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Global Outpatient Care Imaging Services Growth Opportunities

Value Delivery of Radiology Services Across Different Outpatient Care Settings will Influence the Medical Imaging Market

Global Transformational Health Research Team at Frost & Sullivan

The Growth Pipeline™ Company
Powering clients towards a future shaped by growth

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Contents

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Summary

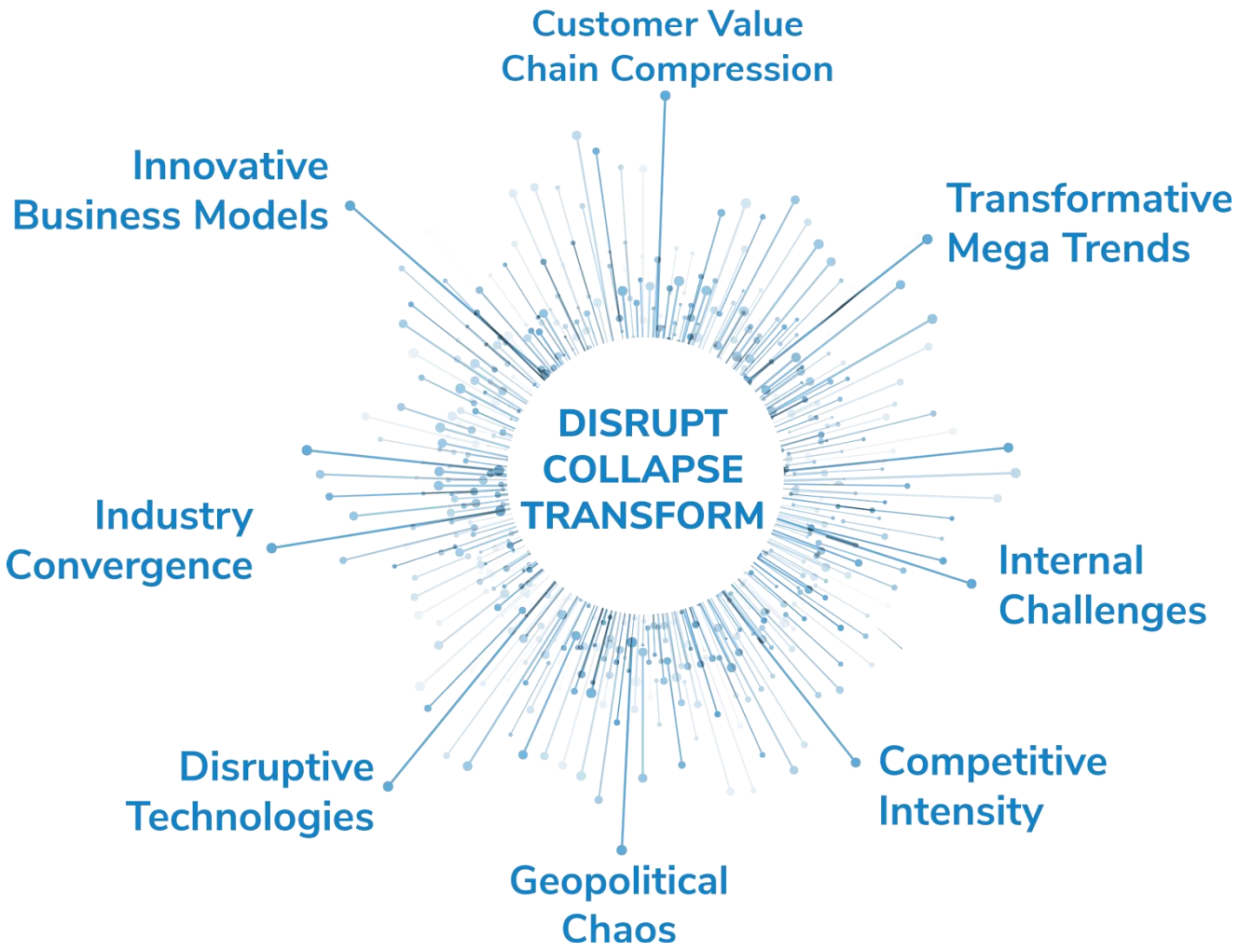
- Important trends in outpatient US imaging sites that will impact the sales of medical imaging equipment include the growing number of ambulatory surgery centers (ASCs), especially for cardiology procedures, and the increase in population-based screenings for cancer, especially breast cancer. These trends can increase procedure volume and drive the demand for equipment. Other trends include the growing demand for AI- and cloud-based imaging informatics solutions and the shift from capital expenditure (CAPEX) investments to an operational expenditure (OPEX) model, which can lead to increased adoption of the latest medical imaging informatics solutions.
- The main trends in outpatient imaging sites in the European Union that will impact the sales of medical imaging equipment are the increase in public health screenings for cancer (including breast cancer) and the establishment of multiple community diagnostic centers in the United Kingdom by the Department of Health and Social Care (DHSC).
- Some of the key trends in outpatient care sites in Asia-Pacific (APAC) and the rest of the world (RoW) are the growing demand for health services in emerging markets (e.g., India and China) and the growing incidence of chronic diseases and cancer in the Middle East and Latin America (LATAM). While some countries are investing in healthcare, many countries—especially in Africa—have poor healthcare infrastructure and limited access to radiology equipment.
- The value of imaging services varies across different outpatient care sites; each site determines the services it will provide and the investments it will make in medical imaging equipment. The imaging services that at-home services and urgent care centers (UCCs) provide are mainly for detection purposes. ASCs and office-based labs (OBLs) use imaging services for prevention, detection, delivery, and monitoring—especially for interventional procedures. Hospitals and academic institutions use imaging services for purposes across the spectrum of prevention to prognosis.

Source: Frost & Sullivan

Strategic Imperatives

Why is it Increasingly Difficult to Grow?

The Strategic Imperative 8™: Factors Creating Pressure on Growth



Source: Frost & Sullivan

The Strategic Imperative 8™

Innovative Business Models	Customer Value Chain Compression	Transformative Mega Trends	Internal Challenges
A new revenue model that defines how a company creates and capitalizes economic value, typically impacting its value proposition, product offering, operational strategies, and brand positioning.	Customer value chain compression as a result of advanced technologies, internet platforms, and other direct-to-consumer models that enables reduction in friction and the number of steps in customer journeys.	Global forces that define the future world with their far-reaching impact on business, societies, economies, cultures, and personal lives.	The internal organizational behaviors that prevent a company from making required changes.
Competitive Intensity	**Geopolitical Chaos**	**Disruptive Technologies**	**Industry Convergence**
A new wave of competition from start-ups and digital business models that challenge the standing conventions of the past, compelling established industries to re-think their competitive stance.	Chaos and disorder arising from political discord, natural calamities, pandemics, and social unrest that impact global trade, collaboration, and business security.	New, disruptive technologies that are displacing the old, and significantly altering the way consumers, industries, or businesses operate.	Collaboration between previously disparate industries to deliver on whitespace cross-industry growth opportunities.

Source: Frost & Sullivan

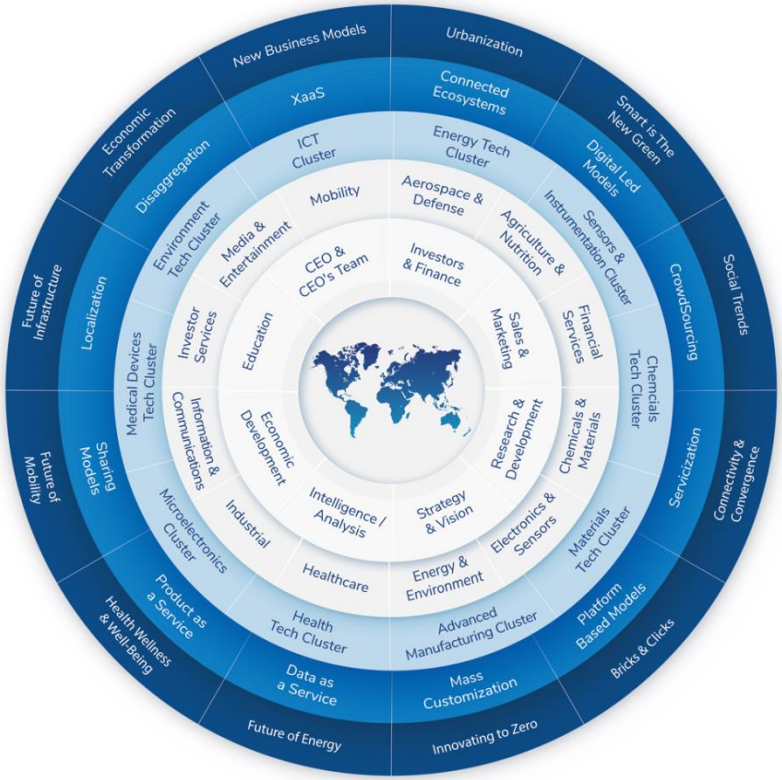
The Impact of the Top 3 Strategic Imperatives on the Imaging Services at Outpatient Care

SI8	Transformative Mega Trends	Competitve Intensity	Innovative Business Models
Why	• The global population is growing, as people are living longer because of advancements in healthcare. • Developed markets (e.g., the United States and Western Europe) are struggling because of increasing healthcare costs and are cutting their expenses by reducing the reimbursements for various hospital procedures.	• The increasing number of non-hospital imaging facilities (e.g., ASCs, UCCs, IDICs) poses a competitive threat to hospitals, as imaging procedures constitute a major revenue source for hospitals. • The advent of COVID-19 increased the imaging service volumes at outpatient care centers (e.g., IDICs) and at-home mobile imaging services, partly because of the increasing uptake of telehealth services.	• Orthopedic, spinal, and cardiovascular procedures have increased at ASCs in the past few years, providing a growth opportunity for medical imaging companies. However, traditional commercial models are costly for the ASCs because they receive lower reimbursement rates than hospitals. Moreover, ASC-based doctors are more price-sensitive than those at hospitals.
Frost Perspective	• In the last decade, payor policies in the United States have moved many approved outpatient surgical procedures to ASCs to reduce the high reimbursement costs associated with surgical procedures at hospitals. • The shift in outpatient volumes from hospitals is impacting the imaging services industry. Imaging volumes are shifting from hospital campuses to independent diagnostic imaging centers (IDICs) and ASCs because of the lower costs at these non-hospital facilities.	• Hospitals are trying to minimize the loss of these outpatient surgical and imaging revenues by building their own ASCs or by acquiring or partnering with existing ASCs. • This emerging trend should gather steam in the next few years as favorable reimbursement policies drive up the surgical volumes at ASCs.	• Because of the capital investment limitations of non-hospital outpatient care centers, medical imaging and informatics companies are offering flexible financing arrangements, such as managed equipment services (MES) contracts and pay-per-use models.

