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Mobile Medical Imaging Market—Trends and Growth Opportunities

Portable Scanners Improve Access for Remote and Immobile Patients and Enable Faster Disease Diagnosis

Transformational Health Research Team at Frost & Sullivan

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

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Contents

Contents (continued)

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Summary

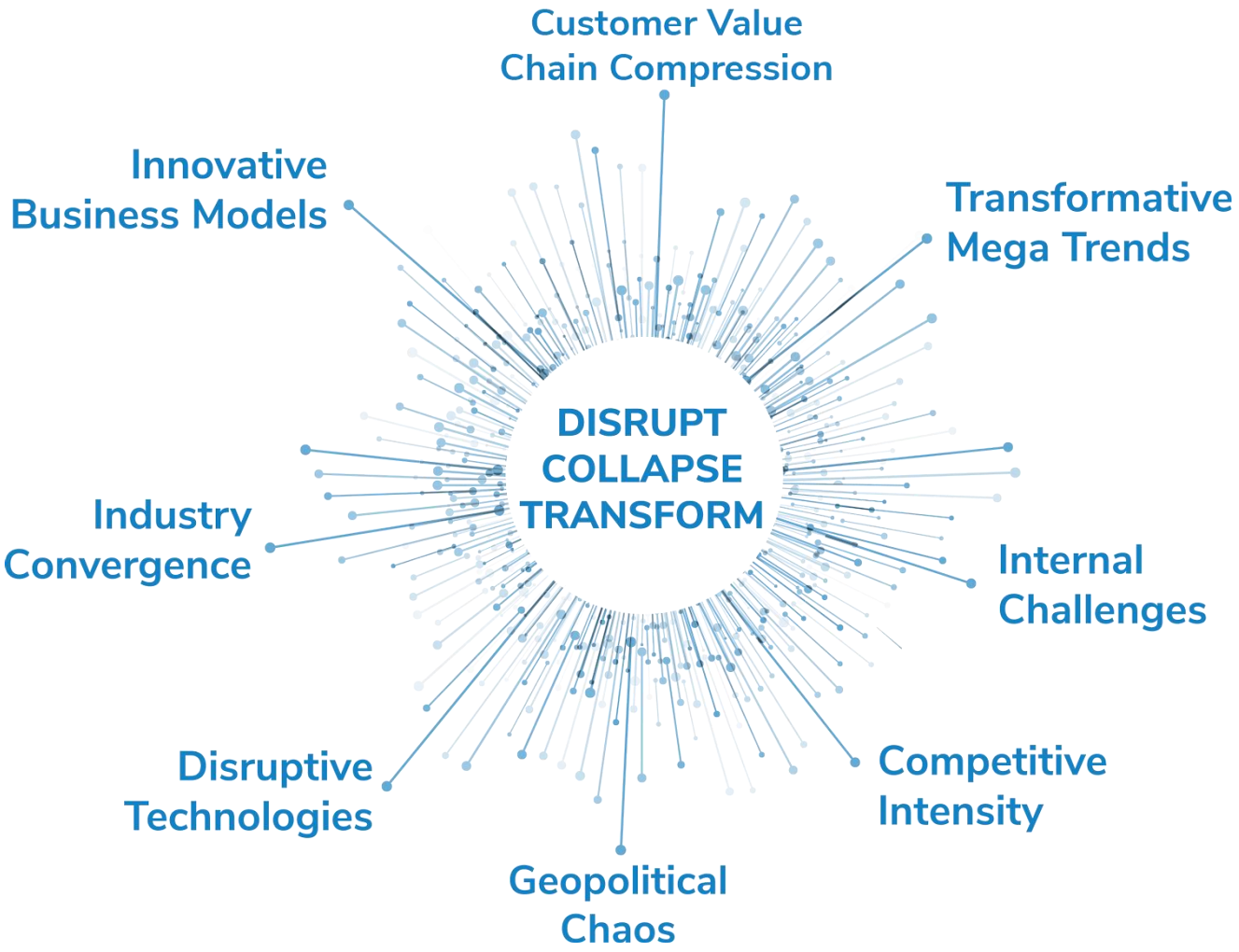
- Important trends that will impact the sales of mobile medical imaging equipment that allows for point-of-care (POC) imaging include a shortage of skilled radiology personnel, the expansion of telemedicine and remote monitoring, the growing application of mobile magnetic resonance imaging (MRI) for neuroimaging, and the use of artificial intelligence (AI)- and cloud-based solutions in mobile imaging, which expands healthcare access.
- Crucial trends that will impact the uptake of mobile medical imaging equipment in emerging markets include the growing demand for health services and the increase of chronic diseases in the Middle East and Latin America (LATAM). Furthermore, poor healthcare infrastructure and limitations in access to radiology equipment in low-income countries (LICs) and low- and middle-income countries (LMICs) create demand for low-cost mobile imaging equipment.
- The adoption of mobile medical imaging equipment will face challenges, such as lower image quality than conventional equipment, and even though it costs less than conventional equipment, it may still cost too much for LMICs and LICs. Cybersecurity poses another challenge because the equipment often handles patients' personal health information, and regulations surrounding patient data privacy and data sharing may slow its adoption.
- Some growth opportunities that mobile medical imaging equipment manufacturers can capitalize on include the increase in demand for such equipment for use in remote diagnosis and in-home imaging services, additional MRI scanning for treating Alzheimer's disease and guiding prostate interventions, and augmenting the capabilities of portable X-ray and POC ultrasound devices with AI.

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

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

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

Transformative Mega Trends

Global forces that define the future world with their far-reaching impact on business, societies, economies, cultures, and personal lives

Internal Challenges

The internal organizational behaviors that prevent a company from making required changes

Competitive Intensity

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

Geopolitical Chaos

Chaos and disorder arising from political discord, natural calamities, pandemics, and social unrest that impact global trade, collaboration, and business security

Disruptive Technologies

New, disruptive technologies that are displacing the old, and significantly altering the way consumers, industries, or businesses operate

Industry Convergence

Collaboration between previously disparate industries to deliver on whitespace cross-industry growth opportunities

Source: Frost & Sullivan

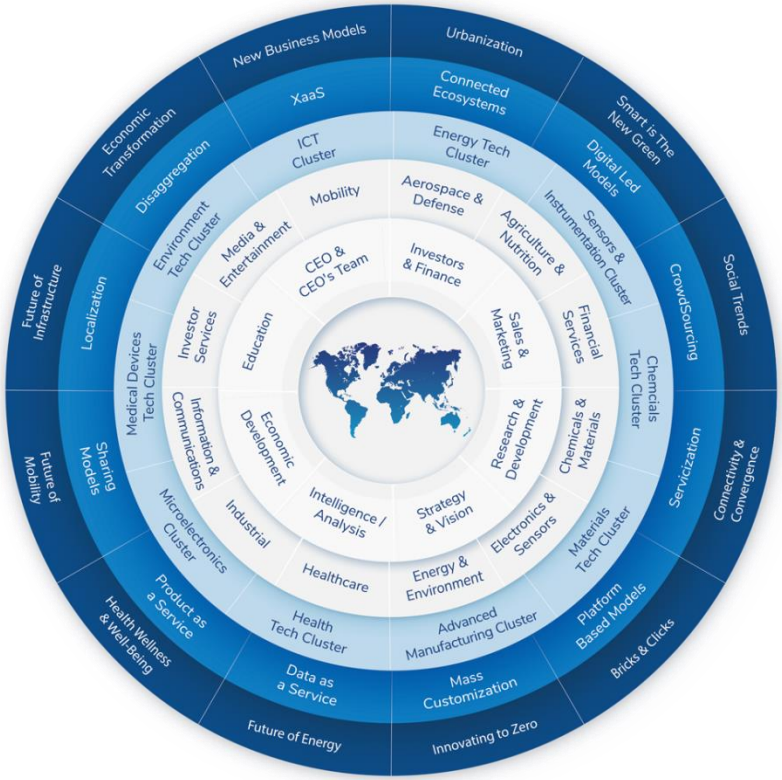
The Impact of the Top 3 Strategic Imperatives on the Mobile Imaging Equipment Industry

SI8	Transformative Mega Trends	Competitive Intensity	Disruptive Technologies
Why	• Since the COVID-19 pandemic began, the use of telemedicine and remote monitoring has increased globally. • Health departments in developed and developing markets are conducting large-scale public screening programs and implementing strategies to increase healthcare access in remote areas. These trends will drive the adoption of mobile imaging equipment.	• While the major players, such as GE Healthcare, Siemens, and Philips, dominate most medical imaging modalities, mobile imaging devices are highly competitive, especially for ultrasound and digital X-ray. • Competition in these segments is growing globally, with many companies emerging in Asia–Pacific (APAC).	• New start-ups are innovating and launching mobile medical imaging equipment, such as mobile computed tomography (CT) and mobile MRI. These machines have received US Food and Drug Administration (FDA) approval in recent years. • Advances in new technologies, such as AI, the 5th generation mobile network (5G), and the cloud, are expanding healthcare access through POC imaging equipment, disrupting the medical imaging market.
Frost Perspective	• Equipment providers must collaborate with healthcare institutions in emerging markets and remote communities with few trained healthcare personnel to develop solutions that suit their resources, ensuring access to low-cost portable equipment.	• Original equipment manufacturers (OEMs) and start-ups are developing portable/mobile medical imaging equipment for use in multiple clinical settings and various indications, and investor funding and government grants will intensify competition in the market.	• Radiology departments are increasingly adopting mobile MRI and CT. Hospitals in the United States and other parts of the world are using POC imaging in intensive care units (ICUs), emergency rooms (ERs), and operating rooms (ORs) because the equipment provides diagnostic information quickly while minimizing transportation requirements and discomfort to patients.

