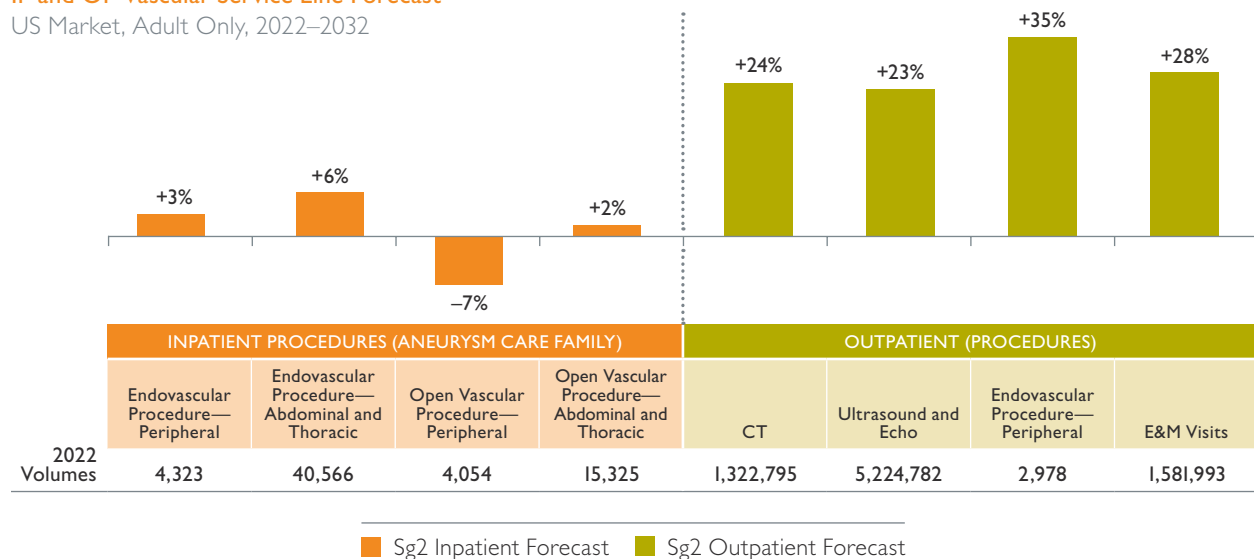
Growth of Aneurysm Repair Procedures

Timely diagnosis and identification of patients at risk of AAA (recommended by the US Preventive Services Task Force) is critical to improving the patient’s short- and long-term health outcomes. Both AAA procedures—endovascular and open surgical—are forecasted to grow over the next 10 years by 6% and 2%, respectively (see Figure 1). Advances in endovascular procedures, device technology and physician experience have increased EVAR utilization compared to the more invasive open approach. The role of EVAR in AAA repair was emphasized in new recommendations from the Society for Vascular Surgery, highlighting better patient outcomes and reduced length of stay. Endovascular procedures will account for approximately 70% of all inpatient AAA repair procedures growth over the next 10 years. While AAA procedures are an important component of patient management, programs set up for success offer services for the diagnosis, monitoring and management of aortic disease across the care continuum. Outpatient imaging visits, including echocardiograms (echos) and vascular duplex scans (ultrasound) and CT scans, are forecasted to grow 23% and 24%, respectively, over the next 10 years, with strong growth in all imaging modalities. Together with imaging, evaluation and management (E&M) visits play a critical role in screening and management of AAA. Vascular E&M visits are forecasted to grow by 28% over the next 10 years, highlighting the key role that these services play in managing a growing population that will potentially need downstream procedures, such as EVAR and TEVAR in the future.