Source: Frost & Sullivan

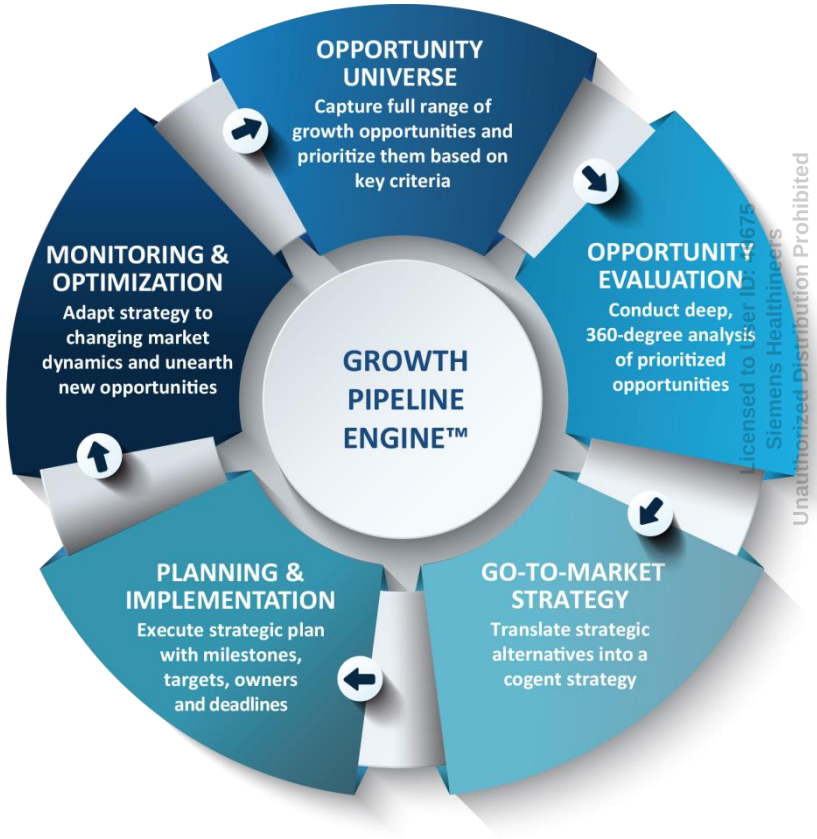
Growth Opportunities Fuel the Growth Pipeline Engine™

The Innovation Generator™



Analytical Perspectives

The Growth Pipeline Engine™



Source: Frost & Sullivan

Growth Opportunity Analysis

Scope of Analysis

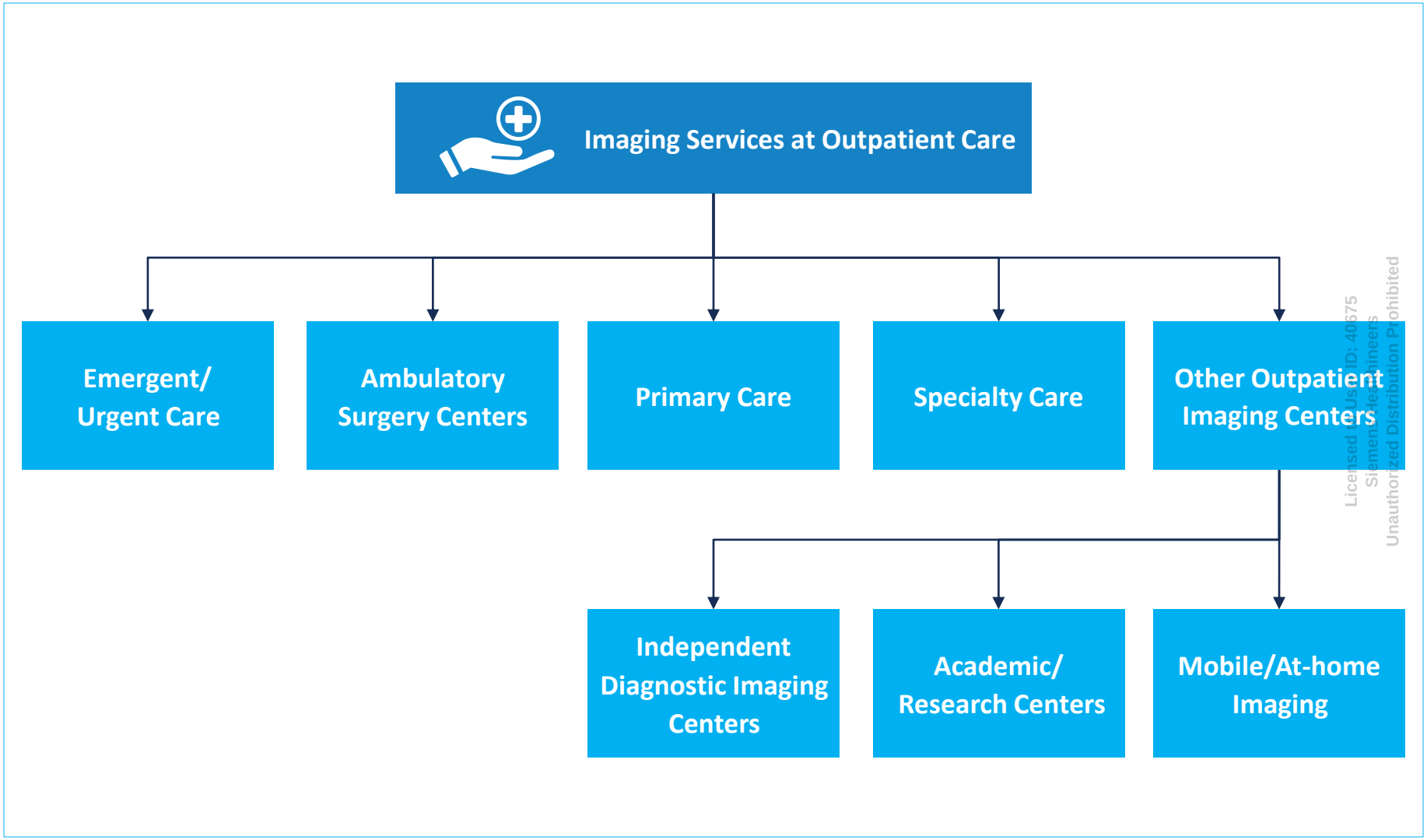
- The aim of this study is to analyze the latest developments in outpatient care imaging services, including evaluating the present market scenario, existing and evolving business models, mergers and acquisitions (M&A), regulatory and reimbursement landscapes, and future growth opportunities.
- The focus of this study is on radiology services in outpatient settings. The geographic scope comprises North America, Europe, and APAC.
- The outpatient care imaging services facilities include 5 main types:
  - Emergent/urgent care
  - ASCs
  - Primary care
  - Specialty care
  - Other outpatient imaging centers: IDICs, academic/research centers, mobile/at-home imaging

Scope	
Geographic Coverage	Global
Study Period	2022–2027
Base Year	2022
Monetary Unit	US Dollars

- This study will analyze the value of radiology services across the different outpatient care settings and a project in which innovative business models will dominate the market.
- This study will analyze the various regulatory and reimbursement issues associated with outpatient care medical imaging services.
- This study will provide growth opportunities for medical imaging equipment and informatics providers at outpatient care medical imaging services.

Source: Frost & Sullivan

Segmentation



Source: Frost & Sullivan

Segmentation (continued)

Emergent/Urgent Care

- UCCs (e.g., Concentra, CityMD, MedExpress) treat injuries or illnesses that require immediate attention but are not serious enough for hospital emergency departments.
- These centers may not offer advanced medical imaging services. The most common radiology procedure that UCCs perform is X-rays.

ASCs

- ASCs provide same-day surgical care, including diagnostic and preventive procedures.
- ASCs provide various imaging services, from X-rays to other radiology services (e.g., ultrasounds, catheterizations), depending on their specialty.

Primary Care

- The imaging services that primary care centers provide usually depend on urgency or need. Depending on the severity of the condition, they may refer patients to secondary/inpatient care. The following facilities conduct imaging services as outpatient care:
  - Hospital outpatient departments (HOPDs)
  - Primary healthcare centers and community health centers (CHCs)
  - Primary care physicians' offices
- The types of imaging services that these centers perform are X-rays or other radiology services. Computerized tomography (CT) scanners and magnetic resonance imaging (MRI) equipment are not available at all primary healthcare centers and primary care physicians' offices, so these centers may refer patients who need advanced medical imaging to hospitals or academic centers.

Source: Frost & Sullivan

Segmentation (continued)

Specialty Clinics

- Specialty clinics (e.g., OBLs) perform outpatient imaging services for exclusive specialties (e.g., cardiovascular, orthopedics, women's health, gastrointestinal, and dentistry).
- The types of imaging procedures they perform vary as per their specialty. For example, women's health centers provide ultrasounds, mammograms, and bone density scans.

Other Imaging Centers

- IDICs: These centers may be owned by physicians, but they are independent of an attending doctor's office or hospital. For example, Akumin (FKA Elite Imaging) has more than 140 imaging centers in the United States and focuses solely on providing outpatient imaging services.
- Academic/Research Centers: Institutes such as the University of Washington Magnetic Resonance Research Laboratory and the Department of Radiology and Imaging Sciences at the Indiana Institute for Biomedical Imaging Sciences provide complex outpatient imaging examinations. These centers offer imaging services, technical expertise, and medical investigators to on-campus scientists for their research and clinical trials.
- Mobile/At-home Imaging: Specialists carry mobile imaging equipment and ancillary materials necessary for imaging services—mainly X-rays and ultrasounds—at nursing homes, assisted living facilities, and patient homes. For example, Ultra-X Imaging performs portable X-rays and ultrasounds in homes.

Source: Frost & Sullivan

Key Trends Influencing Outpatient Care Imaging Services in the United States

Growth in the ASC market

- According to estimates, more than 6,000 ASCs operated in the United States in 2022, performing more than 30 million procedures.
- Surgical procedures are increasingly moving from hospitals to ASCs because of the significant cost savings to Medicare. As per the Ambulatory Surgery Center Association (ASCA), Medicare pays ASCs only 55% of the amount it pays HOPDs for the same procedure.
- Patients who choose ASCs over hospitals save approximately $4.2 billion per year for Medicare and $42.2 billion per year in overall healthcare spending.
- The number of procedures that ASCs conduct will grow in the coming years. Presently, more than 49 million people—15% of the US population—are older than 65, and this percentage will increase to 24% by 2060.

Increase in the number of ASCs will increase the demand for medical imaging services

Patient convenience drives demand

- Along with the growth of ASCs and OBLs, the number of outpatient procedures is increasing. As per estimates, about 80% of the surgeries in the United States occur at outpatient sites (e.g., ASCs, OBLs, HOPDs).
- The reason patients choose ASCs over hospitals is because of the convenience they offer. Wait times are shorter, and patients frequently have less distance to travel.
- Since ASCs are smaller and less busy than hospitals, they can offer convenient and easily accessible parking facilities, more comfortable waiting areas, and friendlier staff.
- Similarly, more patients are choosing to have radiology scans at IDICs instead of hospitals because of the convenience that IDICs offer.