Source: Frost & Sullivan

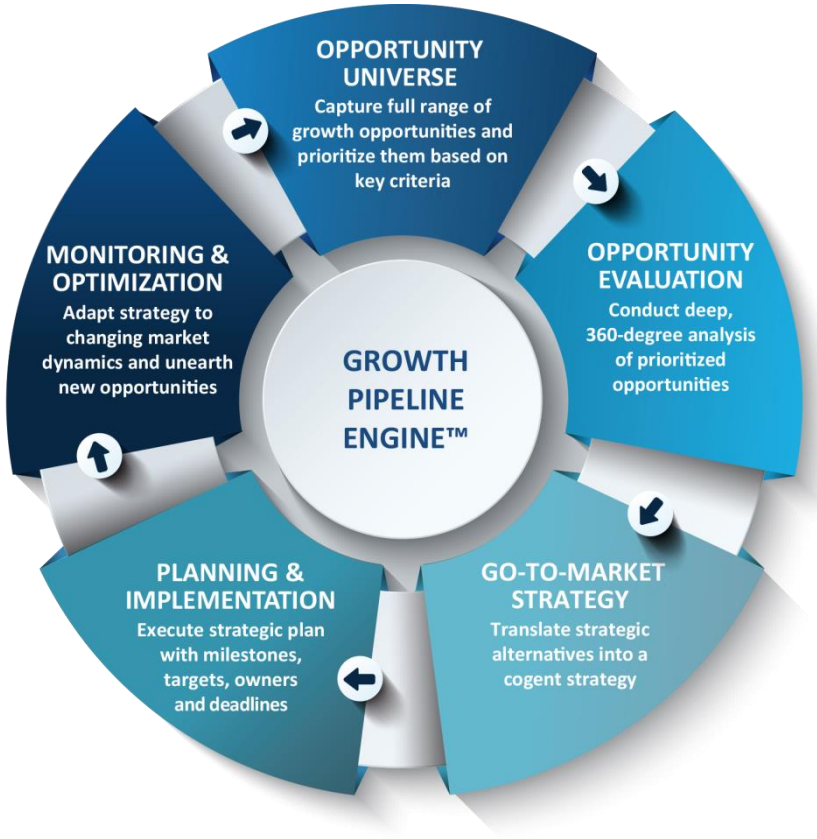
Growth Opportunities Fuel the Growth Pipeline Engine™

The Innovation Generator™



Analytical Perspectives

The Growth Pipeline Engine™



Source: Frost & Sullivan

Growth Opportunity Analysis

Scope of Analysis

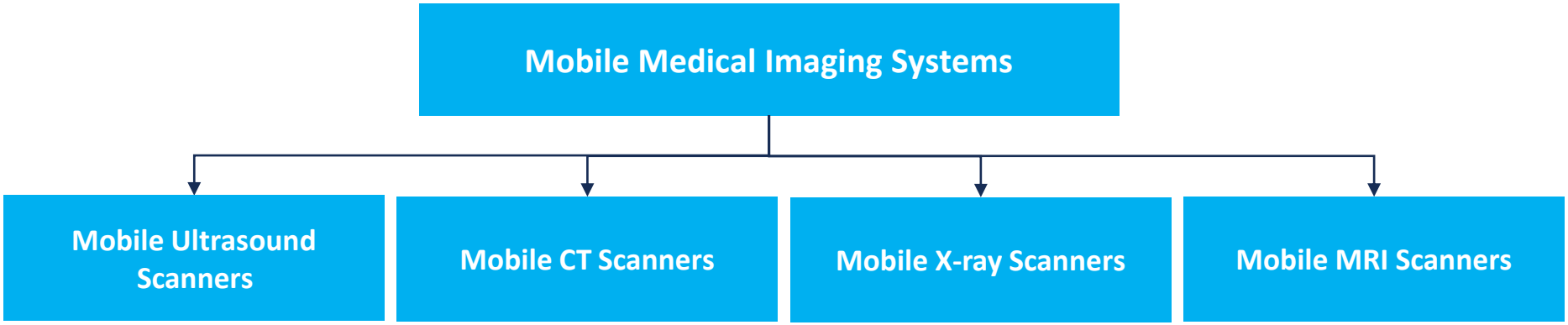
- Medical facilities must fix traditional medical imaging platforms in a dedicated space. These platforms cost a lot and require considerable installation time. In contrast, mobile medical imaging systems offer greater flexibility, providing imaging services outside the radiology department. They are cost-effective solutions for health professionals to perform diagnostic imaging in different clinical settings, including at home, and offer greater convenience to patients.

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

- This study focuses on mobile imaging equipment for POC settings, enabling bedside imaging and remote diagnosis (excluding conventional, trailer-mounted mobile imaging equipment that users must transport to different locations).
- The geographic scope comprises North America, Europe, APAC, and the rest of the world (RoW).
- This global study analyzes 4 main types of mobile imaging systems:
  - Mobile ultrasound scanners
  - Mobile CT scanners
  - Mobile X-ray scanners
  - Mobile MRI scanners
- This study will provide the trends, challenges, and growth opportunities for mobile medical imaging systems in different clinical settings, including at-home medical imaging and remote diagnosis.

Source: Frost & Sullivan

Market Segmentation



- In mobile POC ultrasonography (POCUS), the attending physician (not necessarily a radiologist or cardiologist) acquires, interprets, and integrates ultrasonographic imaging as a bedside test.
- Manufacturers include GE HealthCare, Clarius Mobile Health, Exo Imaging, Inc, Butterfly Network Inc., EchoNous Inc., and Healcerion Co. Ltd.

- Mobile CT imaging systems (also called portable CT scanners or POC-CT scanners) are compact, lightweight devices with motorized wheels, enabling easy transport to the patient's bedside.
- Manufacturers include
- Siemens Healthineers AG, Micro-X Limited, NeuroLogica Corp., and Xoran Technologies, LLC.

- Healthcare professionals use mobile X-ray scanners at outpatient locations that do not have access to a conventional fixed radiographic machine or with patients who are immobile and cannot travel to the radiology department.
- Mobile X-ray scanners weigh less than fixed X-ray machines and can be wheeled or handheld.
- Manufacturers include itie Knowledge Solutions, Canon Medical Systems Corporation, Fujifilm Corporation, Micro-X Limited, OXOS Medical Inc., and GE HealthCare.

- Mobile MRI scanners (also called POC MRI systems or portable MRI [pMRI] systems) are portable platforms that are low in magnetic field strength (64 milliTesla [mT]–1.5 tesla [T]). Users can easily transport, position, and operate these machines.
- Manufacturers include Hyperfine, Inc. Promaxo, Inc., Synaptive Medical Inc., and DeepSpin GmbH.

Source: Frost & Sullivan

Limitations of Traditional Medical Imaging Systems

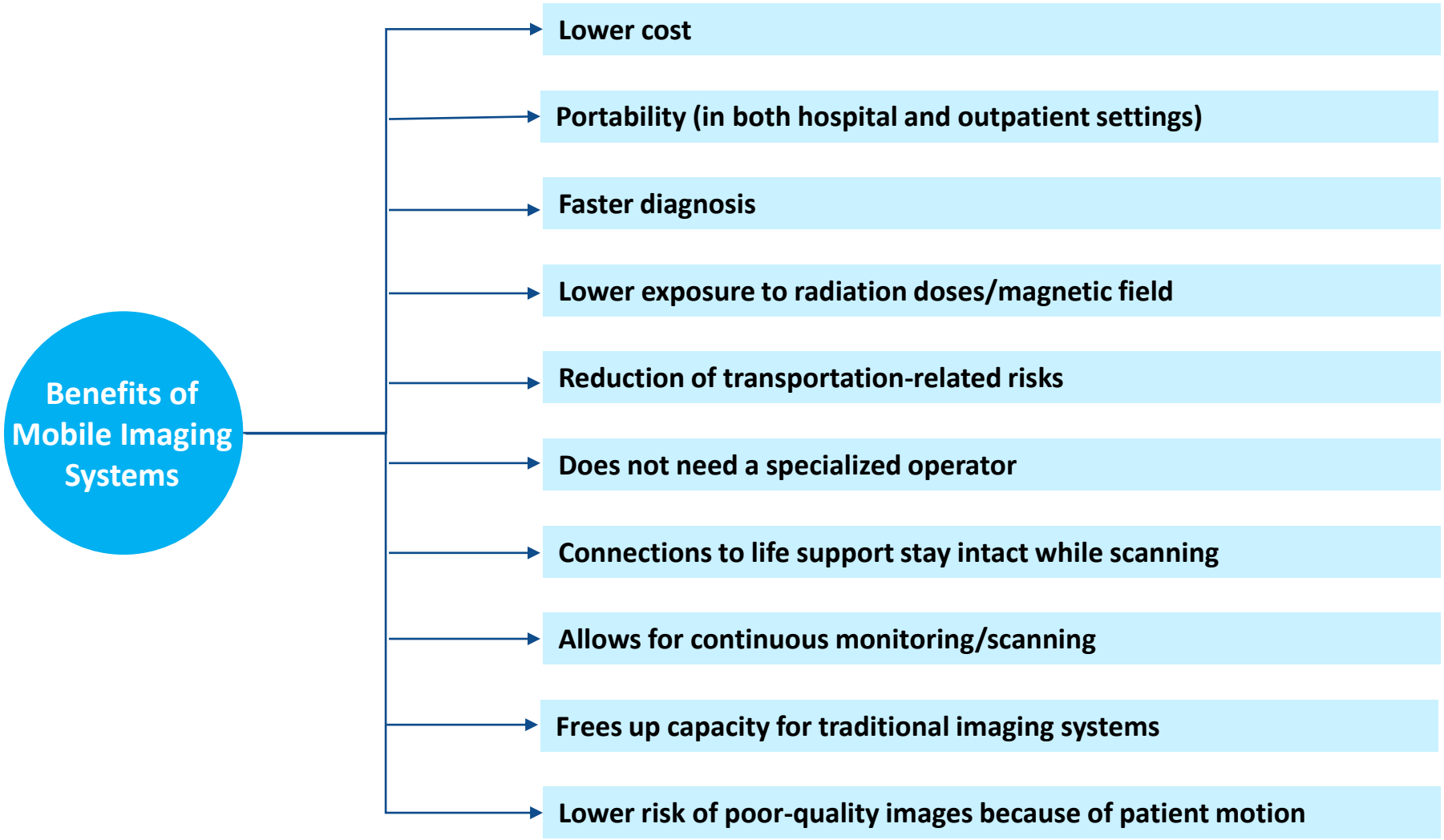
Traditional Imaging Systems

- Doctors use traditional imaging systems to obtain detailed internal images for clinical diagnosis, medical intervention, and visualization of the function of various organs and tissues.
- Medical imaging lets doctors view internal structures that skin and bones hide and diagnose diseases and treat them.
- Doctors use medical imaging to plan treatment, evaluate its efficacy, and assess any changes to or growth of internal bodily structures.

Limitations of Traditional Imaging Systems
High installation and maintenance costs
Complex site requirements and upgrades
Long patient wait time because of scheduling issues
High dependence on skilled radiology lab personnel
Possibility of adverse events when transporting patients to the radiology center
Difficulty in maintaining connection to life support while scanning
Difficulty in performing continuous monitoring/scanning

Source: Frost & Sullivan

Benefits of Mobile Imaging Systems



Source: Frost & Sullivan

Trends Influencing Adoption of Mobile Medical Imaging Equipment

Telemedicine and remote monitoring are expanding.