FIGURE 1. INPATIENT AND OUTPATIENT ENDOVASCULAR PROCEDURES AND IMAGING VOLUMES FORECAST

IP and OP Vascular Service Line Forecast

US Market, Adult Only, 2022–2032

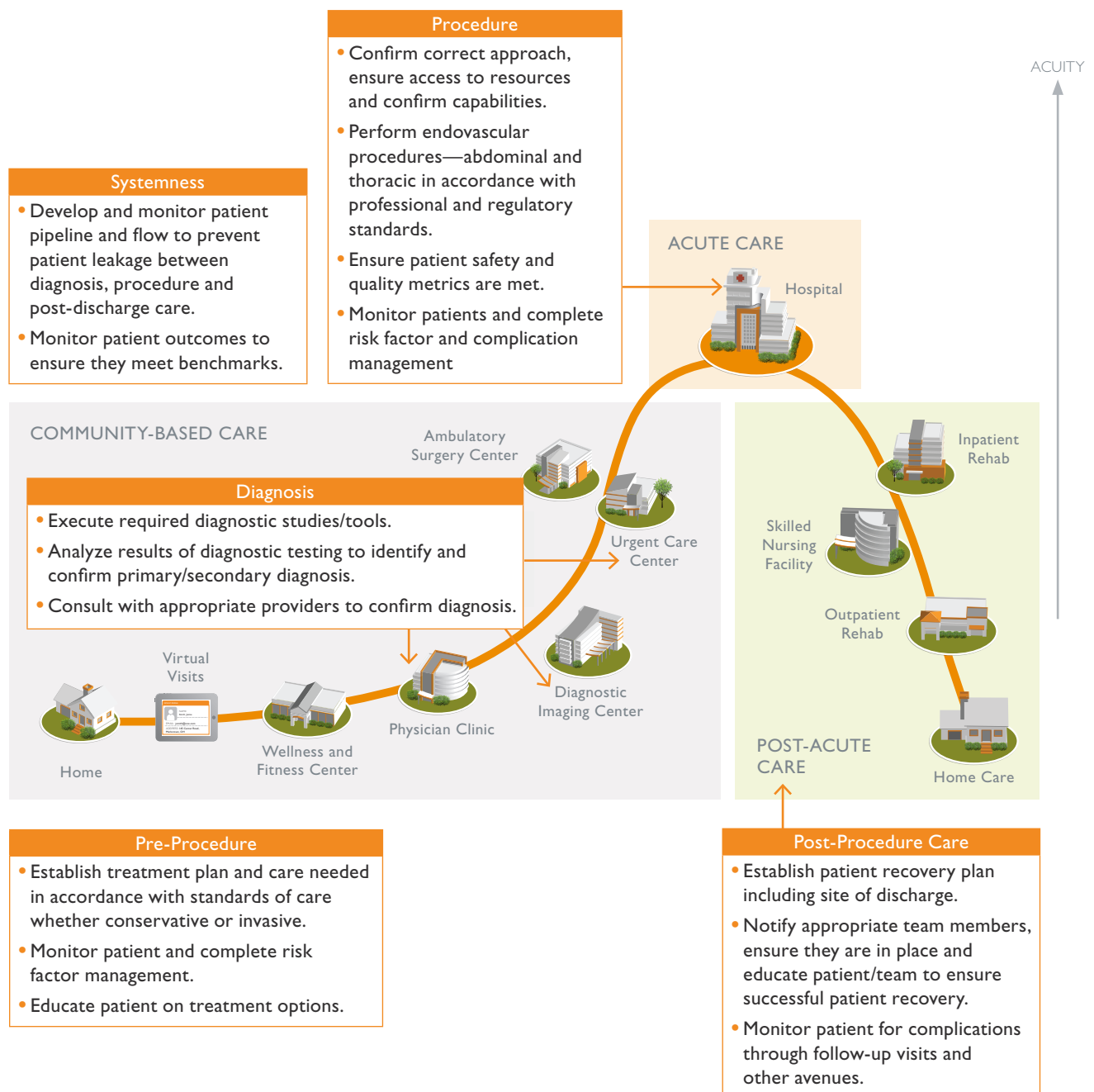


Note: Analysis excludes 0–17 age group. The IP procedures, endovascular procedure—peripheral and endovascular procedure—abdominal and thoracic, are limited to those within the Aneurysm CARE Family. Procedure volumes for CT and E&M are for the following CARE Families: Arterial Embolism; Disease of Venous System (Varicose Veins, Phlebitis, Hemorrhoids); Peripheral Vascular Disease; Aneurysms; and Venous Thromboembolism. All other procedures include volumes that fall across all diseases. Ultrasound and echo category limited to same CARE Families and echo exam of the heart and exam of extremity arteries and veins procedures. All are limited to the cardiovascular service line group. **Sources:** Impact of Change®, 2022; HCUP National Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP) 2019. Agency for Healthcare Research and Quality, Rockville, MD; Proprietary Sg2 All-Payer Claims Data Set, 2019; The following 2019 CMS Limited Data Sets (LDS): Carrier, Denominator, Home Health Agency, Hospice, Outpatient, Skilled Nursing Facility; Claritas Pop-Facts®, 2022; Sg2 Analysis, 2022.

Site of Care and Program Definitions

Effective management and treatment of AAA requires coordination of all services and stakeholders across the care continuum. Fully integrated care models ensure at-risk patients are identified early, monitored appropriately and proactively scheduled for surgery prior to rupture. In the event surgical repair is necessary, patients are scheduled at the appropriate level of care with resources available to support the continuum of care and the experience to ensure quality outcomes. Therefore, effective care of AAA patients and vascular surgery program development often require a multidisciplinary approach across various sites of care (see Figure 2).

FIGURE 2: ABDOMINAL AORTIC REPAIR SERVICES ACROSS THE CARE CONTINUUM



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Successful treatment of abdominal aneurysms requires vascular programs that offer the right complement of services, technologies and staffing based on resources available, patient population and physician skill set (see Table I). Understanding your organization’s capabilities will help reveal the appropriate pathways to decide whether growing the service in house or partnering with a nearby comprehensive AAA program is the right choice for your organization.