ASCs, OBLs, and IDICs are experiencing more traffic because of consumer preference

Source: ASCA; Frost & Sullivan

Key Trends Influencing Outpatient Care Imaging Services in the United States (continued)

Consolidation of ASCs drives investments

- The ASC industry consolidation that occurred in 2021 continued in 2022. The consolidation of ASCs was a result of the shift in high-acuity procedures from hospital inpatient facilities and HOPDs to outpatient care centers, which led to a push by hospitals to increase their ASC footprint to expand their outpatient care presence.
- In 2022, ASCs saw procedural volumes return to pre-pandemic levels, with significant growth in case volumes. The specialties that experienced growth in 2022 were cardiology, orthopedics, and high-acuity spinal procedures.
- As per ASCA, orthopedics was the most common specialty area that ASCs serviced in 2022. ASCs saw significant growth in cardiology procedures, and projections are that more than half of all cardiology procedures will occur at ASCs in the next couple of years.
- UnitedHealth Group's Optum announced the acquisition of Kelsey-Seybold, a Houston-based physician group, for $2 billion in 2022.

Increased consolidation will drive investments in facilities and equipment

Increasing focus on value-based care

- The Centers for Medicare and Medicaid Services (CMS) had planned to start enforcing a new policy for its AUC (Appropriate Use Criteria) program on January 1, 2023; this policy would limit reimbursements by making it mandatory for a physician or his clinical staff to consult a qualified Clinical Decision Support Mechanism (CDSM) before ordering an advanced diagnostic imaging exam (e.g., CT scan, MRI, nuclear medicine scan, positron emission tomography scan). However, CMS has postponed implementing the policy's payment penalty period until later.
- The CDSMs are electronic portals through which physicians access AUC. The CDSM determines whether an order adheres to AUC or if the AUC is not applicable. This consultation will become mandatory before ordering imaging services; otherwise, CMS will not provide payment for the services.
- Once enforcement begins, this policy will apply to all advanced diagnostic imaging services performed at outpatient care sites (e.g., physicians' offices, ASCs, IDICs, HOPDs—including emergency departments).

Reduction in medical imaging services may impact investment in medical imaging equipment

Source: CMS; Frost & Sullivan

Key Trends Influencing Outpatient Care Imaging Services in the United States (continued)

Breast cancer screening beginning 10 years sooner

- A proposed US Preventive Services Task Force (USPSTF) recommendation suggests expanding the age range for biennial breast cancer screenings in women from 50 to 74 years to 40 to 74 years. This recommendation will increase mammography procedures in screening centers, especially in the 40 to 49 age group.
- This change will positively impact the sales of units in the full-field digital mammography and digital breast tomosynthesis (DBT) segments. Procurements of DBT units will increase once the task force officially publishes its guidelines.

A new recommendation will increase mammography equipment sales

Growing demand for ai- and cloud-based solutions

- Integration of advanced technologies, such as AI, in medical imaging informatics is helping improve the quality of outpatient care imaging services. AI helps radiologists provide accurate diagnoses and precise measurements.
- RadNet has created a new division called Radiology Imaging Associates that provides an enhanced breast cancer detection service (powered by Deep Health)—a new AI-based solution that works in concert with a patient's annual breast screening regimen.
- The demand for cloud-based medical imaging informatics solutions is growing, especially at outpatient care sites. The main reasons for this development are the rapidly growing population and the increasing procedural volumes of various medical imaging modalities. Cloud-based solutions offer easy access, archiving, sharing, and analysis of medical images across healthcare facilities. Cloud-based software solutions offer healthcare institutions greater accessibility and lower costs than on-premises solutions.

Digitalization in the healthcare sector is driving the adoption of advanced informatics solutions

Source: USPSTF Program Office; Frost & Sullivan

Key Trends Influencing Outpatient Care Imaging Services in the United States (continued)

Shift from CAPEX to OPEX models

- More care centers are shifting from CAPEX to OPEX models for imaging informatics solutions, especially AI-based solutions.
- A huge expansion of health data is occurring. The population with ailments is growing significantly, and care centers are taking millions of images annually. Healthcare services are evolving, intensifying the need to store, retrieve, and share medical data. The healthcare infrastructure must be capable of handling the growing demand and the technology requirements.
- The CAPEX model has limitations: it requires high investments initially; software can become obsolete and vulnerable to security risks if not updated; maintenance and customer support may require additional expenditures; additional software investments may be necessary to prevent cyberthreats.
- Customers prefer the OPEX model for procuring imaging informatics software because it has low upfront costs; provides continuous support throughout the license period; eliminates the burden of maintaining the software or hardware; offers options to scale solutions based on volume or the number of users; upgrades software regularly to the latest version; offers flexibility to change the software provider; and the vendor manages the data protection.

The adoption of cloud-based imaging informatics solutions (based on OPEX model) will increase in the next few years

Bipartisan bill that boosts access to diagnostic imaging agents

- In March 2023, the US House of Representatives passed a new piece of legislation—the Facilitating Innovative Nuclear Diagnostics (FIND) Act of 2023—which aims to boost Medicare patients' access to diagnostic imaging agents.
- The existing payment program only reimburses radiopharmaceuticals through a packaged system, which poses significant barriers to accessing new nuclear imaging agents. With the FIND Act, the Department of Health and Human Services can issue a separate payment for imaging agents, using a per-day cost threshold of $500.

The new bill will increase procedure volumes for diagnostic nuclear imaging

Source: SNMMI; Frost & Sullivan

Key Trends Influencing Outpatient Care Imaging Services in the European Union

ECIBC recommending DBT for breast cancer screenings

- In 2021, the European Commission Initiative on Breast Cancer (ECIBC) recommended pairing DBT with digital mammography to screen for breast cancer in women with dense breasts. In December 2022, the European Council updated its Article 168 recommendations to encourage the use of DBT for all breast cancer screenings, enabling more women to access DBT. More healthcare institutions are now adopting DBT technology, which previously saw limited use.
- As per the December 2022 updates, the European breast screening and diagnosis guidelines have expanded the age range for preventive screening from 50–69 to 45–74. This change in age range can potentially increase access to preventative screening for millions of women.
- The ECIBC's Guidelines Development Group (GDG) has recommended using an organized mammography screening program for early detection of breast cancer in asymptomatic women.

The new recommendation will increase DBT mammography equipment sales

Growing demand for technology advancements

- The use of AI in medical imaging equipment is increasing because it offers the potential to automate most manual tasks, ensures consistency, and can improve patient care.
- The GDG suggests using AI-assisted double reading in an organized population-based screening program for asymptomatic women with an average risk of breast cancer.
- European healthcare institutions have expressed a growing interest in cloud adoption for the past few years, especially after the COVID-19 pandemic demonstrated the value of cloud-based systems in facilitating remote access and sharing patient data/imaging remotely.
- Additional benefits that drive cloud adoption in healthcare institutions include the enablement of web-based picture archiving and communications systems (PACS) or enterprise imaging systems, easier integration of electronic health records, the reduced information technology (IT) burden of maintaining on-premises servers, and overall cost reduction.

Digitalization in the healthcare sector is driving the adoption of advanced informatics solutions

Source: European Commission; Frost & Sullivan

Key Trends Influencing Outpatient Care Imaging Services in the European Union (continued)

Expansion of Community Diagnostic Centers

- The UK's DHSC announced the creation of 6 new community diagnostic centers in May 2023. The department has already set up 106 community diagnostic centers across England—including 3 temporary sites—in various settings, including shopping centers and university campuses. The community diagnostic centers program has delivered more than 3.8 million tests, checks, and scans since July 2021.
- The UK government launched this program in July 2021 and aims to set up 160 community diagnostic centers by 2025 for £2.3 billion, delivering 9 million tests, checks, and scans per year.
- These community diagnostic centers are conveniently located for easy patient access. General practitioner (GP) referrals to community diagnostic centers speed up diagnosis times as patients obtain tests closer to home, eliminating unnecessary hospital trips.

Expansion of community diagnostic centers drives demand for new imaging equipment

Outpatient care sites (including imaging centers) consolidating in Europe

- Investment firms are acquiring stakes in independently managed outpatient care centers, including European imaging centers.
- Because individuals run more than 60% of all outpatient centers, a high level of M&A activity has occurred in the outpatient sector in Germany during the past few years. Doctors, corporations, and investors have driven consolidations at laboratories, dialysis centers, and diagnostic imaging centers.
- Multiple investment deals took place in the medical imaging market in France in 2022. Résonance Imaging Group, Simago, and Imapole were among the centers involved.
- Affidea acquired Istituto Radiologico Gandini, a medical center in Biella in the Piedmont region of Italy, specializing in diagnostic imaging and senology. Affidea made multiple acquisitions of imaging and diagnostics centers in Portugal, Spain, Switzerland, and Romania in 2022 to expand its presence in Europe.
- RadNet has acquired a 75% interest in London-based Heart & Lung Imaging Limited. Through this transaction, RadNet aims to launch widespread population health screening programs, especially for lung cancer.

Increased consolidation will drive investments in facilities and equipment

Source: GOV.UK; Frost & Sullivan

Key Trends Influencing Outpatient Care Imaging Services in APAC and RoW

Growing demand for health services in emerging markets

- India is one of the fastest-growing large economies in the world. The healthcare industry in India earned an estimated $372 billion in 2022 and will exceed $774 billion by 2030. The market size of the Indian medical technology industry is an estimated $11 billion and will grow rapidly to reach $50 billion by 2030.
- Following the supply chain challenges that occurred during the global pandemic, the Indian government announced the AatmaNirbhar Bharat Abhiyaan, a production-linked incentive scheme to manufacture medical devices in 4 identified categories with a total financial outlay of approximately $456 million.
- China's 14th Five-Year Plan aims for a “healthy China,” which will play an important role in the healthcare industry during the 2021 to 2025 period. China continues to build out and modernize primary care while expanding high-quality medical centers.
- Population-based screening programs, especially for tuberculosis (TB) and cancer, will increase in APAC countries (e.g., India, China, and Southeast Asia).

Increased healthcare spending and investments in India and China offer growth opportunities for imaging equipment manufacturers

Expansion of telemedicine and remote monitoring

- While home healthcare solutions are in the early stages in India, they offer huge potential for future growth because of the country’s increasing elderly population, the increased incidence of chronic diseases, enhanced demand for constant personalized care, and the emergence of nuclear family structures, especially in urban areas.
- As a result of the lockdown measures imposed during the COVID-19 pandemic, telemedicine and remote health monitoring proved to be an effective medium for delivering healthcare services to India’s widespread population, especially in rural areas.
- Telemedicine and remote monitoring have experienced rapid adoption in APAC markets (e.g., China, Korea, Japan, and Australia), especially after COVID-19.