- Telemedicine and remote monitoring have experienced rapid adoption in APAC markets, such as China, Korea, Japan, India, and Australia, especially after COVID-19, because they have been an effective medium for delivering healthcare services globally, especially in rural areas. Mobile imaging solutions have helped provide remote healthcare services.
- For example, India's Ministry of Health and Family Welfare has launched the eSanjeevani program, a national teleconsultation service connecting more than 155,000 health and wellness centers across rural India under the Ayushman Bharat Scheme. This program uses the free, web-based Digital Imaging and Communications in Medicine (DICOM) image viewers. In addition, the government of India funds the Collaborative Digital Diagnosis System, another web-based digital image viewing platform, which enables image sharing and communication between rural healthcare providers and expert radiologists.

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

The incidence of chronic diseases in the Middle East and LATAM is growing.

- The Middle East healthcare market—including the United Arab Emirates' diagnostic imaging services market—is growing rapidly. Drivers for this growth include the aging population, increasing incidence of chronic diseases (such as cardiovascular ailments) that have increased demand for less invasive surgeries and treatments, and the adoption of advancements in medical imaging technologies.
- The aging population and people with chronic diseases (such as cardiovascular and neurological) who require regular medical imaging are driving demand for medical imaging services in LATAM (including Brazil, Argentina, Peru, Chile, Colombia, and Mexico).
- Handheld cardiac ultrasound devices are less expensive, lightweight, and portable and have shown great promise in non-invasive cardiovascular imaging. These handheld devices can provide timely access for patients who cannot travel and for most of the global population who do not have access to medical imaging.

The growing incidence of chronic diseases will increase public spending on handheld imaging equipment, such as portable ultrasound.

Source: eSanjeevani; Frost & Sullivan

Trends Influencing Adoption of Mobile Medical Imaging Equipment (continued)

The application of POC MRI for neuroimaging is growing.

- Healthcare providers use pMRI machines for POC neuroimaging because they can operate in various locations using a standard 110–220-volt wall outlet.
- These machines have proven effective in acute environments. In ERs, pMRI machines supplement hyperacute neurological assessments for patients having stroke symptoms and might soon replace the conventional CT scanners that mobile stroke units use.
- Additionally, pMRI machines have found use in the pediatric and adult assessment of hydrocephalus, an abnormal build-up of fluid in the brain.
- Low-field magnetic strength pMRI machines enhance the field of neuroimaging by increasing accessibility and speed and can supplement conventional neuroimaging in resource-limited areas or time-sensitive situations.
- POC-CT has unique use in ICUs because of its maneuverability in small spaces, and providers can use it in conjunction with surgical navigation and robotics for minimally invasive procedures and neuro and skull base surgeries.
- Australian company Micro-X is developing a lightweight CT scanner for road and air ambulances that can provide POC early stroke diagnosis, reducing the time from stroke onset to treatment.

Growing clinical applications of pMRI will increase the adoption of this equipment.

A shortage of skilled workers exists.

- A global shortage of radiologists puts pressure on imaging centers and the healthcare system. 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.
- POC mobile imaging equipment can supplement conventional medical imaging equipment because it does not require skilled operators, and providers can use it for rapid diagnosis in emergencies.

Mobile imaging solutions require minimal training and do not require skilled operators.

Source: American Academy of Neurology; Frost & Sullivan

Trends Influencing Adoption of Mobile Medical Imaging Equipment (continued)

AI- and cloud-based solutions in POC imaging are expanding healthcare access.

- Integrating AI and machine learning algorithms in POC-CT imaging systems has improved their diagnostic accuracy and expanded their clinical applications. Mobile imaging systems such as POCUS and portable digital X-rays use AI tools to aid diagnosis.
- In India, the use of AI and mobile van-mounted digital X-ray units for tuberculosis (TB) control has shown immense potential in enabling healthcare access for the country's rural population, addressing the healthcare worker shortage issues, and improving access to remote regions.
- Cloud-based solutions are expanding the reach of mobile medical imaging equipment. For example, Siemens leverages Amazon Web Service (AWS) to connect more than 100,000 ultrasound systems globally, including portable and ultraportable systems.

The integration of AI-based image guidance capabilities in portable X-ray and POCUS will increase adoption.

The demand for health services in emerging markets is increasing.

- India is one of the fastest-growing large economies in the world. The country's healthcare industry 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 during the pandemic, the Indian government announced the AatmaNirbhar Bharat Abhiyaan, a production-linked incentive scheme to manufacture medical devices in 4 specific 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 building and modernizing primary care while expanding high-quality medical centers.
- Population-based screening programs, especially for TB and cancer, will increase in APAC countries (such as India, China, and Southeast Asia).

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

Source: AWS.amazon.com; Invest India; gov.cn; Frost & Sullivan

Trends Influencing Adoption of Mobile Medical Imaging Equipment (continued)

LICs and LMICs have poor healthcare infrastructure and limited access to radiology equipment.

- Despite the technological advancements in medical imaging, considerable disparity remains in LICs' and LMICs' ability to access medical imaging and radiotherapy equipment. (LMICs are countries with a per capita gross net income between $1,034 and $4,045.)
- LICs and LMICs lack the financial resources to procure, operate, and maintain expensive medical imaging equipment. Other challenges include an irregular power supply, poor network connectivity, inadequate site infrastructure, and delays because of their geographical distance from OEMs.
- Providers can use mobile imaging equipment in these regions for those who do not have access to conventional medical imaging equipment.
- Hyperfine is collaborating with the International Society for Magnetic Resonance in Medicine, with support from the Bill & Melinda Gates Foundation, to deploy its pMRI device, Swoop, in Bangladesh, Ethiopia, Ghana, Kenya, Malawi, Pakistan, South Africa, and Uganda. Moreover, the Bill & Melinda Gates Foundation granted the company $5 million to assess Swoop's clinical feasibility in providing immediate POC brain imaging to children between the ages of 0 and 24 months in LMICs.

Manufacturers have a significant market opportunity in LMICs.

Source: eClinical Medicine; Hyperfine.io; Frost & Sullivan

Challenges Facing Mobile Imaging Solutions Companies

Image Quality

- While mobile imaging systems have advantages, such as their portability, lighter weight, and lower cost, they do not offer the diagnostic quality that conventional medical imaging systems provide.
- For example, POCUS systems do not have the diagnostic power of high-end ultrasound systems, which have significantly higher frame rates and far more sophisticated quantitative technologies, including three-dimensional (3D) imaging. Similarly, the low-field strength of pMRI limits its use compared to high-field systems in neuroimaging studies.

Mitigation Strategies

- Using mobile imaging systems as a supplement to traditional medical imaging systems frees up conventional imaging systems for cases that require high-resolution images.
- Providers can use mobile imaging solutions in clinical applications that do not require high-resolution images.

Cost Burden

- Although mobile medical imaging equipment costs less than conventional equipment, it is still expensive. This can limit adoption in resource-constrained healthcare settings. For example, Hyperfine's pMRI machine costs about $50,000, which hospitals in LICs or LMICs may not be able to afford.
- The lack of trained personnel to operate the machines and interpret the imaging results can pose a challenge in these regions. In addition, some mobile imaging equipment, such as POC-CT machines, require regular calibration and maintenance.

Mitigation Strategies

- Companies can collaborate with non-governmental organizations that run healthcare initiatives in economically weak countries. For example, with support from the Bill & Melinda Gates Foundation, Hyperfine has placed more than 100 devices in LICs.
- Mobile imaging companies can enter public-private partnerships with governments in LICs and LMICs to provide equipment and train healthcare personnel to operate it and interpret results.

Source: Radiologybusiness.com; Hyperfine.io; Frost & Sullivan

Challenges Facing Mobile Imaging Solutions Companies (continued)

Cybersecurity

- Cyberattacks on healthcare facilities and systems can result in the loss of protected health information and pose health risks for many patients.
- Mobile imaging systems often handle personal health information; consequently, their cybersecurity and privacy requirements are paramount. For example, some handheld ultrasound probes may require a smartphone or tablet to display data and serve as the user interface. These devices can pose additional cybersecurity vulnerabilities.

Mitigation Strategies

- Mobile imaging companies should implement cybersecurity measures at the network and device levels and update them as necessary.
- For example, POCUS cybersecurity measures could include an automatic sleep or log-off mode, user-specific passwords to access the POCUS scanner and requirements to regularly change passwords, and automatic capture and recording of a user access log.

Regulations

- POC imaging equipment has the potential for widespread adoption in LMIC countries with growing access to the internet; however, interconnectivity has its risks. To protect the privacy of patients and regional communities, health systems often must comply with heavy regulations.
- Regulations dealing with patient data privacy and data sharing may slow the adoption of POC imaging equipment, and its ease of operation makes the risk of unauthorized and unskilled usage high.

Mitigation Strategies

- The adoption of POC imaging in LMICs may require appropriate modifications to the regulatory environment.
- Regulation supports the safe use of imaging for both patients and staff. To ensure safety, LMICs can adopt regulatory guidance from global organizations, such as the International Basic Safety Standards and the European Basic Safety Standards Directive.