More vascular procedures are being provided across multiple settings, such as the office for low-acuity peripheral vascular procedures; however, complex vascular procedures (outlined in Table I) including EVAR procedures will continue to require inpatient or hospital-based care setting for the foreseeable future. As innovation and cost pressures shift procedures to the lowest-acuity site of care, programmatic and/or system-wide approaches to AAA patient care will be crucial to ensure optimal use of resources. A multidisciplinary approach will play a key role in the identification of appropriate transitions in site of care, optimization of cost of care per beneficiary and improved key quality metrics.

TABLE I. VASCULAR SERVICES PROGRAM TYPES AND DEFINITIONS

	OUTPATIENT	INPATIENT	COMPLEX INPATIENT
Services	<ul style="list-style-type: none"> • Endovascular procedures <ul style="list-style-type: none"> – Aortoiliac occlusive – Infrainguinal arterial – Upper extremity arterial – Deep venous – Superficial venous – Arteriovenous access • Noninvasive vascular diagnostics (accredited by IAC/ACR) <ul style="list-style-type: none"> – Duplex ultrasound scans—carotid, renal, abdominal, mesenteric, extremity – Physiologic arterial studies • Angiography: arterial and venous • Supervised exercise training 	<ul style="list-style-type: none"> • Endovascular and open procedures <ul style="list-style-type: none"> – Descending thoracic aorta (endovascular) – Aortoiliac occlusive – Aortoiliac aneurysmal – Infrainguinal arterial – Upper extremity arterial – Carotid-vertebral – Deep venous – Superficial venous – Arteriovenous access – Thrombolytic infusion • 24/7/365 emergency vascular coverage 	<ul style="list-style-type: none"> • Complex endovascular and open aortic procedures <ul style="list-style-type: none"> – Aortic arch and proximal branches – Thoraco-abdominal repairs – Visceral aorta and branches – Descending thoracic aorta (open) – Neurointerventional • 24/7/365 emergency vascular and cardiothoracic coverage • Clinical research
Technology	<ul style="list-style-type: none"> • Duplex ultrasound • Fluoroscopy • ASC/office-based lab 	<ul style="list-style-type: none"> • CT and MRI • 3D CT • Endovascular suite/catheterization lab • Fixed and/or portable fluoroscopy • Inpatient and ICU beds • Intravascular ultrasound (IVUS) • Hybrid OR 	<ul style="list-style-type: none"> • Cardiopulmonary bypass • Biplane angiography equipment • Transesophageal echo • Cerebral monitoring
Staffing	<ul style="list-style-type: none"> • Medical director • Program manager • Vascular technician(s) • Data abstractor 	<ul style="list-style-type: none"> • Vascular surgeon—board certified • Vascular administrator • Vascular nurse coordinator • Anesthesiology 	<ul style="list-style-type: none"> • Cardiothoracic surgeon—board certified • ICU and critical care • Remote monitoring support • IT support across settings • Clinical research coordinator