Increased home monitoring and telemedicine will drive the adoption of remote medical imaging equipment

Source: Invest India; Gov.Cn; Frost & Sullivan

Key Trends Influencing Outpatient Care Imaging Services in APAC and RoW (continued)

Rapid adoption of enterprise imaging solutions

- With the growing adoption of enterprise imaging technology in the United States and the European Union, healthcare institutions in APAC will keep pace by implementing enterprise imaging solutions—especially considering the consolidation of healthcare facilities in some parts of APAC.
- Healthcare institutions are adopting enterprise imaging solutions because they lower costs, reduce complexity, and improve data management and administration. In addition, enterprise imaging solutions consolidate all imaging data and associated content into a centralized platform that enables seamless access to patient data by all clinicians, both within the facility and beyond.

Digitalization of the healthcare sector in APAC will drive demand for IT imaging solutions

Growing incidence of chronic diseases and cancer in the Middle East and LATAM

- The Middle East healthcare market—including the United Arab Emirates (UAE) diagnostic imaging services market—is growing rapidly. Drivers for this growth include the aging population, increasing incidence of chronic diseases (e.g., cardiovascular ailments) and cancer, increased demand for less invasive surgeries and treatments, and adoption of advancements in medical imaging technologies.
- Similarly, the aging population, people with chronic diseases (e.g., cardiovascular and neurological) who require regular medical imaging, and the growing incidence of cancer are the main drivers for the increased demand for medical imaging services in LATAM (e.g., Brazil, Argentina, Peru, Chile, Colombia, and Mexico).
- Given the increased focus on public healthcare—especially after COVID-19—healthcare facilities in many LATAM countries have increased their budgets to equip and upgrade medical imaging technologies to serve their patients better.

The growing incidence of chronic diseases and cancer will increase public spending on medical technologies

Source: Frost & Sullivan

Key Trends Influencing Outpatient Care Imaging Services in APAC and RoW (continued)

Poor healthcare infrastructure and limited access to radiology equipment in LICs and LMICs

- Despite the technological advancements in medical imaging, considerable disparity remains in access to medical imaging and radiotherapy equipment, especially in low-income countries (LICs) and low- and middle-income countries (LMICs). LMICs are countries with a per capita gross net income between $1,034 and $4,045.
- The main impediment to medical imaging access for LICs and LMICs is limited financial resources to procure, operate, and maintain expensive medical imaging equipment. Other challenges include irregular power supply, poor network connectivity, inadequate site infrastructure, and delays because of the geographical distance from original equipment manufacturers (OEMs).
- Nigeria—Africa's biggest economy—is facing a bed shortage and overcrowding in its emergency tertiary healthcare centers, causing a significant problem in Nigeria's healthcare system.
- The availability of trained radiologists is another significant challenge some LMICs face.

OEMs have a limited market opportunity in LMICs

National accreditation program for diagnostic imaging in Brazil

- Brazil has more than 10,000 board-certified radiologists and an equal number of diagnostic establishments. In 2014, the *Agência Nacional de Saúde Suplementar* (ANS) and the Brazilian College of Radiology introduced the Program for Accreditation in Diagnostic Imaging (PADI), a national accreditation program to help diagnostic imaging facilities achieve minimum quality and safety requirements.
- The Brazilian National Health Agency has recognized this program and recommends that an accredited radiology facility should have reimbursement advantages. The agency has created a quality index, and PADI-accredited centers are eligible for a 10% to 15% bonus on their procedure reimbursements.

Accredited centers have more incentive to upgrade their aging equipment and invest in new and advanced machines

Source: RSNA; Frost & Sullivan

Key Challenges Facing Outpatient Care Imaging Service Providers

Shortage of Skilled Workforce

- A global dearth of radiologists is putting pressure on imaging centers and the healthcare system.
- Because of radiology staff shortages, outpatient imaging centers in ASCs, UCCs, OBLs, and IDICs must compete with healthcare systems and hospitals to recruit and retain the small pool of skilled radiologists.
- Hiring qualified staff is a major challenge for smaller centers, especially in APAC and RoW, as they must compete with large hospitals that can offer higher salaries and better benefits.

Mitigation Strategies

- Imaging centers at outpatient care sites should consider implementing AI-based imaging informatics solutions to reduce stress and burnout for radiologists.
- AI solutions increase the efficiency and productivity of radiologists. In addition, they improve accuracy, enabling superior radiologist performance outcomes and potentially addressing the radiologist shortage.

Cybersecurity

- The increased risk of cyberattacks on healthcare facilities and systems could lead to health risks for many patients, in addition to the loss of protected health information.
- Cybersecurity is a challenge for big healthcare systems and smaller facilities (e.g., ASCs and UCCs). Outpatient facilities have reported cyberattacks.
- Many hospitals continue to use medical Imaging equipment with outdated software components, which increases the risk of ransomware attacks.

Mitigation Strategies

- The risk of cyberattacks targeting on-premises legacy systems is high. Legacy PACS are easy to breach because of security oversights.
- However, if smaller hospitals choose cloud-based PACS, the external vendor will manage the security risks. The vendors will adhere to strict security and privacy protocols. Cloud-based solutions keep data much safer from cyberthreats.

Source: Frost & Sullivan

Key Challenges Facing Outpatient Care Imaging Service Providers (continued)

Resource Constraints

- Many countries in APAC, LATAM, and Africa—especially LICs and LMICs—cannot afford imaging equipment, and often a shortage of healthcare workers exists. These countries have limited financial resources and a frugal attitude toward healthcare expenditures.
- These countries have an underdeveloped medical infrastructure and workforce, which hinders the adoption and use of medical imaging technologies. Moreover, they do not have consistent regulatory and reimbursement systems, which deters the introduction of advanced technologies.

Mitigation Strategies

- Innovative business models, such as pay-per-scan leasing, can benefit some of these countries. Vendors provide imaging equipment (e.g., CT and MRI scanners) on a rental basis, and the centers levy charges on customers per scan service they perform.
- The MES model can help diagnostic centers in these markets.
- Imaging equipment centers can explore public-private partnerships.

Increasing Costs

- Many outpatient diagnostic imaging centers in the United States face growing costs and shrinking profit margins. Diagnostic imaging centers in the United States and European Union are facing high labor costs because of the shortage of skilled labor.
- Moreover, diagnostic imaging centers face profitability pressure due to supply chain disruptions and increasing raw material costs.
- The ongoing Russo–Ukrainian War has increased energy costs in many parts of Europe, consequently increasing the operations costs of many diagnostic imaging centers.

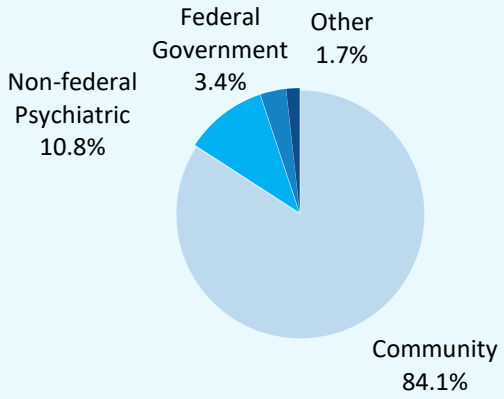
Mitigation Strategies

- Diagnostic centers can adopt AI-based imaging informatics solutions to enhance operational efficiency, improve diagnosis accuracy, and potentially lower labor costs.
- Diagnostic centers can broaden their range of imaging services to attract new patients. They can offer specialized imaging services or partner with other healthcare providers to expand their scope of services.

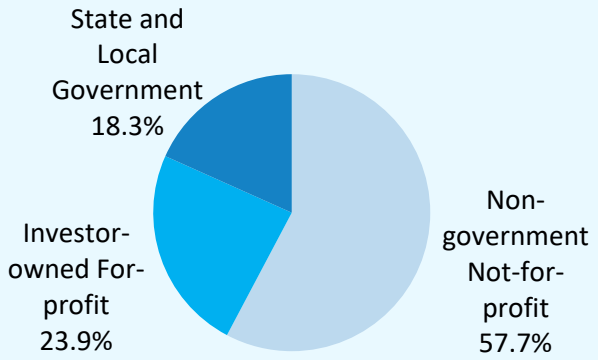
Source: Frost & Sullivan

Imaging Services at HOPD in the US

Hospitals in the United States, 2023



Community Hospitals in the United States, 2023

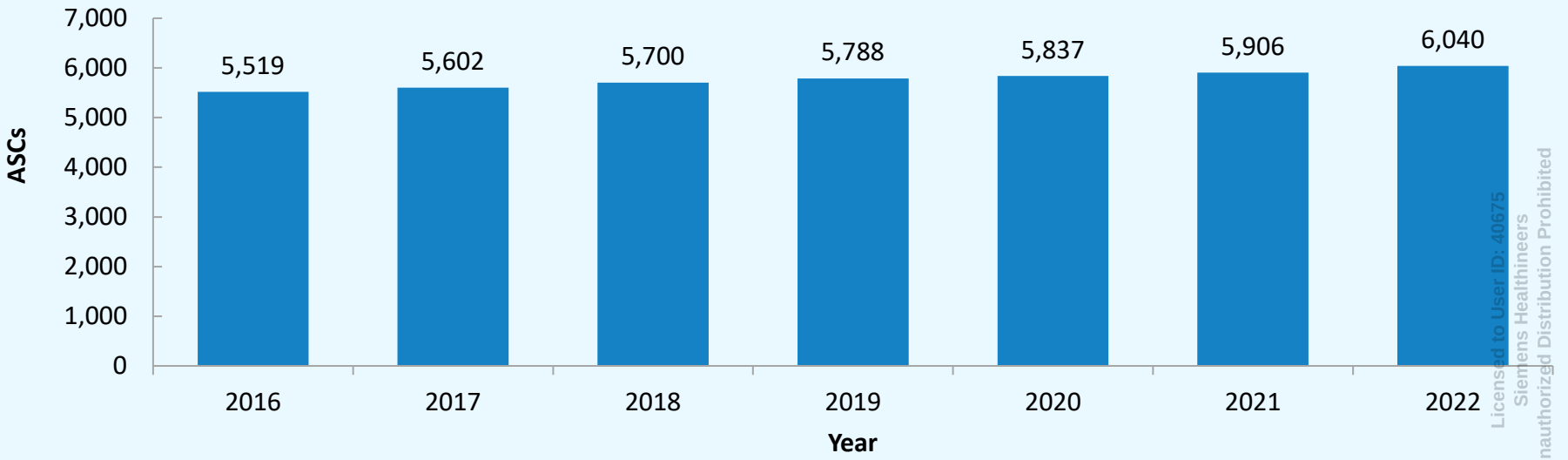


- As of FY 2021, the United States has 6,129 hospitals, with almost 84% (5,157) being community hospitals.
- As of July 2022, CMS has identified 4,773 Medicare-certified HOPDs.
- Almost a decade ago, radiology departments in US hospitals were major revenue generators. However, changes in Medicare billing rules for HOPD services have made these services less attractive.
- Diagnostic imaging volumes have been shifting from HOPDs to IDICs because of the lower cost of performing these procedures. CMS has implemented site-neutral payment policies to eliminate differences in reimbursement rates based on the service site. This policy applies to reimbursements for imaging services and will utilize the site-specific Medicare Physician Fee Schedule rate, which is about 40% lower than HOPD rates.
- In the United States, many general practitioner and family practice physician offices provide imaging services, such as X-rays and point-of-care ultrasound (POCUS). However, in Europe, the availability of ultrasound examinations in primary care centers differs between countries. The use of POCUS by GPs is common in Germany, Slovenia, and Switzerland, but it is low in Denmark, Croatia, and England.