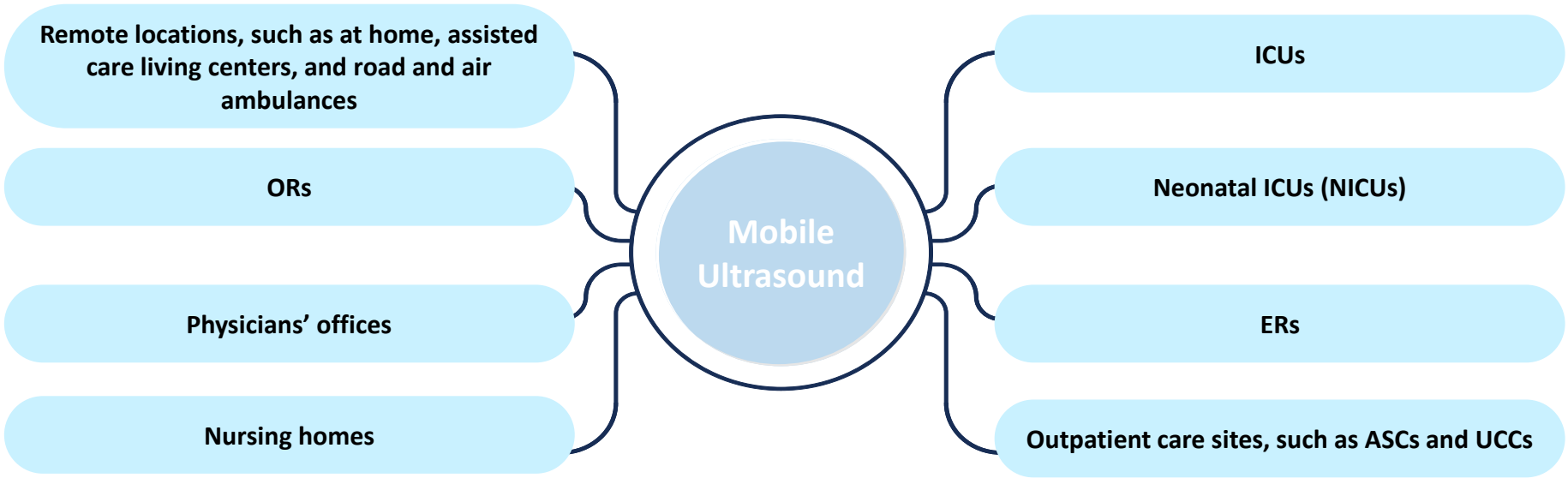
Source: Frost & Sullivan

Mobile Ultrasound Scanners

In mobile POCUS, the attending physician (not necessarily a radiologist or cardiologist) acquires, interprets, and integrates ultrasonographic imaging as a bedside test. Many disciplines, especially emergency medicine, use POCUS as a rapid diagnostic tool. The main imaging modes the POCUS machine offers include B-Mode, M-Mode, color Doppler imaging (to view blood flow in arteries and veins), elastography mode (to evaluate the stiffness of tissue), and 3D and real-time 3D (4D) mode. Portable and ultraportable ultrasound scanners weigh between 135 grams (g) and less than 5 kilograms (kg). Types of mobile ultrasound include portable or hand-carried systems (laptop-based), ultraportable or handheld systems, and cart-based systems.

- Hand-carried systems typically weigh 3 kilograms (kg) to 5 kg and look like laptops with built-in batteries and probes. Users can carry these by hand or mount them on a cart.
- Handheld systems are ultraportable, pocket-sized ultrasound systems that weigh approximately 136 g–800 g. These systems have wired or wireless probes, smartphone-shaped display units, and iOS/Android-compatible mobile applications.
- Hospitals, imaging centers, surgical suites, and outpatient clinics use portable cart-based systems.

Mobile Ultrasound Deployment Across Clinical Settings



ASC—Ambulatory Surgical Center; UCC—Urgent Care Center

Source: Medical Expo; NCBI; Frost & Sullivan

Benefits of Mobile Ultrasound Scanners

Mobile Ultrasound

Cost-effective: The portable and ultraportable POCUS devices cost a few thousand dollars, unlike the expensive stationery imaging modalities, which can cost over $100,000, making them cost-effective.

Safety: POCUS is safer than some of the other modalities because it is a non-invasive diagnostic procedure that does not carry the risk of ionizing radiation.

Enables remote diagnosis: Wireless and satellite transmissions of POCUS images allow radiologists to read the images remotely, making it a valuable tool for telemedicine and for providing imaging access to patients in remote rural regions.

AI: Ultrasound scanners are incorporating AI to aid in diagnosis.

Faster data processing: The ultraportable POCUS uses advanced technologies, such as Octal Beamforming, which accelerates the data processing and provides images with granular details.

Enhanced imaging convenience: POCUS is more portable than other modalities. Healthcare providers are supplementing their bulky stationery modalities with these portable devices to improve patient care, reduce unnecessary patient transportation to the radiology department, increase diagnosis speed, and store data digitally instead of using conventional films.

Source: The New England Journal of Medicine (NEJM); Frost & Sullivan

Clinical Applications of Mobile Ultrasound Scanners

Cardiovascular

- Left-ventricular form and function
- Left-ventricular hypertrophy
- Wall motion abnormalities
- Pericardial fluid

Respiratory

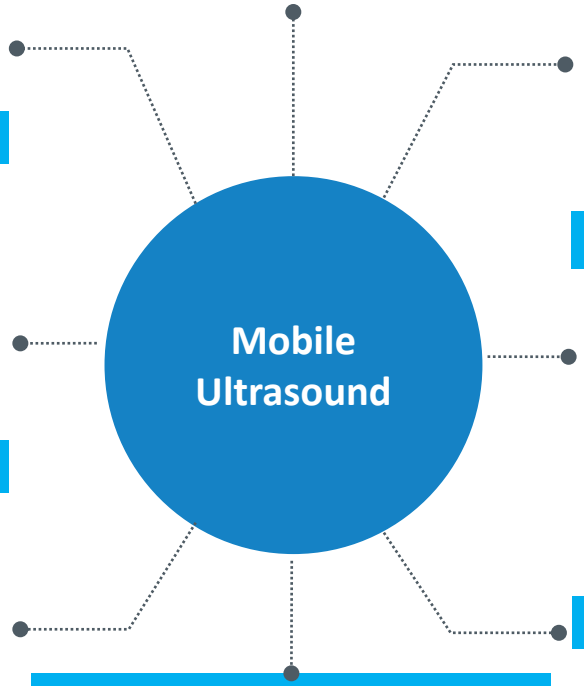
- Pulmonary edema
- Pneumonia
- Pneumothorax
- Rib fractures
- Asthma or chronic obstructive pulmonary disease

Musculoskeletal

- Screening of abscess and soft tissue infection
- Pediatric soft tissue neck masses
- Soft tissue foreign bodies
- Acute tendon trauma, shoulder dislocation, and bone fractures
- Pediatric hip effusions
- Rotator cuff tear
- Meniscal tear
- Emergency screening of swollen joint
- Joint effusion
- Other

Anesthesiology

- Ultrasound-guided peripheral nerve blockade and vascular access



Gastrointestinal

- Hydronephrosis as a surrogate for nephrolithiasis
- Epididymitis, orchitis, testicular torsion
- Cholelithiasis
- Appendicitis
- Intussusception

Vascular System

- Screening for abdominal aortic aneurysms
- Lower extremity deep vein thrombosis
- Ultrasound-guided peripheral venous catheter
- Screening for cardiovascular diseases, such as carotid artery stenosis
- Varicose veins
- Other

Abdominal Screening

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

Obstetrics

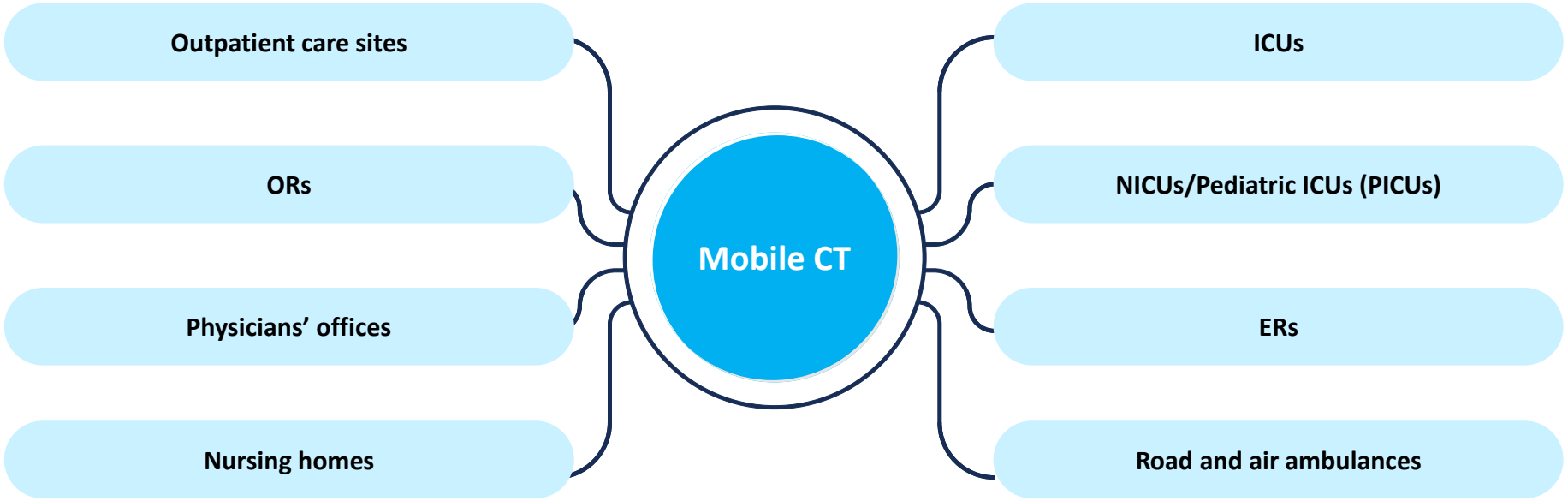
- Routine scan or observation
- Measurement of gestational age
- Diagnosing ectopic pregnancy
- Bleeding in the first trimester
- Position of the fetus and placenta
- Fetal growth monitoring
- Labor progress
- Amniotic fluid volume measurements
- Other

Source: NCBI; Frost & Sullivan

Mobile CT Scanners

- Mobile CT imaging systems (portable CT scanners or POC-CT scanners) are compact, lightweight devices with motorized wheels, enabling easy transport to the patient's bedside. The POC-CT can turn any space (e.g., patient's bedside, ICU, ER, OR, interventional radiology suite, ASC, outpatient site, and physicians' office) into an imaging room.
- Mobile CT scanners can scan the entire body or individual parts and generate high-quality images.
- The bore sizes of the POC-CT machines range from 32 centimeters (cm) to 85 cm, while the bore sizes of conventional CT machines range from 70 cm to 85 cm.
- Most mobile CT machines are compatible with DICOM 3.0, and the images can travel quickly through the existing hospital picture archiving and communication system (PACS) or the equipment's online image viewing and backup platform.

Mobile CT Deployment Across Clinical Settings



Source: Frost & Sullivan

Benefits of Mobile CT Scanners

Cost-effective: Mobile CT scanners cost less than traditional CT scanners. These machines use battery power and a standard wall power outlet for charging.

Optimized staff deployment: Mobile CT scanners reduce the physical burden on staff because patients do not need transportation to a dedicated scanner and table. ICU staff can focus on their patients rather than transporting patients to the radiology department.

Patient convenience: The patient does not have to get out of bed; a simple headboard adjustment allows adequate access inside the scanner. Attaching a head holder and shoulder board to the scanner ensures the alignment of the head is straight during scanning. The attachment of all tubes and cables to the patient remains intact throughout scanning.