ACR = American College of Radiology; ASC = ambulatory surgery center; IAC = Intersocietal Accreditation Commission.

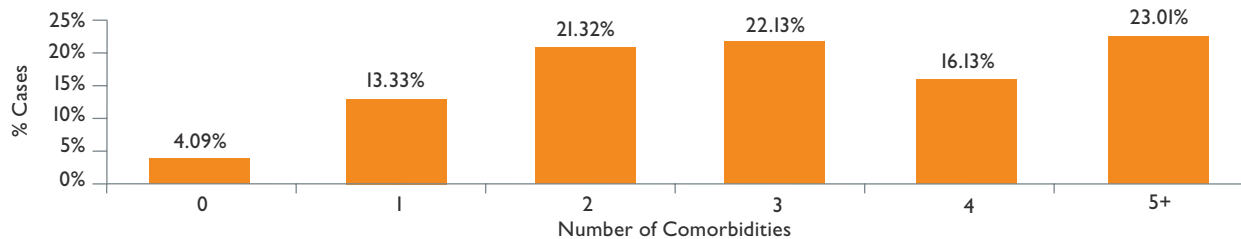
Considerations for Deciding to Build or Partner for Comprehensive Endovascular Programs

Patient population, program design and internal resources are critical when deciding whether to expand AAA repair options within your health system or partner with higher-volume comprehensive AAA programs. Consider the following information when making those decisions.

Patient Demographics Within Vizient Clinical Data Base (CDB)

- Most EVAR patients are covered by Medicare, as evidenced by the payer mix distribution: 1) Medicare: 76.69%, 2) Commercial: 13.32%, 3) Medicaid: 4.52%, and 4) All Other: 5.47%. While Medicaid patients account for nearly 5% of overall volume, their health care utilization is the highest of the four payer types when evaluating length of stay, ICU percentage, mean ICU days, complication percentage and 30-day readmissions.
- Approximately 60% of EVAR patients have three or more comorbidities, reflecting the complexity and unique needs of this patient population.
 - The top four comorbidities include: 1) hypertension uncomplicated: 55.35%, 2) peripheral vascular disease: 46.88%, 3) chronic pulmonary disease: 34.69%, and 4) hypertension complicated: 31.23%.

FIGURE 3. DISTRIBUTION OF COMORBIDITIES FOR PATIENTS UNDERGOING EVAR (N=8,244) (VIZIENT CLINICAL DATA BASE)



Sources: Data from the Vizient® Clinical Data Base used with permission of Vizient, Inc. All rights reserved; Time Frame: Q4 2021–Q3 2022; Adult inpatient population (18+ years); Comorbidities (also seen as AHRQ Comorbidities and Elixhauser Comorbidities) are publicly available code sets created by AHRQ. For more information on the Elixhauser Comorbidities, visit the [Elixhauser Comorbidity Software Refined for ICD-10-CM](#). AHRQ = Agency for Healthcare Research and Quality.

Select Patient Outcomes

Scheduled cases comprise the majority of EVAR procedures and consistently have lower utilization patterns compared to more resource intensive emergent and transfer cases as measured by case mix index (CMI).