Source: American Hospital Association; Frost & Sullivan

Imaging Services at ASCs in the US

Medicare-certified ASCs, US, 2016–2022

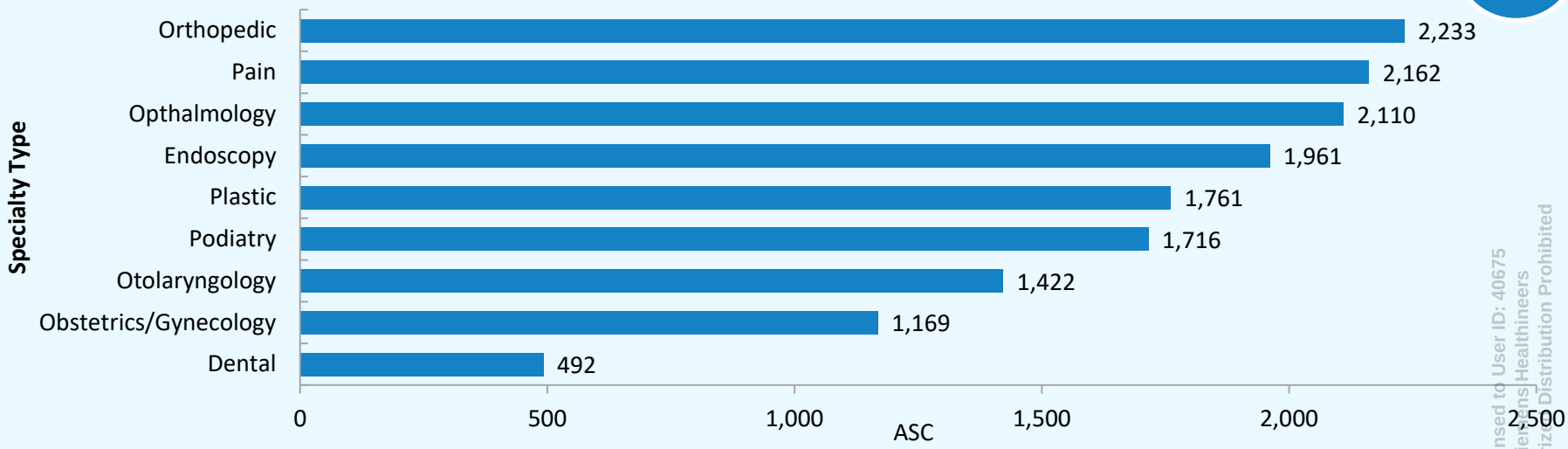


- As of December 2022, the number of Medicare-certified ASCs in the United States was 6,040. ASCs are growing significantly in the United States.
- ASCs conduct more than 30 million surgical procedures every year. More than 80% of surgeries in the United States take place in outpatient settings.
- As per CMS, an ASC may provide certain radiology services that are reasonable, necessary, and integral to covered surgical procedures. The ASC does not have to enroll in Medicare as an IDIC to receive coverage for imaging services.
- Patients choose ASCs because they offer more convenience to patients than hospitals. Wait times are much lower, and they are often more conveniently located than hospitals.

Sources: ASCA; Frost & Sullivan

Imaging Services at ASCs in the US (continued)

Medicare-certified ASCs by Specialty Type,* US, 2022



*Some of the centers may have more than 1 specialty.

- The number of procedures that ASCs conduct will grow in the coming years, as more than 49 million people (15% of the US population) are older than 65. The percentage of people older than 65 will grow to 24% by 2060.
- CMS added only 4 new procedures to the ASC Covered Procedures List for 2023. ASCA had proposed adding 47 new procedures, which private insurers are already reimbursing for. Omitting these procedures from the list denies Medicare beneficiaries the access and convenience of high-value care at ASCs and increases patient costs because hospitals charge higher rates.
- Imaging services are essential at ASCs that perform neurospinal, pain management, orthopedic, podiatric, and cardiology procedures. The fastest-growing ASC specialty is cardiology. CMS added diagnostic heart catheterizations and percutaneous coronary interventions (PCIs) to the ASC Covered Procedures List in 2020. The shift in cardiology procedures will continue because ASCs have lower costs than hospitals.

Sources: ASCA; Frost & Sullivan

Imaging Services at ASCs in the US (continued)

A Cost Analysis Comparison Between ASC And HOPD for CPT Codes 92920 and 93458

	Ambulatory Surgery Center Total includes facility and doctor fees. Additional costs may apply if more than 1 doctor is needed.			Hospital Outpatient Department Total includes facility and doctor fees. Additional costs may apply if more than 1 doctor is needed.			ASC Overall Cost Savings (%)
Percutaneous transluminal coronary angioplasty (single major coronary artery or branch)—CPT code 92920	**Total Cost***		**$3,663**	Total Cost*		$5,598	**35%**
	Doctor Fee	$537		Doctor Fee	$537		
	Facility Fee	$3,126		Facility Fee	$5,061		
	Medicare Pays		**$2,930**	**Medicare Pays**		**$4,478**	
	Patient Pays		**$733**	**Patient Pays**		**$1,120**	
Left heart coronary catheterization procedure—CPT code 93458	**Total Cost***		**$1,735**	**Total Cost***		**$3,259**	**62%**
	Doctor Fee	$298		Doctor Fee	$298		
	Facility Fee	$1,437		Facility Fee	$2,961		
	Medicare Pays		**$1,387**	**Medicare Pays**		**$2,334**	
	Patient Pays		**$348**	**Patient Pays**		**$925**	

- An increasing number of surgical procedures are moving from hospitals to ASCs because of the significant cost savings to Medicare. As per ASCA, Medicare pays only 55% of the amount it pays HOPD for the same procedure.
- ASCs provide services at a more affordable cost. In addition to the savings they offer the government and third-party payers, patients pay lower coinsurance for procedures that ASCs perform.
- Patients who choose ASCs over hospitals save approximately $4.2 billion per year for Medicare and $42.2 billion each year in overall healthcare spending.

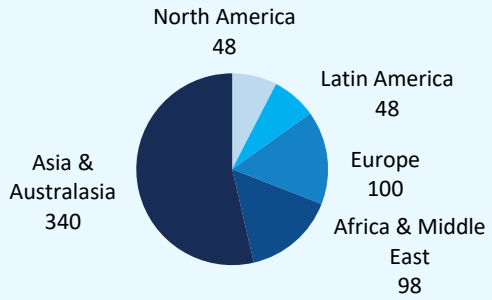
Note: * All costs are national averages; CPT = Current Procedural Terminology.

Sources: Procedure Price Lookup for Outpatient Services | Medicare.gov; Frost & Sullivan

Global Imaging Services at OBLs and Specialty Clinics for Cardiology

- The prevalence of cardiovascular ailments is growing globally; an estimated 634 million cases occurred in 2021, requiring various interventions (e.g., pharmacotherapy, surgical procedures). Although complicated procedures usually take place at hospital inpatient facilities, outpatient sites (e.g., OBLs, specialty cardiology centers) are conducting many procedures.
- An OBL is an extension of a physician's office that performs imaging services, such as X-rays or other radiology procedures. The managers of OBLS are predominantly vascular surgeons, interventional radiologists, and other physicians, who provide ambulatory examinations, diagnosis, and treatment. More than 700 OBLs perform endovascular and other interventional procedures in the United States, as per the Outpatient Endovascular and Interventional Society.

Global Heart & Circulatory Disease Prevalence, 2021

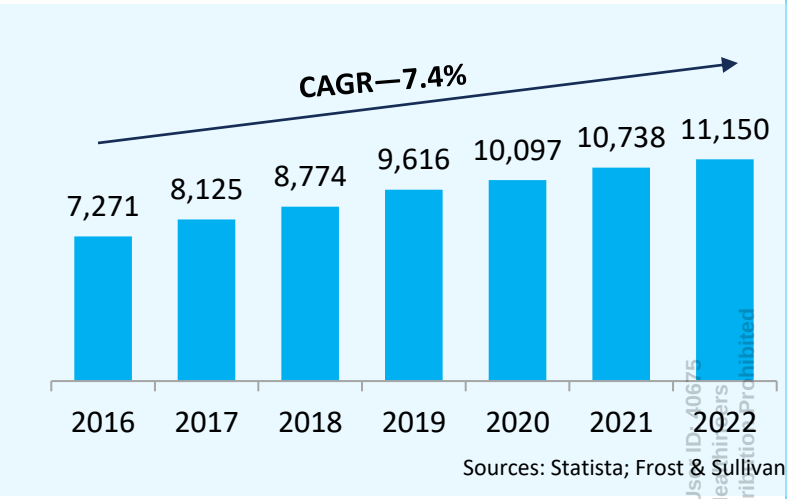


- The cardiovascular procedures that OBLs conduct (e.g., image-guided minimally invasive therapy) are growing yearly. Similarly, specialty clinics for gynecology and obstetrics, orthopedics, dentistry, and others provide imaging services. The number of clinics offering such procedures is growing because of the convenience they provide patients.
- CMS and insurers encourage patients to obtain procedures at outpatient sites, such as OBLs, because reimbursement rates have decreased. Global rates combine professional and technical services payments, and the physician's office provides additional staff and equipment. Moreover, patients make lower copayments at OBLs than at hospitals.
- In APAC, access to care varies between urban and rural areas. For example, in China, healthcare providers have historically concentrated in cities, requiring people in rural areas to travel for many hours to reach the nearest healthcare provider. However, county-level hospitals are now bringing quality healthcare closer to rural patients.
    - For instance, Philips works with county-level hospitals to set up local treatment centers for chest pain or stroke patients. The centers have equipment to conduct diagnostic tests and minimally invasive procedures in their catheterization labs.
- Similarly, in India, patients in rural areas and Tier II and Tier III cities have limited access to quality healthcare. Private sector hospitals are setting up cardiology centers in multiple locations across the country.
    - In India, Philips is working with Artemis Hospitals, a private multi-specialty hospital, to set up cardiology centers across the country to bring quality care closer to patients in Tier II and Tier III cities.

Sources: British Heart Foundation; Frost & Sullivan

Imaging Services at UCCs in the US

- UCCs and retail clinics should complement the primary care physician or regular care center. They should not be a substitute.
- The United States had more than 11,150 UCCs in 2022. With a compound annual growth rate (CAGR) of more than 7%, with over 3,000 new UCCs opened in the last 5 years.
- As primary care access becomes more limited, patients—especially younger ones—seek care in different settings, such as UCCs and retail clinics. Hospitals are entering into strategic alliances with UCCs.
- The long wait time in emergency rooms (ERs) is another reason patients seek UCCs for low-acuity care. Moreover, the cost of treatment and the copayment are much lower at UCCs than at hospital Ers.