Low infrastructure requirement: Unlike conventional CT scanners, portable CT scanners do not require a dedicated radiology room.

Lower radiation risk: Radiation levels of portable CT scanners are much lower than those of conventional machines, exposing patients to a lower effective radiation dose. The mobile CT machines are internally lead-shielded, which reduces the risk of exposure to scatter radiation.

Reduction in time: Using the mobile scanner saves time because it is faster and does not require time to transport the patient to the radiology room.

Real-time imaging: Mobile CT provides real-time imaging results, enabling healthcare professionals to make immediate decisions regarding patient care. This will improve patient outcomes and reduce treatment delays.

Reduced transport risk for patients: The machine's portability eliminates the risk associated with transporting patients to a dedicated scanning room.

Source: Frost & Sullivan

Clinical Applications of Mobile CT Scanners

Sinus

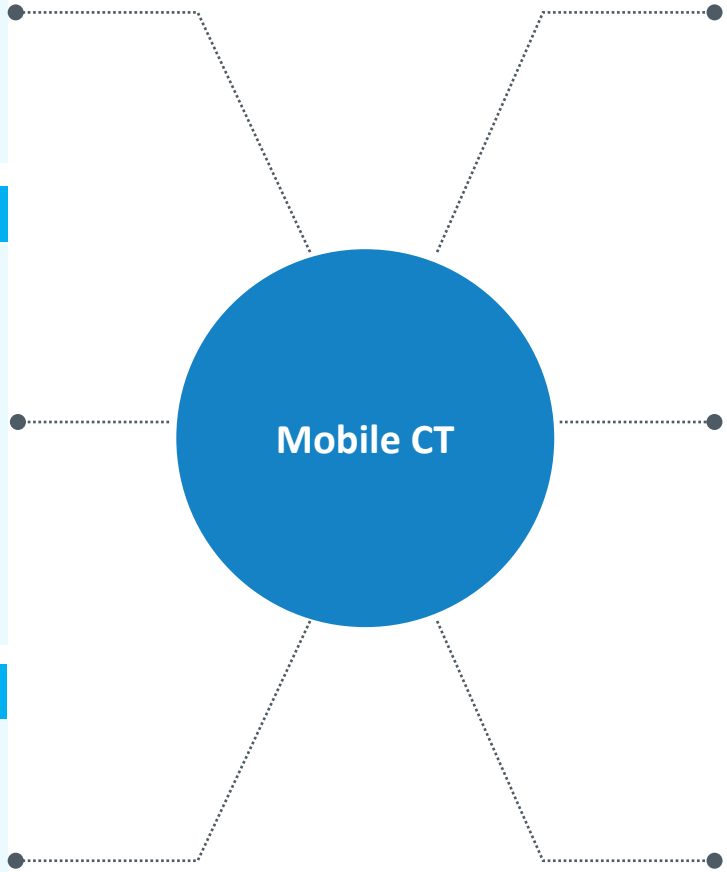
- Sinusitis
- Tumors of nasal cavity
- Thickened sinus membrane
- Image-guided sinus surgery

Respiratory

- Bronchi inflammation
- Trauma to blood vessels or lungs
- Benign and malignant tumors
- TB
- Congenital anomalies
- COVID pneumonia
- Cystic fibrosis
- Inflammation or other diseases of pleura

Spine

- Fractures
- Pain
- Bone density
- Congenital anomalies
- Tumors in the vertebral column



Temporal Bone

- Cochlear implant evaluation
- Otosclerosis and cholesteatoma
- Chronic otitis media
- Superior semicircular canal dehiscence

Head

- Brain injuries
- Skull fractures
- Stroke
- Bleeding aneurysm
- Brain tumors
- Diseases or malformations of skull
- Hydrocephalus
- Temporal bone diseases

Abdomen and Pelvis

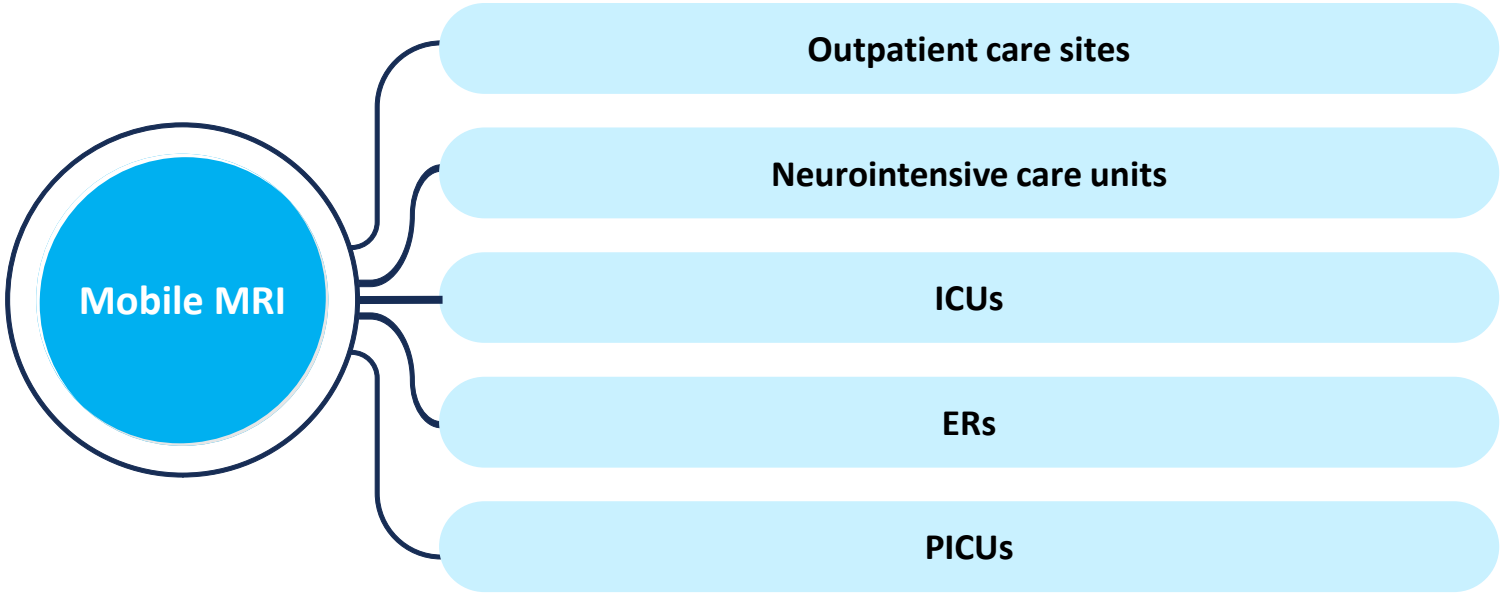
- Infections, such as appendicitis and pyelonephritis
- Cancers of the prostate, ovaries, and bladder
- Kidney and bladder stones
- Abdominal aortic aneurysms

Source: Frost & Sullivan

Mobile MRI Scanners

- Mobile MRI systems are portable platforms with low magnetic field strength (64 mT–1.5 T) that users can easily transport, position, and operate. The pMRI machine does not require specialized radiographers, and the lower magnetic field minimizes the risk of thermal burns and ferrous projectiles hitting patients and personnel.
- The pMRI machines are DICOM compatible and integrate with the hospital's existing PACS. Hospitals that do not have a PACS can utilize a cloud PACS, and physicians can access the images remotely.

POC MRI Deployment Across Clinical Settings



Source: Frost & Sullivan

Benefits of Mobile MRI Scanners

Mobile MRI

Cost-effective: Mobile MRI scanners cost less than conventional MRI machines and use a standard wall power outlet.

Optimized Staff Deployment: Operation does not require a licensed MRI technician; a non-credentialed staff member with simple training can operate the machines, making them useful in diverse clinical environments, outpatient clinics, and potentially soon in ambulances.

Reduced Transport Risk for Patients: The machine's portability eliminates the risk that transporting patients to a dedicated scanning room poses and is especially useful for immobile patients who cannot leave their hospital room, such as cardiac arrest patients, ventilated patients with severe acute respiratory distress syndrome, and those with multiple-organ failure and connection to continuous renal replacement therapy.

Low Infrastructure Requirement: Using pMRI machines does not require a dedicated radiology room.

Patient Convenience: Providers can easily transport, position, and operate the device at the bedside.

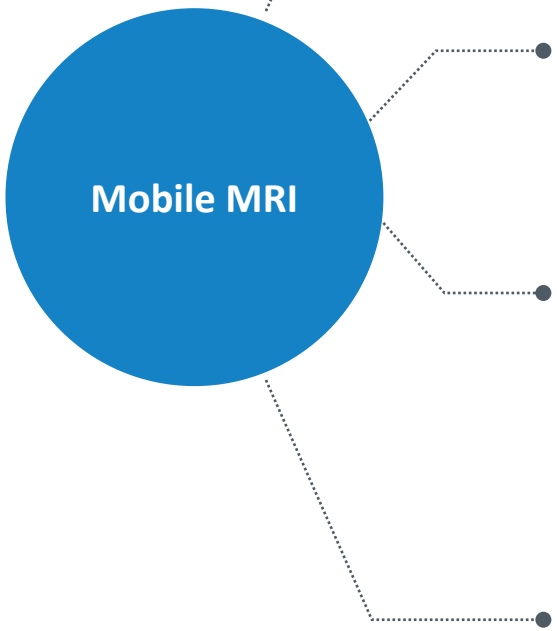
Reduced Scan Time: Using the pMRI machine saves time because it is faster and does not require time to transport the patient to the radiology room.

Low Magnetic Field Exposure: The pMRI machine has a lower magnetic field strength than traditional machines. Moreover, providers do not need to disconnect patients from their medical equipment while undergoing scanning because, unlike conventional machines, the pMRIs can function alongside common hospital ferromagnetic devices, such as ventilators, intravenous pumps, electrocardiogram monitors, and dialysis machines.

Real-time Imaging: Mobile MRI provides real-time imaging results, enabling healthcare professionals to make immediate decisions regarding patient care. This will improve patient outcomes and reduce treatment delays.