TABLE 2. SELECT UTILIZATION MEASURES FOR ALL EVAR CASES (VIZIENT CLINICAL DATA BASE)

ADMISSION TYPE	CASES (N=8,244)	CMI	MEAN OBSERVED LOS	% ICU CASES	MEAN ICU DAYS	30-DAY READMISSIONS
Scheduled	73.87%	4.41	2.32	29.26	2.04	4.77%
Emergent	14.24%	5.24	8.81	58.60	4.24	11.10%
Transfers	11.89%	5.52	9.73	70.00	4.72	9.26%

Sources: Data from the Vizient Clinical Data Base used with permission of Vizient, Inc. All rights reserved; Time Frame: Q4 2021–Q3 2022; Adult inpatient population (18+ years); **Emergent:** Revenue charge codes 450–459; **Transfer:** Transfer from a hospital, Transfer from a SNF, ICF, ALF or NF, Transfer from Ambulatory Surgery Center, Transfer from another health care facility, Transfer from designated disaster alt care site, Transfer from Hospice and is Under a Hospice Plan of Care or Enrolled in a Hospice Program, Transfer from one distinct unit of the hospital to another; **Scheduled:** Excludes transfers and ED admits; 30-day hospital-wide readmissions include all cause unplanned readmissions to the index hospital; Case Mix Index (CMI): The average relative weight of all MS-DRGs for a specific population or time frame reflective of the intensity of resources used. ALF = assisted living facility; ICF = intermediate care facility; NF = nursing facility; SNF = skilled nursing facility.

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Volume to Outcomes for All EVAR Cases

CMI increases as hospital EVAR volume rises, potentially driven by average transfer percentage. Nearly 80% of all transfers in the sample occur in hospitals with a minimum of 25 annual cases, suggesting current market dynamics are rationalizing transfers to high-volume centers.

TABLE 3. SELECT OUTCOMES FOR ALL EVAR CASES BASED ON ANNUAL HOSPITAL VOLUME (VIZIENT CLINICAL DATA BASE)

HOSPITAL VOLUMES	CMI	% TRANSFERS	% ICU CASES	MEAN ICU DAYS
<10	4.56	2.64%	57.63%	2.33
10–24	4.60	7.68%	45.64%	2.54
25–49	4.63	11.20%	35.53%	2.94
50+	4.74	15.38%	33.37%	4.21

Sources: Data from the Vizient Clinical Data Base used with permission of Vizient, Inc. All rights reserved; Time Frame: Q4 2018–Q3 2019 and Q4 2021–Q3 2022; Adult inpatient population (18+ years); % Transfers refers to transfers from a different hospital (admission source code 4); Data excludes cases with any transfer discharge status.

Volume to Outcomes for All Scheduled EVAR Cases

As scheduled EVAR volume increases, percentage of ICU cases decrease. More strikingly, percentage of observed in-hospital deaths and early deaths are notably higher in the lowest-volume hospital group. These correlations reinforce the importance of aligning patients with the most appropriate site of care based on their complexity and your organization’s maturity for AAA repair.

TABLE 4. SELECT OUTCOMES FOR SCHEDULED EVAR CASES BASED ON ANNUAL HOSPITAL VOLUME (VIZIENT CLINICAL DATA BASE)

HOSPITAL VOLUMES	% ICU CASES	MEAN ICU DAYS	% OBSERVED DEATHS	% EARLY DEATHS
<10	55.11%	1.65	0.92%	0.43%
10–24	34.79%	1.76	0.47%	0.22%
25–49	22.57%	2.04	0.49%	0.07%
50+	17.65%	3.71	0.53%	0.09%

Sources: Data from the Vizient Clinical Data Base used with permission of Vizient, Inc. All rights reserved; Time Frame: Q4 2018–Q3 2019 and Q4 2021–Q3 2022; Adult inpatient population (18+ years); Scheduled: Excludes transfers and ED admits; % Early deaths: Vizient defined metric for deaths within two days of admission as a proportion of total discharges; Data excludes cases with any transfer discharge status.

Internal Resources

A recent estimate of vascular surgery workforce indicated a persistent 28% shortfall of vascular surgeons, which may impact program development. Additionally, the shortfall further heightens the need for system-wide coordination and improved hospital-by-hospital efficiencies. This situation is not expected to resolve until the end of 2030.