Sources: Statista; Frost & Sullivan

- Although UCCs' most common services are vaccinations, almost 25% are for trauma and injuries.
- The imaging services that UCCs perform are predominantly X-rays, but the use of ultrasound—especially POCUS—equipment is growing.
- As per a UCC association survey, many UCCs face reimbursement issues, either with rates remaining the same or decreasing. Reimbursement rates vary by insurers and by state. The costs to operate UCCs are increasing, but the reimbursement rates are not.
- Most UCCs are corporate-owned. Among the major UCCs are Concentra Health Services, FastMed Urgent Care, NextCare Urgent Care, HCA Healthcare, St. Joseph's Healthcare London, MedExpress, and GoHealth Urgent Care.
- The National Urgent Care Center Accreditation categorizes urgent care facilities into 4 levels to provide better clarity for patients seeking treatment. Level I facilities, essentially the equivalent of freestanding emergency departments, provide X-rays, CT scans, and ultrasounds, with radiology or teleradiology immediately available during operational hours. Level II facilities provide on-site X-rays and imaging. Level III and Level IV facilities do not provide radiology services.

Source: Frost & Sullivan

Imaging Services at IDICs in the US

- The United States has more than 6,000 IDICs. According to estimates, outpatient imaging centers and physician clinics perform 40%–50% of the imaging volume.
- CMS and private insurers have adopted various policies (e.g., price transparency measures, site-neutral reimbursements) for outpatient imaging procedures. These measures have encouraged patients to go to lower-cost outpatient sites for imaging services.
  - CMS price transparency regulations require hospitals to publish prices for some shoppable healthcare services, making it easier for patients to compare price information before choosing a site for radiology services.
  - CMS has implemented site-neutral payment policies, aiming to eliminate pricing differential for certain healthcare services based on the service site. As per this policy, reimbursements for radiology services will use the site-specific Medicare Physician Fee Schedule rates, which are about 40% of the HOPD rates.
  - High-deductible insurance plans from private insurance players (e.g., Anthem, UnitedHealth) have grown significantly over the past few years, incentivizing consumers to shop for lower healthcare service prices. This development has driven consumers to IDICs for radiology services, as the treatment costs and patient copayments are lower.
- Another factor driving patients to visit IDICs for imaging services is consumer behavior, as IDICs offer more convenient parking facilities and geographical proximity than HOPDs.
- Commercial insurers are mandating the preauthorization of advanced radiological procedures to ensure a medical need exists. This policy will increase imaging procedure volumes at outpatient centers.
- Regulations impacting IDICs include the certificate of need laws, which require healthcare centers (including IDICs) to justify facility expansions or investments in high-value equipment (e.g., imaging equipment).
- Because of the significant patient migration to IDICs for imaging services, many hospitals and healthcare systems have demonstrated interest in forming joint ventures (JVs) with IDICs to mitigate the lost business volume and to provide physicians and patients with multiple imaging service options.
- Healthcare systems and independent delivery networks (IDNs) are increasing partnerships with outpatient centers (e.g., IDICs) to expand their imaging services or increase their geographical reach.

Source: Frost & Sullivan

Key Imaging Center Acquisitions Across the World

Organization A	Organization B	Type	Transaction Details
Canada Diagnostic Centers	Guardian Radiology and The Ultrasound Centre	Multiple acquisitions in Canada in 2023	This acquisition is to expand Canada Diagnostic Center's presence in Saskatchewan and reinforce its standing in Alberta and British Columbia.
Leveljump Healthcare	4 diagnostic imaging clinics from private Alberta vendors	Acquisition in Canada in 2022	This acquisition aims to expand the geographical reach of Leveljump Healthcare's imaging services subsidiary, Canadian Teleradiology Services.
RadNet's JV—New Jersey Imaging Network	Montclair Radiology	Acquisition in the US in 2022	New Jersey Imaging Network has acquired the outpatient radiology assets of Montclair Radiology to expand its presence in northern New Jersey.
RadNet	Aidence Holding B.V. and Quantib B.V.	Acquisition in the Netherlands in 2022	Aidence Holding B.V. and Quantib B.V. are AI solutions providers based in the Netherlands. This acquisition aims to expand RadNet's AI-based screening solutions.
Akumin	Alliance HealthCare Services	Acquisition in the US in 2021	Akumin acquired Alliance, a leading national provider of radiology and oncology solutions to hospitals, to expand its services and customer base.
RAYUS Radiology	Diagnostic Centers of America	Acquisition in the US in 2021	RAYUS Radiology acquired Diagnostics Centers of America to partner with the Boca Radiology Group in Florida and provide quality services to these growing communities.
RAYUS Radiology	InHealth Imaging	Acquisition in the US in 2021	RAYUS Radiology acquired 3 InHealth Imaging centers serving the greater Kitsap Peninsula, Olympic Peninsula, and West Puget Sound communities.
Solis Mammography	Progressive Radiology	Acquisition in the US in 2021	Solis Mammography acquired Progressive Radiology to expand its state-of-the-art multimodality medical imaging capabilities in Maryland, Virginia, and Washington, DC.
Texas Oncology	Del Sol Medical Center	Acquisition in the US in 2022	Texas Oncology acquired the radiation assets at the Del Sol Medical Center to expand its radiation oncology services in EL Paso.
Affidea	Istituto Radiologico Gandin	Acquisition in Italy in 2023	Affidea acquired Istituto Radiologico Gandini, a medical center in Biella that specializes in diagnostic imaging and senology, to expand its presence in Italy.

Source: Frost & Sullivan

Key Imaging Center Acquisitions Across the World (continued)

Organization A	Organization B	Type	Transaction Details
Affidea	Clínica Nuno Álvares and Clínica de Santa Mafalda	Multiple acquisitions in Portugal in 2022	Affidea acquired Clínica Nuno Álvares and Clínica de Santa Mafalda, providers of advanced diagnostics and outpatient services, to expand its presence in Portugal.
Affidea	Infanta Mercedes Medical Center, El Mirador Polyclinic, and Colmenar Viejo Radiodiagnosis	Multiple acquisitions in Spain in 2022	Affidea acquired Infanta Mercedes Medical Center and El Mirador Polyclinic to expand its presence in Spain.
Affidea	2 Phoenix medical centers in Deva and Alba Iulia	Multiple acquisitions in Romania in 2022	Affidea acquired 2 Phoenix medical centers that provide imaging services to expand its presence in Romania.
Affidea	Brust-Zentrum Zürich	Majority stake acquisition in Switzerland in 2022	Affidea aims to expand its breast cancer imaging presence in Switzerland through this acquisition.
RadNet	Heart & Lung Imaging Limited	Acquisition in the UK in 2022	RadNet acquired 75% interest in London-based Heart & Lung Imaging Limited, aiming to launch widespread population health screening programs (especially for lung cancer).
Groupe Bruxelles Lambert	Affidea	Majority stake acquisition in the Netherlands in 2022	Groupe Bruxelles Lambert acquired a majority stake in Affidea.
A.P. Moller Holding	Unilabs	Acquisition in Switzerland in 2022	Denmark's A.P. Moller Holding, which the Maersk family founded and runs, acquired Unilabs.
Andera Partners	Résonance Imagerie	Investment deal in France in 2022	This financing deal aims to infuse capital to acquire new equipment and expand the services of Resonance Imagerie.
Ardian	Simago	Investment deal in France in 2022	This financing deal aims to infuse capital to acquire new equipment and expand the services of Simago.
Eurazeo	Imapole	Investment deal in France in 2022	This financing deal aims to expand the services of Imapole.

Source: Frost & Sullivan

Key Imaging Center Partnerships and Collaborations Across the World

Organization A	Organization B	Type	Partnership Details
Atlantic Medical Imaging (AMI)	Inspira Health and Regional Diagnostic Imaging (RDI)	Joint venture agreement in the US in 2023	AMI, Inspira, and RDI are partnering at 9 existing imaging centers (3 AMI locations and 6 Inspira locations). Inspira Health will brand all locations as AMI to increase access, expand services, and enhance patient experience.
SimonMed	Myriad Genetics	Partnership in the US in 2023	This collaboration is for the planned launch of a new hereditary cancer assessment program, which will combine diagnostic imaging and genetic risk assessment to enable affordable access to genetic testing and deliver personalized insights to better inform clinical decisions for millions of patients.
RAYUS Radiology	Fujifilm	Partnership in the US in 2022	RAYUS Radiology selected Fujifilm's Synapse Enterprise Information System as the workflow management solution for its network of more than 150 imaging centers across the United States.
Lumina Imaging	Siemens Healthineers	Partnership in the US in 2023	Siemens Healthineers will be the exclusive provider of MRI and CT equipment in all future Lumina sites, deploying the latest technology and services to support Lumina's expansion plans.
Solis Mammography	iCad	Partnership in the US in 2022	This collaboration will focus on using mammography to define cardiovascular risk. The application will be able to identify women at risk of cardiovascular diseases (CVDs) using mammogram data.
RadNet's Aidence AI Subsidiary	Google Health	Collaboration in the US in 2022	This collaboration aims to help improve lung cancer screening with AI solutions.
RAYUS Radiology	VIDA Diagnostics	Partnership in the US in 2022	This collaboration aims to expand the number of sites for clinical trial imaging.

Source: Frost & Sullivan

Key Imaging Center Partnerships and Collaborations Across the World (continued)

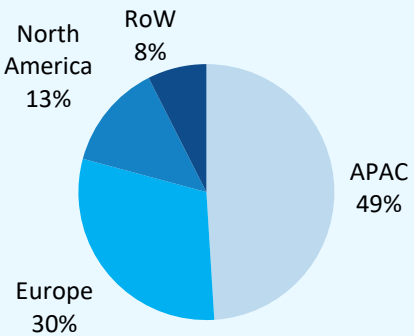
Organization A	Organization B	Type	Partnership Details
GenesisCare	Vision RT	Partnership in the US in 2022	As part of the agreement, Vision RT will provide GenesisCare with 30 new AlignRT systems (and the potential for 10 more) in the next 2 to 3 years.
GenesisCare	MIM Software	Partnership in the US in 2022	This partnership aims to improve cancer patient outcomes by augmenting the radiation, oncology, and molecular therapy treatment planning ecosystem.
SimonMed	Tripment Health	Partnership in the US in 2022	SimonMed is partnering with Tripment Health, a digital healthcare marketplace, to list its imaging services on the web in a transparent manner.
Unilabs	SmartSoft Healthcare	Partnership in Switzerland in 2023	Unilabs has partnered with SmartSoft Healthcare to deploy its AI solution, CoLumbo, to enhance lumbar spine MRI reading and reporting in Spain.
Affidea	Incepto	Partnership in the Netherlands in 2022	Through this partnership, Affidea aims to use Incepto's platform to integrate 4 AI solutions in the fields of oncology, neurology, and breast in 14 centers in Portugal.
Vista Health	Asda	Partnership in the UK in 2022	Vista Health is partnering with Asda, one of the United Kingdom's leading supermarket chains, to deliver imaging services to local communities.
Unilabs	GE Healthcare	Partnership in Portugal in 2022	Unilabs has partnered with GE Healthcare to provide cutting-edge imaging equipment and digital technology in Portugal.