Source: Frost & Sullivan

Clinical Applications of Mobile MRI Scanners



Neck and Spine

- Tumors
- Internal bleeding
- Swelling
- Infections

Knee and Shoulder

- Sports-related injuries
- Tumors of the bones and joints
- Bone fractures
- Infections such as osteomyelitis

Abdomen

- Abnormal and inflamed blood vessels
- Tumors of the abdomen
- Liver diseases and pancreatic abnormalities

Head

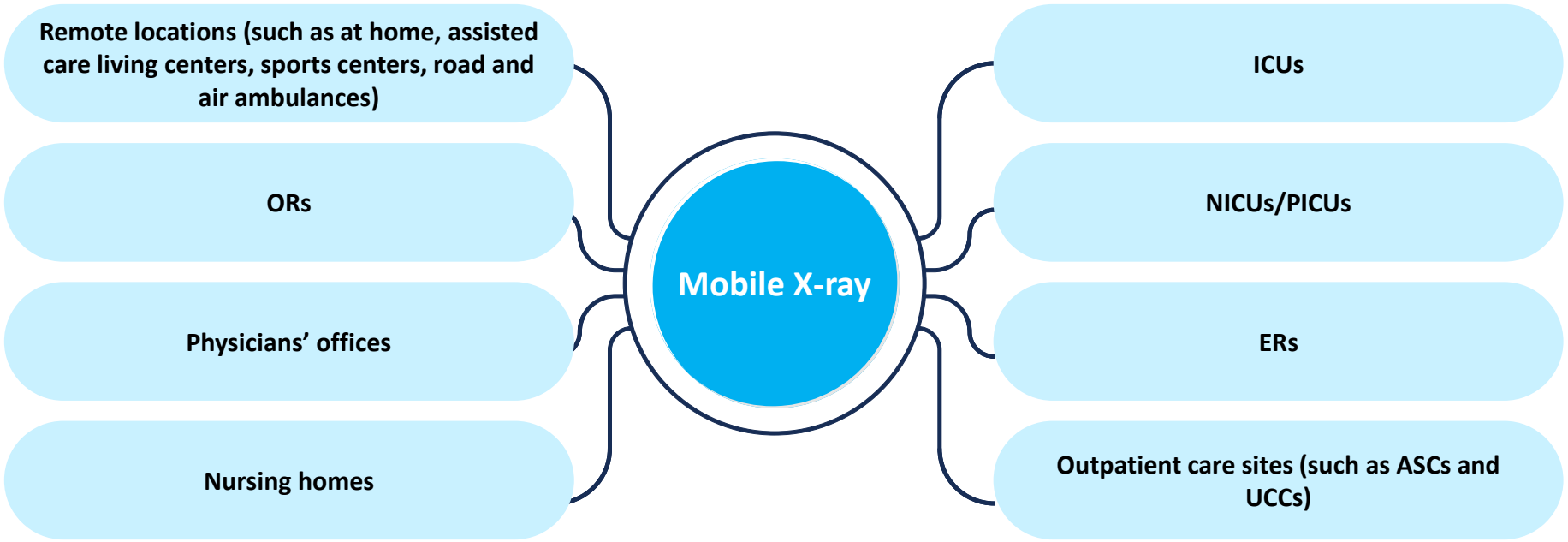
- Cranial neuropathy
- Cerebral edema
- Ataxia
- Stroke
- Intracranial hemorrhage
- Hematoma
- Hydrocephalus
- Traumatic brain injury
- Blurred vision
- Atrophy monitoring
- Multiple sclerosis
- Alzheimer’s disease

Source: Frost & Sullivan

Mobile X-ray Scanners

- Healthcare professionals use mobile X-ray scanners at outpatient locations that do not have access to a conventional fixed radiographic machine or with patients who are immobile and cannot travel to the radiology department.
- Mobile X-ray scanners weigh less than fixed X-ray machines and can be wheeled or handheld.
  - The wheeled cart-based mobile X-ray unit consists of an X-ray generator, a movable tube stand, and an X-ray tube that receives power from a rechargeable battery.
  - Handheld X-ray units include a miniaturized X-ray detector, shoulder strap, and rechargeable battery. Because of their compactness, clinicians can easily transport and use them in various clinical settings.

Mobile X-ray Deployment Across Clinical Settings



Source: Frost & Sullivan

Benefits of Mobile X-ray Scanners

Patient Convenience: Providers can easily transport, position, and operate the portable X-ray device at the patient's bedside or outpatient settings.

Low Infrastructure Requirement: Unlike conventional X-ray systems, mobile X-rays do not require a dedicated radiology room.

Cost-effective: Portable X-ray scanners cost less than conventional X-ray machines and use battery power, enabling remote diagnosis.

Safety: The mobile X-ray machine emits significantly less radiation than conventional X-ray machines and has a shield in the front that prevents scatter radiation exposure to the operators. Hence, the mobile X-ray machine exposes patients and healthcare professionals to less radiation.

Triaging: With mobile X-rays that use AI algorithms, healthcare practitioners can prioritize patients with life-threatening conditions, such as pneumothorax, because the mobile X-ray prioritizes the severity of the condition through a rating mechanism. This rating helps provide triaging or imaging services according to a patient's risk of clinical deterioration.

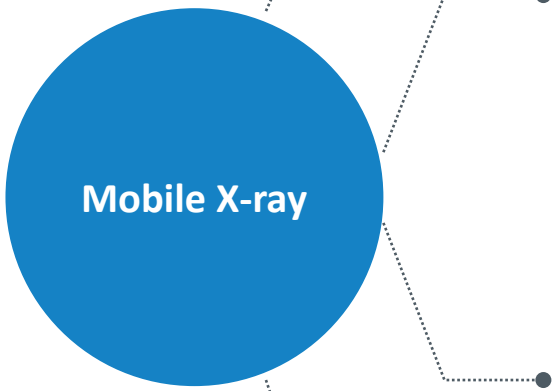
Enhanced Image Quality: Mobile X-rays suppress the scattering and attenuation of X-ray signals using advanced image processing technologies, noise reduction circuits, optical sensors, and high-resolution panels. This ensures high-quality images, providing high diagnostic value to healthcare professionals.

Increased Clinician Productivity: Mobile X-ray scanners provide a simple user interface, enabling health professionals to quickly learn to operate them with minimal training. The setup for a diagnostic exam is shorter than traditional X-ray units, and some machines can automatically select patient information using information from the barcode reader without the manual entry of details.

Speed: Mobile X-ray machines offer quick scanning and eliminate long wait times. The mobile X-ray takes less than 20 minutes to process the scanning image. Users can access the results in real time and send them directly to the patient's physician, allowing for immediate diagnosis and initiation of treatment.

Source: Frost & Sullivan

Clinical Applications of Mobile X-ray Scanners



Dental

- Advanced periodontal diseases
- Cysts in jawbones
- Jaw tumors and oral cancer
- Fractures in teeth
- Jaw disorders
- Sinusitis

Chest

- COVID pneumonia
- Heart failure and other heart-related problems
- TB
- Lung cancer
- Fluid or air collection around the lungs
- Emphysema

Bones

- Fractured bones or joint dislocation
- Injury, infection, arthritis, and abnormal bone growth
- Bone cancer
- Foreign objects in soft tissues around the bones

Abdomen

- Kidney and urinary bladder stones and gallstones
- Intestinal blockages
- Perforation of the stomach or intestine

Source: Frost & Sullivan

Mobile Medical Imaging—Ultrasound Competitive Landscape

No.	Vendor	Cart-based Ultrasound	Portable (Hand-carried) Ultrasound	Ultraportable Handheld Ultrasound	Description
1	**Butterfly Network, Inc.**			Yes	Butterfly Network, Inc. launched in the United States in 2011. The company has developed a single-probe, whole-body POCUS solution, and its software can integrate into hospital networks to help clinicians transform care delivery and improve efficiency.
2	**CHISON Medical Technologies Co., Ltd.**	Yes	Yes	Yes	CHISON Medical Technologies Co., Ltd. launched in China in 1996. This medical imaging OEM focuses specifically on ultrasound technology and has products in all 3 categories.
3	**Clarius Mobile Health**			Yes	Clarius Mobile Health launched in Canada in 2014. The company focuses on an ultraportable handheld ultrasound system that does not compromise on image quality, and its app works reliably with iOS and Android smart devices.
4	**EchoNous Inc.**			Yes	EchoNous Inc. launched in the United States in 2016. The company offers an AI-enabled ultraportable ultrasound device that leverages AI tools to allow real-time imaging and analysis. The device has tele-ultrasound capabilities and is compatible with both Android and iOS.
5	**Esaote S.p.A**	Yes	Yes		Esaote S.p.A launched in Italy in 1980 and offers cart-based and portable (hand-carried) ultrasound systems. Its products incorporate the latest AI-driven Augmented Insight technology.
6	**GE HealthCare**	Yes	Yes	Yes	GE Healthcare launched in the United States in 1994. The company offers cart-based, portable (hand-carried), and handheld ultrasound systems. GE Healthcare acquired Caption Health, an AI healthcare company in Feb 2023, which allowed it to add AI-enabled image guidance to its ultrasound device portfolio.

Note: The list is not exhaustive. Companies appear in alphabetical order.

Source: Butterfly Network, Inc; CHISON; Clarius Mobile Health; EchoNous Inc.; Esaote S.p.A; GE HealthCare; Frost & Sullivan

Mobile Medical Imaging—Ultrasound Competitive Landscape (continued)

No.	Vendor	Cart-based Ultrasound	Portable (Hand-carried) Ultrasound	Ultraportable Handheld Ultrasound	Description
7	**Healcerion Co., Ltd.**			Yes	Healcerion Co., Ltd. launched in Korea in 2012. The company focuses on handheld ultrasound systems, and its products are compatible with all types of mobile devices.
8	**Konica Minolta, Inc.**	Yes	Yes	Yes	Konica Minolta, Inc. established in 2003 in Japan. The company offers cart-based, portable (hand-carried), and handheld ultrasound systems. Its advanced software provides AI to increase diagnostic capabilities, features to increase workflow efficiency and automate workflows, reporting and archival systems, and patient record management to meet the demands of various clinical applications.
9	**Shenzhen Mindray Bio-Medical Electronics Co., Ltd.**	Yes	Yes	Yes	Shenzhen Mindray Bio-Medical Electronics Co., Ltd. (Mindray) launched in China in 1991 and offers cart-based, portable (hand-carried), and handheld ultrasound systems.
10	**Koninklijke Philips N.V.**	Yes	Yes	Yes	Dutch multinational company Koninklijke Philips N.V., (Philips) launched in 1891. The company offers cart-based, portable (hand-carried), and handheld ultrasound sytems. In 2022, Philips added pulsed-wave Doppler technology to Lumify, allowing all physicians to quickly assess cardiac hemodynamics.
11	**Pulsenmore Ltd.**			Yes	Pulsenmore Ltd. launched in Israel in 2014 and focuses on portable handheld ultrasound devices. The company offers a self-scan device for remote screening and facilitates online physician consultation via an app available with the scanner.