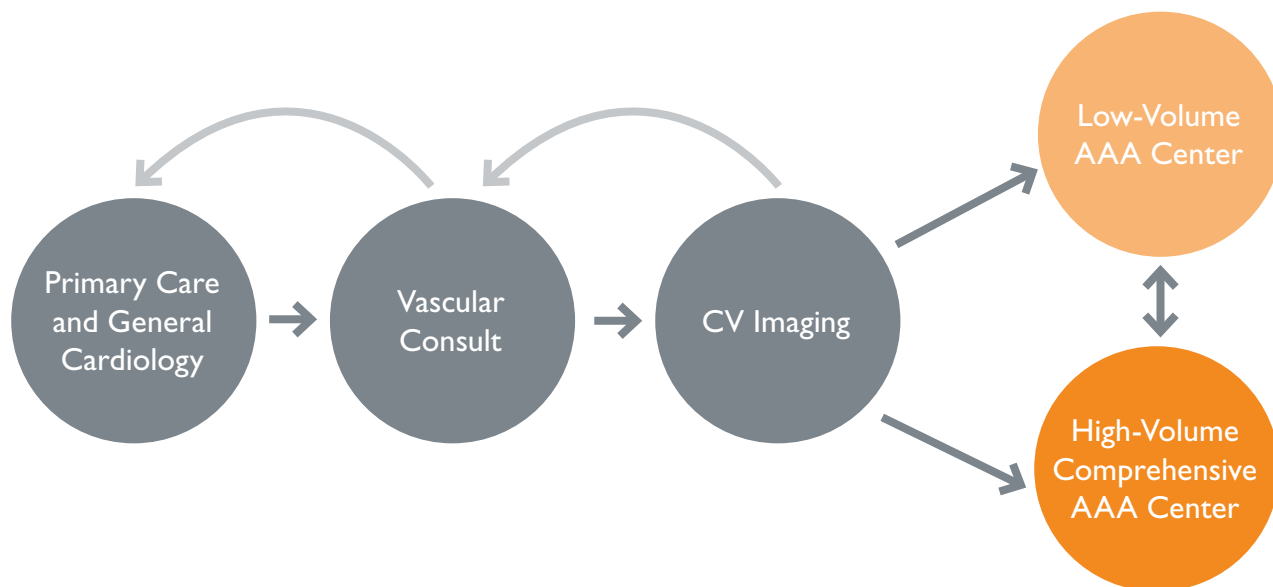
Health systems must reorient from a procedure focus to a comprehensive patient-centric focus—either through partnership when faced with limited resources or by strategic growth initiatives—to emerge as a choice regional comprehensive AAA program.

Set Yourself Up for Future Success

Programmatic care coordination around AAA patients is critical for high-quality patient outcomes and program growth and sustainability. Effective first-line management starts with high-impact primary care services to screen at-risk populations. Coordination between cardiovascular imaging, vascular consults and primary care is critical to establishing management and treatment options for suspected and diagnosed AAA. When surgical repair is warranted, choosing the right procedure and facility is key.

A new practice guideline on the care of patients with AAA by the Society for Vascular Surgery recommends the EVAR technique as the first-line approach when anatomically feasible for emergent AAA cases. Additionally, the consensus document recommends that EVAR should be preferentially performed at centers with regular case volume and experience, which is defined as at least 10 EVAR cases yearly and a less than 2% perioperative mortality and conversion ratio to open surgical repair. Organizations need to assess their service capabilities and internal resources to establish a patient care pathway that optimizes outcomes for the patient. As a volume-to-quality relationship for AAA repair procedures (including open and endovascular procedures) must be maintained, not all institutions are equipped to provide a comprehensive AAA program. Lower-volume AAA repair programs should offer elective EVAR on lower-acuity patients but refer highly complex patients to the higher-volume comprehensive programs; this recommendation is also supported by the Vizient CDB analysis. In the case of a ruptured aneurysm, a rapid evaluation of the feasibility of transferring the patient to a higher-volume comprehensive program is recommended with demonstrated effectiveness. The proposed coordination of AAA care requires education, communication and appropriate referrals within, and potentially in partnership across, health care systems. Figure 4 provides an example structure and patient flow between management/screening and eventual treatment.