Source: Frost & Sullivan

Outpatient Imaging Centers Using AI tools and Teleradiology to Overcome the Radiologist Shortage

- Globally, the number of trained radiologists is about 250,000; about half of them are in APAC. A global shortage exists across different countries and regions.
- The United States has about 90 radiologists per million population. The radiologist shortage in the United States is mainly because the Medicare population growth is significantly outpacing the number of radiologists joining the workforce. The growth in the 65-and-older population is much higher than the growth in the diagnostic radiology workforce. As the population ages, the demand for radiology services increases.
- Radiology centers across Europe (e.g., England, Portugal, Switzerland, Spain) are facing a shortage of trained radiologists. The United Kingdom has only about 71 radiologists per million population.

Radiologist Workforce, Global , 2022

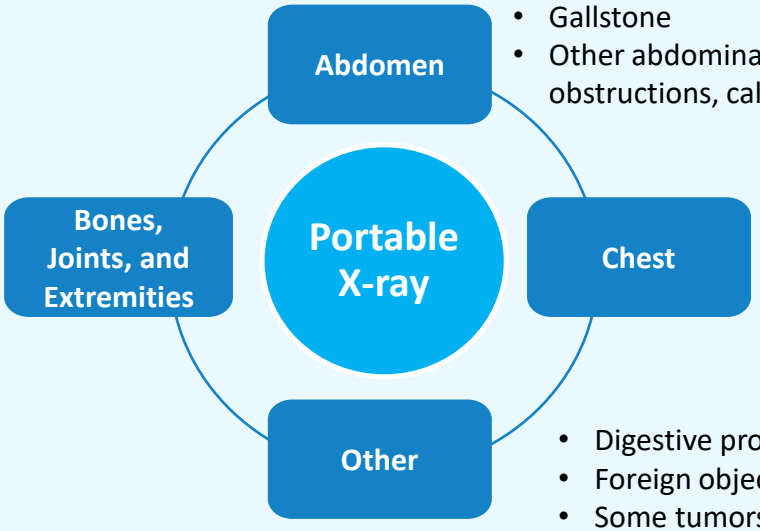


- Similarly, some countries in APAC (e.g., India, Singapore, Japan) are facing a radiologist shortage.
- These shortages are affecting patient safety because they impact the ability to diagnose patients accurately and promptly, which leads to delayed treatment, higher expenses, and poor health outcomes. In addition, the shortages affect staff morale as doctors must work under high pressure.
- The radiologist shortage is leading health systems to outsource image reading activity as they are short on trained staff.
- Hospitals are deploying AI solutions as part of their radiology workflow to provide effective radiologist support.
  - For instance, Deeptek.ai's Augmento, an AI-powered radiology optimization platform, is servicing more than 350 hospitals and imaging centers across India and APAC and has received US Food and Drug Administration approval.
  - Similarly, Lunit, a global provider of an AI-powered cancer diagnostic solution, is providing Capio S:t Göran Hospital (Stockholm, Sweden) with Lunit INSIGHT MMG, an AI solution for mammography analysis, for the next 3 years.

Source: Frost & Sullivan

At-home Medical Imaging—Growing Acceptance of Portable Imaging Post Pandemic

Key Conditions Where Providers Use Portable X-rays



- Kidney and urinary bladder stones
- Gallstone
- Other abdominal pathologies, including bowel obstructions, calcifications and neoplastic changes

- Fractured bone
- Joint dislocation
- Injury, infection, arthritis, and abnormal bone growth
- Bone cancer
- Bone loss
- Foreign object in soft tissues around or on bones

- Pneumonia
- Heart failure and heart problems
- TB
- Lung cancer
- Fluid or air collection in lung area
- Emphysema

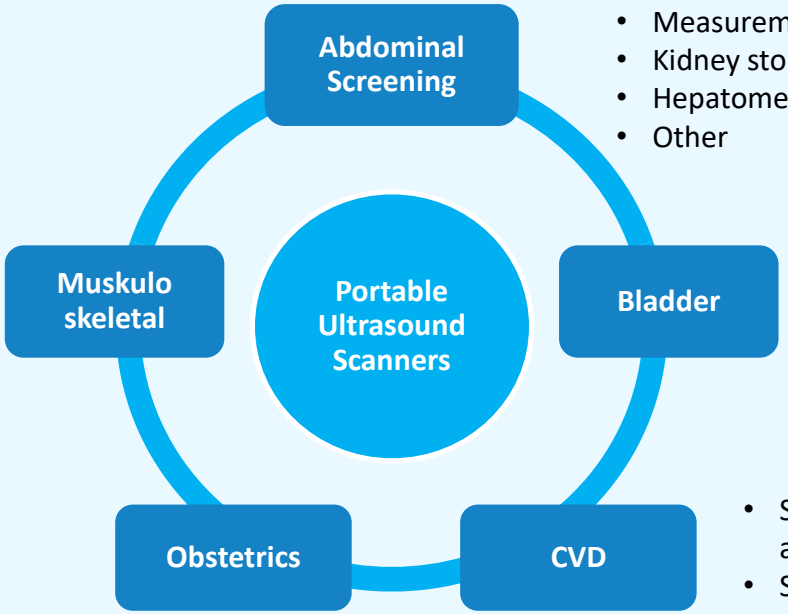
- Digestive problems
- Foreign object swallowed
- Some tumors
- Hand X-ray

- Mobile or at-home imaging increased after the global pandemic. Mobile diagnostics services providers are partnering with hospitals and insurance companies to offer mobile imaging services (e.g., X-rays, ultrasounds) to their patients in homes and assisted living communities for immobile patients and senior citizens. For instance, DispatchHealth partners with Humana, Eastern Connecticut Health Network, UCI Health, and others.
- Multiple service providers in the United States offer X-rays and ultrasounds at home, including Alpha One Imaging, Ultramobile Imaging, Ultra-X Imaging, Palm Diagnostics, Mobile X-Ray, and DispatchHealth (which has acquired Professional Portable X-Ray and Dynamic Mobile Imaging).
- Mobile imaging is gathering momentum in many European countries, such as Germany, France, Italy, and the United Kingdom. A similar trend is happening in APAC countries, such as India, Australia, and Singapore.

Source: Frost & Sullivan

At-home Medical Imaging—Growing Acceptance of Portable Imaging Post Pandemic (continued)

Key Conditions Where Providers Use Portable Ultrasounds



- Trauma management
- Detection of blood around heart or abdominal organs
- Abdominal aortic aneurysm
- Measurements of the abdominal aorta
- Kidney stones and gall stones
- Hepatomegaly
- Other

- Rotator cuff tear
- Meniscal tear
- Emergency screening of swollen joint
- Joint effusion
- Other

- Bladder volume testing (for urinary incontinence or urinary tract infection)
- Other

- Routine scan or observation
- Position of the fetus and placenta
- Fetal growth monitoring
- Labor progress
- Amniotic fluid volume measurements
- Other

- Screening for CVDs, such as carotid artery stenosis
- Screening for deep vein thrombosis
- Varicose veins
- Other

Source: Frost & Sullivan

Academic Centers Providing Outpatient Imaging Services through JVs with Community Hospitals and Other Outpatient Imaging Centers

- Because of increasing healthcare costs in the United States during the last several years, healthcare has changed practices and reimbursements. With the changes, academic institutions—especially radiology departments—have had to modify their financial and business models to balance academic research and clinical care. Academic radiologists are contributing to efficient patient management.
- Academic radiology centers provide outpatient imaging services independently or enter joint ventures with community hospitals or other outpatient imaging centers.
  - For instance, university hospitals provide adult and pediatric diagnostic, therapeutic, and interventional radiology services while focusing on research and education through numerous fellowships and residency programs.
  - Thomson Jefferson University has launched a JV with Community Imaging Centers, through which it serves 3 hospitals and 2 outpatient imaging centers in Philadelphia and Bucks County.
  - The University of Virginia Health System has partnered with Outpatient Imaging Affiliates, an owner and operator of outpatient imaging centers, to manage UVA Imaging, an advanced outpatient diagnostic imaging center.
  - Baylor University Medical Center, part of Baylor Scott & White Health, offers many advanced outpatient medical imaging procedures at several locations through its JV with Touchstone Imaging.

Source: Frost & Sullivan

Varied Availability of Imaging Modalities Across Outpatient Care Sites

Imaging Modalities	At-home Imaging	UCCs	Primary Care	ASCs/OBLs	IDICs	Community Hospitals & Hospital Systems	Academic Institutions (Tertiary/ Quaternary Care)
Portable X-ray							
Portable Ultrasound							
Digital X-ray							
Ultrasound							
Mammography							
Interventional X-ray							
C-arm							
CT							
MRI							
Molecular Imaging							

Generally available Available in some centers Rarely available

The use of imaging modalities varies across different outpatient care settings. At-home imaging primarily provides portable X-rays and ultrasounds. UCCs and primary care centers provide imaging services, such as X-rays and ultrasounds, primarily for emergency care. ASCs and OBLs provide imaging services beyond X-rays and ultrasounds. ASCs and OBLs that conduct cardiovascular procedures with catheterization labs have advanced imaging equipment. IDIC groups and standalone IDICs provide imaging services through multiple modalities. Community hospitals and academic institution radiology centers offer imaging services with all the major imaging modalities.

Source: Frost & Sullivan

Varied Value of Imaging Services Across Outpatient Care Sites

Outpatient Care Sites	Prevention	Detection	Diagnosis	Delivery and Monitoring of Therapy	Prognosis
At-home Imaging					
UCCs					
Primary Care					
ASCs/OBLs					
IDICs					
Community Hospitals & Hospital Systems					
Academic Institutions					

Mostly used Sometimes used Rarely used

The Purpose and Value of Imaging Services Varies Across the Different Outpatient Care Sites.

- At-home imaging services and UCCs mainly use radiology for detection purposes. OEMS can target this segment for portable X-ray and ultrasound devices.
- Primary care centers provide X-rays and ultrasounds for detection and diagnosis purposes so that, based on the need, they can refer patients to hospitals or quaternary centers at academic institutions. OEMS can target this segment for digital radiology equipment and portable X-ray and ultrasound devices.
- ASCs and OBLs may use imaging services for prevention, detection, delivery, and monitoring, especially for interventional procedures. OEMS can target this segment for C-arms, imaging tables (with the appropriate resolution), and software packages for vascular procedures.
- IDICs usually provide radiology services based on the referring physician's prescription, which may involve preventing, detecting, and diagnosing various conditions. IDICs sometimes use imaging services for delivery and monitoring purposes, especially in cases where they provide molecular imaging services. Patients may visit IDICs to evaluate the prognosis of their medical condition. OEMS can target this segment for all major modalities, cloud-based imaging informatics, and AI-powered radiology optimization platforms.
- Hospitals and academic institutions use imaging services across the spectrum from prevention to prognosis. OEMS can target this segment for all major modalities and AI-based solutions for public health screenings and radiology workflow optimization.