Note: The list is not exhaustive. Companies appear in alphabetical order.

Source: Healcerion Co., Ltd.; Konica Minolta, Inc.; Shenzhen Mindray Bio-Medical Electronics Co., Ltd. Koninklijke Philips N.V., Pulsenmore Ltd; Siemens Healthineers; Frost & Sullivan

Mobile Medical Imaging—Ultrasound Competitive Landscape (continued)

No.	Vendor	Cart-based Ultrasound	Portable (Hand-carried) Ultrasound	Ultraportable Handheld Ultrasound	Description
12	**Siemens Healthineers**	Yes	Yes		Siemens Healthineers launched in Germany in 2017. The company offers cart-based and portable (hand-carried) ultrasound systems and leverages AWS to connect more than 100,000 ultrasound systems globally, including portable and ultraportable systems.
13	**Sonoscanner**	Yes	Yes	Yes	Sonoscanner launched in France in 2003. The company offers cart-based, portable (hand-carried), and handheld ultrasound sytems. The entire product line is available with a remote workflow tool, SonoReplay, to enable remote access from any location or device.
14	**SonoScape Medical Corp.**	Yes	Yes		SonoScape Medical Corp. launched in China in 2002 and offers cart-based and portable (hand-carried) ultrasound systems. The company partnered with DiA Imaging Analysis in 2021 to provide AI-based cardiac ultrasound solutions.
15	**FUJIFILM Sonosite, Inc.**	Yes	Yes		FUJIFILM Sonosite, Inc., a subsidiary of FUJIFILM Holdings Corporation, Tokyo, launched in the United States in 1998. The company offers cart-based and portable (hand-carried) ultrasound systems. Fujifilm has developed AI-based DeepInsight Technology to reduce noise in ultrasound images. The solution enables imaging in deep anatomical regions.
16	**Terason Division Teratech Corporation**	Yes	Yes		Terason Division Teratech Corporation launched in the United States in 1994 and offers cart-based and portable (hand-carried) ultrasound systems. In 2019, the company partnered with DiA Imaging Analysis to integrate superior AI cardiac solutions with POCUS.

Note: The list is not exhaustive. Companies appear in alphabetical order.

Source: Sonoscanner; SonoScape Medical Corp.; FUJIFILM Sonosite, Inc.; Terason Division Teratech Corporation; Frost & Sullivan

Mobile Medical Imaging—X-ray Competitive Landscape

No.	Vendor	Mobile X-ray	Portable/ Handheld X-ray	Description
1	**Allengers Medical Systems Ltd**	Yes		Allengers launched in India in 1987 and manufactures mobile X-ray units that eliminate motion artifacts because of lower exposure time and offer good film quality. The units' high frequency results in a lower radiation dose.
2	**Canon Medical Systems Corporation**	Yes		Canon Medical Systems Corporation launched in Japan in 1914. The images the mobile X-ray units capture appear on the main unit monitor in about 2 seconds, allowing immediate confirmation and more efficient exams.
3	**Fujifilm Corporation**	Yes	Yes	Fujifilm Corporation launched in Japan in 2006 and offers mobile X-rays and portable (handheld) X-ray systems. The company provides open AI platforms to support imaging workflow and develops technologies that support diagnostic imaging with deep learning AI across its medical imaging modalities, including X-rays.
4	**GE HealthCare**	Yes		GE Healthcare launched in the United States in 1994 and offers mobile X-ray systems. The company introduced the X-ray industry's first on-device AI solution for triaging and enhancing productivity.
5	**Intermedical S.r.l.**	Yes		Intermedical S.r.l. launched in Italy in 1998 and offers mobile X-ray systems. The company's motorized mobile X-ray units operate on battery power, have a standard or telescopic column, and are available in 2 versions: an analog version and a fully digital version.
6	**itie Knowledge Solutions**		Yes	The company itie Knowledge Solutions launched in India in 2007 and offers portable (handheld) X-ray systems. The company's portable X-ray has low radiation (about 100–1000 lower than the conventional X-rays), operates on battery power, and weighs less than 2 kg. The system requires only 3 seconds to take an X-ray, and providers can quickly share images via WhatsApp or email. The device has AI- based software that can detect COVID-19.

Note: The list is not exhaustive. Companies appear in alphabetical order.

Source: Allengers Medical Systems; Canon Medical Systems Corporation; Fujifilm Corporation; GE HealthCare; Intermedical Srl; itie Knowledge Solutions; Frost & Sullivan

Mobile Medical Imaging—X-ray Competitive Landscape (continued)

No.	Vendor	Mobile X-ray	Portable/ Handheld X-ray	Description
7	**Konica Minolta, Inc.**	Yes		Konica Minolta, Inc. launched in Japan in 2003 and offers mobile X-ray systems. The company's machine transmits pulsed X-rays and displays static images. Dynamic digital radiology (DDR) visualizes the motion of structures, such as the lungs and diaphragm, and provides more information than conventional static images for bedside radiography.
8	**Micro-X Limited**	Yes		Micro-X Limited launched in Australia in 2011 and offers mobile X-ray systems. The company's mobile X-ray uses a carbon nanotube, a cold electron source material instead of a traditional heated filament. This electronic X-ray tube is smaller, lighter, and faster than many other X-ray machines.
9	**OXOS Medical Inc.**		Yes	OXOS Medical launched in the United States in 2016 and offers portable handheld X-ray machines. OXOS X-ray provides dynamic imaging with clear images. The device connects to the cloud and allows on-demand image and study management, giving providers instant access to the information they need anywhere, at any time.
10	**Perlong Medical Equipment Co., Ltd.**	Yes		Perlong Medical Equipment Co., Ltd. launched in China in 1993 and offers mobile X-ray systems.
11	**Koninklijke Philips N.V.**	Yes		Dutch multinational company Koninklijke Philips N.V. (Philips) launched in 1891 and offers mobile X-ray systems. The company's mobile X-ray machine offers augmented detection and advanced workflow with Lunit INSIGHT CXR, an AI-based clinical decision support solution that improves diagnostic performance, reduces overlooked abnormalities, and streamlines workflows.
12	**Samsung Healthcare**	Yes		Samsung Healthcare launched in Korea in 1969. The company's X-ray machines operate on battery power, can charge quickly, and can take up to 1,900 exposures or be on standby for up to 35 hours in sleep mode. The models are lightweight, which supports easier patient positioning for the technician, and they operate at low noise levels.

Note: The list is not exhaustive. Companies appear in alphabetical order.

Source: Konica Minolta, Inc.; Micro-X Limited; OXOS Medical Inc; Perlong Medical; Koninklijke Philips N.V.; Samsunghealthcare.com; Frost & Sullivan

Mobile Medical Imaging—X-ray Competitive Landscape (continued)

No.	Vendor	Mobile X-ray	Portable/ Handheld X-ray	Description
13	**Shimadzu Corporation**	Yes		Shimadzu Corporation launched in Japan in 1875 and offers mobile X-ray systems. The company has equipped its latest system with DDR, which captures a series of static images at high speed and displays them as a moving image. The mobile DDR visualizes the motion of structures, such as the lungs and diaphragm, and provides more information than conventional static images. Shimadzu plans to implement an imaging transformation strategy for combining AI and the Internet of Things with X-ray radiography systems to offer additional value.
14	**Siemens Healthineers AG**	Yes		Siemens Healthineers AG launched in Germany in 2017 and offers mobile X-ray systems that combine all the benefits of portable X-ray imaging at the patient's bedside with full digital integration.
15	**Shanghai United Imaging Healthcare Co., LTD**	Yes		Shanghai United Imaging Healthcare Co., LTD (United Imaging) launched in the United States in 2011. The company's mobile X-ray is a high-performing and agile system with an ultra-narrow body design, a high-voltage generator, and the uVision Remote Console that redefines the workflow for POC imaging.

Note: The list is not exhaustive. Companies appear in alphabetical order.

Source: Shimadzu Corporation; Siemens Healthineers AG; Shanghai United Imaging Healthcare Co., LTD; Frost & Sullivan

Mobile Medical Imaging—CT Competitive Landscape

No.	Vendor	Mobile Cone-beam CT (CBCT)	Mobile Weight-bearing CT	POC-CT/Mobile Conventional CT	Company Highlights
1	**Epica Human Health**			Yes	Epica Human Health launched in the United States in 2019. The company's multi-modality mobile CT offers fluoroscopy and digital radiography capabilities. The device utilizes the hybrid technology of high-definition volumetric imaging to deliver a 3D map of densities with spatial resolution that is the same in all 3 dimensions, with contrast equivalent to conventional CT.
2	**Micro-X Limited***			Yes*	Micro-X Limited launched in Australia in 2011. The company is developing a lightweight CT scanner that will provide POC early stroke diagnosis, reducing the time from stroke onset to treatment. It is suitable for integration into road and air ambulances. The Australian Government Medical Research Future Fund provides funding for the project.
3	**NeuroLogica Corp.**			Yes	NeuroLogica Corporation, a Samsung Electronics subsidiary, launched in the United States in 2004. The company has a portable head and neck CT scanner for use in ICUs, neurosurgical ORs, ERs, and mobile stroke units. In addition, it has full-body 32-slice and 64-slice scanners for use in ERS, diagnostics, brachytherapy suites, medical examiner facilities, and veterinary hospitals. The company has launched a 16-slice head and neck CT scanner for use at the POC. In 2022, NeuroLogica received FDA 510(k) clearance for a mobile, photon-counting CT (PCCT) scanner.
4	**Planmed Oy**	Yes	Yes		Planmed Oy launched in Finland in the early 1970s and offers a mobile CBCT unit for orthopedic and head and neck imaging and a POC weight-bearing extremity CT scanner that provides high-quality 3D images with a low dose.

Note: The list is not exhaustive. Companies appear in alphabetical order.

*Product in development

Source: Epica Human Health; Micro-X Limited; NeuroLogica Corporation; Planmed Oy; Frost & Sullivan

Mobile Medical Imaging—CT Competitive Landscape (continued)

No.	Vendor	Mobile CBCT	Mobile Weight-bearing CT	POC-CT/Mobile Conventional CT	Company Highlights
5	**Samsung Healthcare**			Yes	Samsung Healthcare launched in Korea in 1969 and offers a portable, full-body, 32-slice CT scanner that is a multi-departmental imaging solution capable of transforming any room in the hospital into an advanced imaging suite. The system's gantry is 85 cm, and the field of view is 60 cm—the largest available in a portable CT scanner.
6	**Siemens Healthineers AG**			Yes	Siemens Healthineers AG launched in Germany in 2017 and provides a portable head CT imaging solution with reliable and consistent image quality, right at the patient's bedside.
7	**Xoran Technologies, LLC.**			Yes	Xoran Technologies, LLC. launched in the United States in 2001. The company's scanner provides mobile full-body CT that produces high-definition, 3D CT images in real time. The equipment has intuitive, easy-to-use software for viewing and reconstructing scan images.