FIGURE 4: ABDOMINAL AORTIC REPAIR SERVICES ACROSS THE CARE CONTINUUM



Strategic Considerations Summary

	OVERVIEW	ACTON STEPS
Program Components	AAA repair programs require a well-integrated approach across multiple services lines.	<p>Effective AAA repair programs require integration across the continuum of care.</p> <ul style="list-style-type: none"> • Provide a robust screening program targeting at-risk patient populations to identify asymptomatic patients. • Establish protocols to ensure patients with known AAA are proactively managed with yearly imaging, in accordance with current guidelines. • Develop formal communication protocols across the care continuum to ensure patients receive the highest quality care. • Optimize EVAR and open surgical repair options with consideration to length of stay and patient quality outcomes. • Evaluate the current vascular program, to determine whether a formal transfer agreement with a comprehensive AAA program is necessary.
Workforce	Maintain staffing resources across the AAA care continuum to ensure high-quality health outcomes.	<p>Minimize the burden of 24/7 emergency coverage and maintain job satisfaction by spreading overnight call duty among a larger staff pool.</p> <ul style="list-style-type: none"> • Schedule elective EVAR procedures at the most appropriate site of care to optimize patient-centric outcomes including quality outcomes and total cost of care. • Vascular surgeons are well versed in open and endovascular interventions as well as long-term follow-up of patients with vascular disease, including AAA. • The current shortage of surgeons across the vascular service line is projected to worsen over the next decade.
Resources	Hospital and ambulatory settings are used to deliver innovative vascular screenings, diagnostics and treatments to patients across the care continuum.	<p>Hospital-based facilities are important to the delivery of high-acuity vascular care, such as AAA repairs.</p> <ul style="list-style-type: none"> • Nearly 75% of vascular surgeons have access to a hybrid OR. • Imaging and diagnostic services are provided by nearly 95% of vascular surgeons. Consider novel approaches to support system-wide coverage or ways to meet the needs of underserved markets. • Screening services are offered by nearly 70% of vascular surgeons; however, additional efficiencies are needed to improve screening throughput to address the short-term vascular surgeon shortfall.

ACTION STEPS FOR HOSPITAL SYSTEMS

STRATEGY

- What vascular offerings do our hospitals or systems currently have? What are the future goals and capabilities of our vascular program?
- What AAA care options should we offer that meet our patients needs and complement our long-term service line goals?

ASSESSMENT

- What resources do we need to be successful?
- How does the current patient population utilize vascular services in our market?
How will demand change over time, and what resources will we need to meet future demand?

GOVERNANCE

- Do we have the governance structure and physician leadership to grow our endovascular options within vascular surgery?

COORDINATION

- Are we coordinating services across the continuum of care within our own system? Within our market? Is there a role for collaborating with a competitor for services we currently do not offer?

PHYSICIAN ALIGNMENT

- Do we have alignment across our vascular service line to ensure long-term, high-quality endovascular and overall surgical procedures to our community?

Sources: Xu J et al. NCHS Data Brief No 456: Mortality in the United States, 2021. Centers for Disease Control. December 2022; Yazdanyar A and Newman A. *Clin Geriatr Med.* 2009;25:563–577; Guirguis-Blake JM et al. *JAMA.* 2019;322(22):2219–2238; Go M et al. *Ann Vasc Surg.* 2020;66:282–288; McMahon G et al. *Ann Vasc Surg.* 2012;26(4):571.e7–9.

NOTES

Sg2, a Vizient company, is the health care industry's premier authority on health care trends, insights and market analytics.

Our analytics and expertise help hospitals and health systems achieve sustainable growth and ensure ongoing market relevance through the development of an effective System of CARE.