Sources: Radiological Society of North America; Frost & Sullivan

Growth Drivers

Imaging Services in Outpatient Care: Growth Drivers, Global, 2023–2027

Driver	1–2 Years	3–4 Years	5th Years
The increase in the incidence of chronic diseases and cancer and the aging global population will drive the demand for outpatient imaging services.	High	High	High
Pressure is growing to reduce healthcare costs in the United States, which is driving the shift of various surgical procedures from hospital inpatient care to outpatient care.	High	High	High
A proposed USPSTF recommendation suggests lowering the start of biennial breast cancer screenings from 50 years old to 40 years old. In the European Union, the ECIBC has made a similar recommendation to expand the breast cancer screening age to add women who are 45 to 49 and 70 to 74 years old. This will increase mammography procedures at screening centers.	Medium	High	High
Investments in digitalization by outpatient diagnostics imaging centers will help increase their operational efficiency and enhance their quality of care. AI-based solutions improve diagnostics accuracy and reduce human error. Growing cybersecurity threats are driving the need for cloud-based medical imaging informatics solutions.	Medium	Medium	High
Mobile/at-home medical imaging services have increased globally, especially since the advent of COVID-19.	Medium	Medium	Medium

Source: Frost & Sullivan

Growth Restraints

Imaging Services in Outpatient Care: Growth Restraints, Global, 2023–2027

Restraint	1–2 Years	3–4 Years	5th Years
The shortage of trained radiologists and radiologist work overload are major limitations facing outpatient radiology centers globally.	High	High	High
Data migration and integration issues (including conventional on-premises medical imaging informatics systems and cloud-based informatics solutions) restrain healthcare providers from adopting cloud-based medical imaging software solutions.	High	Medium	Medium
Data privacy concerns in Europe and the Middle East restrain cloud infrastructure deployment.	High	Medium	Medium
Centers must achieve sufficient patient volumes to justify their investments in highly expensive advanced medical imaging equipment.	High	Medium	Low
Comprehensive radiation protection requirements based on IAEA International Basic Safety Standards need national support and the availability of dedicated experts, especially in the case of nuclear medicine. These regulations restrict access to advanced imaging technologies in many emerging markets.	Medium	Medium	Medium

Source: Frost & Sullivan

Growth Opportunity Universe

Growth Opportunity 1: Enterprise Imaging Platform for Teleradiology

Opp. Size in 5 Years	$1 B–$1.5 B
Timeline for Action	4 Years
Base Year	2023

Relevant End-user Industries for this Growth Opportunity

- Manufacturing
- Mobility
- Metal & Mining
- Energy & Environment
- Chemicals & Materials
- Information & Communications Technologies
- Electronics & Semiconductors
- Agriculture, Food & Nutrition
- Govt and Public Sector
- Construction
- Education
- Healthcare & Lifesciences
- Consumer
- Aerospace
- Hospitality
- Retail
- Defense
- Banking & Financial Services

Applicable Regions

Frost & Sullivan Has Identified 10 Growth Processes that Serve as Levers for Determining and Evaluating New Growth Opportunities.

Growth Processes

- Customer & Branding
- Distribution Channel
- Geographic Expansion
- Vertical Market Expansion
- Competitive Strategy
- Strategic Partnering
- Product Development
- Merger & Acquisition
- Product Launch
- Technology & IP

Source: Frost & Sullivan

Growth Opportunity 1: Enterprise Imaging Platform for Teleradiology (continued)

Context and Definition

- The global demand for imaging studies is increasing, but a shortage of radiologists exists.
- As per the World Health Organization, the over-60 segment will comprise about 16% of the global population in 2030 and will increase to 22% by 2050. As the population grows older, the demand for imaging grows proportionally.
- In the United States, Medicare enrollment has increased with the aging population. The demand for imaging is outpacing the radiologist workforce, and the supply of new radiologists is not keeping up with the demand.
- The radiologist shortage situation is similar in Europe and the United Kingdom. Europe has 13 radiologists per 100,000 population, while the United Kingdom has only 8.5.
- In APAC, Malaysia has only 30 radiologists per million population, and India has only 15,000 radiologists available for a population of 1.4 billion.

Call to Action

- One possible solution to address the radiologist shortage is recruiting retired physicians or physicians between work phases to re-enter the radiology workforce.
- Offering hybrid work modes to radiologists by using cloud-based imaging solutions for remote reading could be another strategy to address the radiologist shortage.
- Many hospitals and outpatient imaging centers are outsourcing to teleradiology service providers for remote reading.
- To enable access to teleradiology services, hospitals and outpatient imaging centers must reinvest in their PACS and radiology information system platforms to leverage the scalability and elasticity of a cloud-native deployment.
- Examples of cloud-native enterprise imaging platforms enabling teleradiology are GE Healthcare's TruePACS and Change Healthcare's (now Optum) Stratus Imaging.

Source: Frost & Sullivan

Growth Opportunity 2: AI in Breast Cancer Screening

Opp. Size in 5 Years	$100 M–$500 M
Timeline for Action	2 Years
Base Year	2023

Relevant End-user Industries for this Growth Opportunity

- Manufacturing
- Mobility
- Metal & Mining
- Energy & Environment
- Chemicals & Materials
- Information & Communications Technologies
- Electronics & Semiconductors
- Agriculture, Food & Nutrition
- Govt and Public Sector
- Construction
- Education
- Healthcare & Lifesciences
- Consumer
- Aerospace
- Hospitality
- Retail
- Defense
- Banking & Financial Services

Applicable Regions

Frost & Sullivan Has Identified 10 Growth Processes that Serve as Levers for Determining and Evaluating New Growth Opportunities.

Growth Processes

- Customer & Branding
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- Product Launch
- Technology & IP

Source: Frost & Sullivan

Growth Opportunity 2: AI in Breast Cancer Screening (continued)

Context and Definition

- Mammography has been vital to reducing breast cancer mortality in women. Screening programs and improvements in breast cancer treatment have lowered mortality by 30%.
- The United States will lower the breast cancer screening age to include women over 40 once the implementation of the USPSTF recommendations occurs.
- Similarly, the ECIBC recommendations have lowered the breast cancer screening age to include women over 40 in Europe, which will lead to an increase in mammography screenings across the European Union.
- As a result of the preventive screenings and the increased incidence of breast cancer, mammography procedure volumes are increasing significantly.
- Population-based breast cancer screening programs using mammograms produce a significant workload for radiologists. Some have suggested using AI as an automated second reader for mammograms, but health agencies have not yet approved this proposal because of limited evidence on AI use in real-world screenings.
- AI could be of great value in interpreting mammograms, potentially reducing radiologist workloads and improving clinical outcomes.

Call to Action

- Computer-aided detection (CAD) providers should collaborate with major equipment manufacturers and provide AI-based solutions that can be easily integrated into screening centers' existing PACS. RadNet's Artificial Intelligence subsidiary, DeepHealth, obtained USFDA approval for its third AI mammography product Saige-Density.
- AI-based CAD vendors should expand their solutions to assess other clinical areas, such as breast arterial calcifications, to detect the risk of cardiovascular disease to expand their clinical application areas. Also, AI-based solutions vendors should focus on population-based breast cancer screening programs to promote broader acceptance in the diagnostic community.
  - In 2022, iCAD partnered with Solis Mammography, which offers breast screening as well as diagnostic services in the United States, for the use of ProFound AI alongside Solis's diagnostic services.
  - Google Health partnered with iCAD in 2022 to license an AI-based mammography research model for real-world use in breast cancer screening. In addition, iCAD will have access to Google Cloud to expand the model's footprint.

Source: Frost & Sullivan

Growth Opportunity 3: Mobile and Portable Imaging Equipment for Remote Diagnosis and In-home Imaging Services

Opp. Size in 5 Years	$500 M–$1 B
Timeline for Action	2 Years
Base Year	2023

Relevant End-user Industries for this Growth Opportunity

- Manufacturing
- Mobility
- Metal & Mining
- Energy & Environment
- Chemicals & Materials
- Information & Communications Technologies
- Electronics & Semiconductors
- Agriculture, Food & Nutrition
- Govt and Public Sector
- Construction
- Education
- Healthcare & Lifesciences
- Consumer
- Aerospace
- Hospitality
- Retail
- Defense
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Applicable Regions

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Source: Frost & Sullivan

Growth Opportunity 3: Mobile and Portable Imaging Equipment for Remote Diagnosis and In-home Imaging Services (continued)

Context and Definition

- Each year, hundreds of millions of diagnostic imaging services occur globally. Patients usually visit hospitals or imaging centers for their required X-rays, ultrasounds, or other imaging studies. Because of the high demand for these services, hospital in-house departments and outpatient centers often become crowded, leading to long wait times. This situation changed after COVID-19, with patients trying to limit exposure to busy waiting rooms and wanting to complete their procedures quickly.
- Transporting critically ill patients from hospitals to diagnostic imaging centers can lead to various complications. Mobile medical imaging systems can perform diagnostic imaging at a patient's bedside, eliminating the need to transport the patient and the related complications.
- Mobile imaging services give patients more convenient and flexible access to imaging scans. In addition, this type of service is cost-effective. Mobile imaging allows for faster turnaround times, helping physicians to diagnose patients in a shorter time frame.
- Mobile imaging enables access to imaging services (e.g., X-rays, ultrasounds, bone densitometers) wherever physicians and patients need them—in an office, home, assisted living space, or medical facility. This service is especially helpful for aged or immobile patients and those with memory-related disorders who prefer familiar environments.

Call to Action

- Mobile imaging companies need to focus on using single-exposure, dual energy-subtraction, and X-ray technology-based detectors in their mobile X-ray scanners. This offers new opportunities for point-of-care high-quality diagnostic imaging and can help increase access in underserved regions. The other advantage is that these detectors are small and reduce the mobile X-ray scanner's weight.
- Photon-counting computed tomography (PCCT) in CT is considered a major technological breakthrough as it uses energy-resolving detectors, enabling scanning at multiple energies. Mobile CT manufacturers should partner with research institutes and companies focused on technologies related to developing and manufacturing semiconductor detector modules to incorporate PCCT in mobile CT scanners.
- Mobile MRI scanner companies have developed machines that can be easily moved within hospital premises for bedside imaging. However, they should also focus on developing portable MRI machines that can be transported to outpatient care sites such as homes and assisted living communities for immobile patients and senior citizens

Source: Frost & Sullivan

List of Exhibits

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