Note: The list is not exhaustive. Companies appear in alphabetical order.

Source: Samsung; Siemens Healthineers AG; Xoran Technologies, LLC.; Frost & Sullivan

Mobile Medical Imaging—MRI Competitive Landscape

No.	Vendor	Mobile Small Form-factor MRI	Portable POC MRI	Description
1	**DeepSpin GmBH***		Yes*	DeepSpin GmBH launched in Germany in 2019. The company is developing an economical pMRI that weighs only a few hundred kilograms and does not require infrastructure adjustments, expensive maintenance, or specialized cooling systems. Moreover, the machine offers an AI-powered intuitive interface and system design that allows for complete control of the device.
2	**Hyperfine, Inc.**		Yes	Hyperfine, Inc. launched in the United States in 2014. The company's pMRI is the world's first MRI system capable of providing neuroimaging at the POC. The system drives directly to a patient's bedside and plugs into a standard electrical outlet, with an Apple iPad controlling it. The system is ready to scan in less than 3 minutes and enables care decisions without requiring the patient to be transported to a radiology suite.
3	**Promaxo, Inc.**	Yes		Promaxo, Inc. launched in the United States in 2016 and has developed a portable open MRI system to image the internal structures of the body. The company designed the system for use in a physician's office without considerable facility upgrades. With a limited footprint and fringe field, users can easily place it inside a standard office. Promaxo's MRI system uniquely combines several technologies and encapsulates high-quality MRI into a small form factor with a low magnetic field.
4	**Synaptive Medical Inc.**	Yes		Synaptive Medical Inc. launched in Canada in 2012 and has received US FDA approval for its pMRI system, which looks similar to traditional MRI machines with its open-bore shape. However, Synaptive's MRI system uses a 0.5T lower strength superconducting magnet compared to the typical 1.5 T or 3 T conventional MRI machines. This MRI system can be used to scan the head, for example, to evaluate stroke patients in the ER or ICU without transporting them to a radiology suite.

Note: The list is not exhaustive. Companies appear in alphabetical order.

*Product in development

Source: DeepSpin GmBH; Hyperfine, Inc.; Promaxo, Inc.; Synaptive Medical Inc.; Frost & Sullivan

Growth Drivers

Global Mobile Medical Imaging: Growth Drivers, Global, 2023–2027

Driver	1–2 Years	3–4 Years	5 Years
The incidence of chronic diseases and the size of the aging global population are increasing. The World Health Organization estimates that by 2030, the population over age 60 years will be approximately 1.4 billion and will increase to more than 2.1 billion by 2050. Chronic diseases, such as cardiovascular diseases, cancer, diabetes, and respiratory illnesses, will account for more than 86% of the 90 million deaths annually by 2050. This will drive the demand for mobile medical imaging.	**High**	**High**	**High**
The growth of remote healthcare and telemedicine will drive the uptake of mobile medical imaging equipment.	**High**	**High**	**High**
Mobile/At-home medical imaging services have increased globally, especially since COVID-19. This will drive the use of portable POC imaging services, such as portable digital X-rays and portable ultrasound.	**Medium**	**High**	**High**
Hospitals will invest in mobile medical imaging equipment to free up capacity of conventional imaging devices.	**Medium**	**Medium**	**High**
Opportunities exist for healthcare investments in low-cost portable medical imaging equipment in markets that do not have the financial resources for expensive conventional equipment.	**Medium**	**Medium**	**Medium**

Source: Frost & Sullivan

Growth Restraints

Global Mobile Medical Imaging: Growth Restraints, Global, 2023–2027

Restraints	1–2 Years	3–4 Years	5 Years
Portable equipment's small bore size increases scan-related anxiety in patients.	**High**	**High**	**High**
Lower image quality than conventional imaging equipment may limit its clinical application areas.	**High**	**Medium**	**Medium**
Mobile imaging devices pose high cybersecurity risks because of exposure to unsecured mobile networks and the potential for theft or equipment falling into the wrong hands.	**High**	**Medium**	**Medium**
Frequent use of mobile imaging equipment increases the risk of spreading infection without the adoption of proper disinfection methods.	**High**	**Medium**	**Low**
Operator fatigue, improper positioning, or patient movement during scanning may affect scan quality.	**Medium**	**Medium**	**Medium**

Source: Frost & Sullivan

Growth Opportunity Universe

Growth Opportunity 1—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	**2024**

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—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 necessary 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 during COVID-19, with patients trying to limit exposure to busy waiting rooms and wanting to complete their procedures quickly.
- Mobile medical imaging systems can perform diagnostic imaging at a patient's bedside, eliminating the risk of transportation-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 quickly diagnose patients.
- Mobile imaging enables access to imaging services wherever physicians and patients need them—in an office, home, assisted living space, or medical facility. This service benefits aged or immobile patients and those with memory-related disorders who prefer familiar environments.
- Increasing preference for portable, low-dose mobile CT usage will drive mass-scale lung screening.

Call to Action

- Mobile imaging companies must focus on developing user-friendly, lightweight, portable imaging equipment, which offers new opportunities for high-quality POC diagnostic imaging and can help increase access in underserved regions.
- Photon counting CT is a major technological breakthrough because it uses energy-resolving detectors, thereby enabling scanning at multiple energies. Mobile CT manufacturers should partner with research institutes and companies that focus on technologies related to the development and manufacture of semiconductor detector modules to incorporate PCCT in mobile CT scanners.
  - In 2022, NeuroLogica received FDA 510(k) clearance for its mobile, photon-counting CT (PCCT) scanner.
- Mobile MRI scanner companies have developed machines that healthcare professionals can easily move within the hospital; however, they should focus on developing pMRI machines that users can easily transport to outpatient care sites, such as homes and assisted living communities, for immobile patients and senior citizens.

Source: Frost & Sullivan

Growth Opportunity 2—MRI Scanning for Alzheimer's Disease Treatment and to Guide Prostate Interventions

Opp. Size in 5 Years	$100 M–$500 M
Timeline for Action	2 Years
Base Year	2024

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 2—MRI Scanning for Alzheimer's Disease Treatment and to Guide Prostate Interventions (continued)

Context and Definition

- Doctors conduct MRI scans for active surveillance of prostate cancer. An experimental prostate cancer treatment uses MRI to target radiation and intensify the dose to the tumor while reducing side effects. This novel MRI-guided radiotherapy enables doctors to obliterate tumors in just 5 treatment sessions without harming nearby cells.
- Multi-parametric MRI has use as an efficient tool to guide prostate biopsy decision-making.
- With the development of better magnet design, radiofrequency, and gradient technologies, interest in low-field MRI for targeted applications is increasing.
- Drugs targeting Alzheimer's disease, such as Aduhelm and Leqembi, require brain MRI before initiating treatment and MRI scans before the 5th, 7th, 9th, and 12th infusions for Aduhelm and the 5th, 7th, and 14th infusions for Leqembi to monitor side effects (known as amyloid-related imaging abnormalities) and to determine treatment recommendations. This requirement will increase the demand for MRI scanning for Alzheimer’s disease patients on these drugs.

Call to Action

- POC MRI manufacturers can capitalize on the opportunity that exists with Alzheimer’s disease drugs that require frequent MRI scans because pMRI costs a fraction of what conventional MRI machines cost.
- The ability to perform an MRI scan in an outpatient setting instead of a radiology department or a diagnostic center will increase patient convenience. Moreover, immobile patients and patients with Alzheimer’s disease who may find it difficult to visit the hospital or would prefer to remain in a familiar environment would benefit from receiving their MRI scans at home. Mobile MRI manufacturers should focus on capitalizing on this opportunity.
- Active surveillance for prostate cancer presents another opportunity for mobile MRI manufacturers. Doctors can use the POC MRI machines to target prostate lesions in alignment with the current standard of care.

Source: Biogen; Eisai Inc.; Frost & Sullivan

Growth Opportunity 3—Integration of AI Capabilities in Portable X-ray and POCUS

Opp. Size in 5 Years	**$100 M–$500 M**
Timeline for Action	**2 Years**
Base Year	**2024**

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


North America


Western Europe


Latin America


Africa


Central/ Eastern Europe


Asia-Pacific

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 3—Integration of AI Capabilities in Portable X-ray and POCUS (continued)

Context and Definition

- Some regions, such as India, are conducting mobile screening programs with ultraportable chest X-rays along with AI tools to enable faster screening of patients for TB.
- With the advent of POCUS, the imaging paradigm has shifted from the conventional model of trained sonographers acquiring images and radiologists interpreting them to treating physicians performing and interpreting POCUS in real time while developing a treatment plan for the patient.
- AI solutions dramatically increase the effectiveness of POCUS by providing interpretation assistance to physicians, which is one of the barriers to POCUS adoption. AI in POCUS machines can give users immediate actionable feedback to improve the image. Using AI to provide interpretation assistance is expanding to different clinical application areas, such as cardiology.

Call to Action

- Portable X-ray manufacturers can develop AI capabilities in their equipment or partner with pure-play AI companies that develop AI-based solutions for portable X-rays. Integration of AI capabilities will make the diagnosis more effective and efficient, and healthcare professionals with minimal training can operate the equipment. This will increase the adoption of portable X-ray machines.
  - MinXray has collaborated with Qure.ai to integrate its qXR automated chest X-ray AI solution. The new AI software can detect and localize 30 chest X-ray abnormalities, including TB and variations related to COVID-19 infections.
- POCUS manufacturers should develop AI functionalities or collaborate with AI solutions companies to integrate AI features to enhance equipment capabilities across different clinical application areas and enable physicians with minimal training to operate it.
  - GE HealthCare acquired Caption Health, Inc., an AI-powered image guidance provider that creates clinical applications to aid in early disease detection, using AI to assist in conducting ultrasound scans.
  - Philips has received a second round of funding from the Bill & Melinda Gates Foundation to accelerate the global adoption of AI algorithms in the Philips Lumify handheld ultrasound.

Source: GE HealthCare; Koninklijke Philips N.V; MinXray, Inc; Frost & Sullivan

List of Exhibits

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