SAMS

For Every Heartbeat

A SAMS Report on Rebuilding Advanced Cardiac Care in Syria



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Rebuilding Advanced Cardiac Care in Syria
2026

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MISSION & VISION

Our mission is to deliver life-saving services, revitalize health systems during crises, and promote medical education through a network of humanitarians in Syria, the US, and beyond.

Our vision is to strengthen the future of Syria's healthcare by delivering dignified medical relief where needed, fortified by a dedicated medical community.

ABOUT SAMS

The Syrian American Medical Society (SAMS) was founded in 1998 as a professional society to provide networking and educational opportunities for medical professionals of Syrian descent across the United States. The charitable arm of SAMS, the SAMS Foundation, was launched in 2011. With the eruption of the conflict in Syria, SAMS Foundation became one of the most active medical relief organizations working on the front lines of crisis relief in Syria, neighboring countries and beyond.



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About This Report

This report presents a program-centered account of advanced cardiac services delivered by the Syrian American Medical Society (SAMS) across its supported facilities in Syria. It examines how a structured model of cardiovascular care has been built around outpatient cardiology, diagnostics, cardiothoracic surgery, catheterization laboratories, cardiac critical care, electrophysiology, and stroke intervention.

It draws on program data, operational material, interviews with clinicians and program leadership, and selected academic and policy literature on cardiovascular disease in Syria, the wider Middle East and North Africa, and conflict-affected health systems.

Who This Report Is For

This report is intended for donors, health authorities, technical partners, and clinicians interested in how advanced cardiovascular services can be organized and delivered inside Syria. It is also relevant to those working on noncommunicable diseases, tertiary referral systems, hospital-based care, and health system recovery in fragile or conflict-affected settings.

For clinical readers, it offers a structured account of service scope, program growth, and the practical realities of delivering surgery, catheter-based intervention, stroke care, and critical care support. For institutional partners, it provides evidence of what the program is doing, why these services matter, and what constraints continue to shape their sustainability.

Acknowledgments

This report reflects the work of surgeons, cardiologists, anesthesiologists, intensivists, nurses, technicians, emergency teams, program staff, and visiting specialists across SAMS-supported facilities. It also reflects the contribution of the doctors and health workers who helped establish and expand these services through repeated missions, technical supervision, mentorship, and clinical support. Their experience shaped not only the services themselves, but also the interpretation presented here.

Preface

Syria once held an important place in medicine in the Arab world. In cardiology and cardiac surgery, Syrian physicians built a respected tradition, including the generation shaped by pioneers such as Dr. Sami Al-Kabbani in the 1970s. That tradition was built on clinical skill, public hospitals, teaching, and the belief that complex care could be practised inside the country.

The decline came in stages. Under decades of authoritarian rule, the health system gradually became more closed and less connected to international scientific exchange. New techniques, tools, technologies, and training opportunities became harder to access. Cardiology continued to exist, but the space for renewal narrowed.

The 2011 uprising and the conflict that followed brought a deeper rupture. Hospitals were damaged or pushed out of service. Training pathways were interrupted. Equipment and supplies became scarce. Many physicians left the country, while those who remained carried heavy clinical workloads under difficult conditions. Cardiac disease did not pause during those years. Patients continued to suffer heart attacks, valve disease, congenital defects, rhythm disorders and strokes, often reaching care late.

For Syrian physicians abroad, including many SAMS members in the United States and beyond, the conflict created pain and responsibility at the same time. It also created an opening to reconnect with colleagues and patients inside Syria. The first steps were modest: support to field hospitals, referrals, visiting missions, equipment, and case discussions. Over time, these efforts grew into a broader cardiac program.

After December 2024, the space for engagement expanded further. SAMS members and partners moved quickly to support hospitals across different geographies, bringing clinical expertise, equipment, training and renewed commitment. What began as a humble response is now becoming a national effort to rebuild advanced cardiac care across Syria.

This report tells the story of that journey. It follows the growth of SAMS's cardiac program from clinics and diagnostics to cath labs, cardiac surgery, electrophysiology, stroke care, critical care, training and health financing. It also looks at what can serve patients beyond individual missions.

At its core, this is a report about reconnection. It is about Syrian teams inside the country working with Syrian and Syrian American specialists abroad to bridge years of isolation, transfer knowledge and restore confidence in local care. It is about helping Syria's heart services beat again, through the talent of its doctors, the resilience of its teams and the belief that advanced care can once more be built inside the country.



Luay Alkotob

Dr. M. Luay Alkotob, MD, FACC, FSCAI
Interventional cardiologist and Chairman of SAMS Foundation

1. Heartache

The urgency of delayed cardiac and stroke care

Chronic heart diseases often progress quietly. People may live with them for years before reaching the right care, especially when early symptoms appear gradually, come and go, or seem easy to explain away. Chest discomfort may pass. Breathlessness may be blamed on fatigue. Climbing stairs may become harder little by little. The heartbeat may feel fast, irregular, or unsteady, then settle again. At first, these changes are often endured rather than treated.

Sooner or later, a series of questions begins. Can a cardiologist be found? Can the consultation be paid for? If tests, medicines, or a catheterization procedure are needed to better understand what is happening inside the heart, where is the nearest center, and what will it cost? If the answer is surgery, a device to steady the heartbeat, or long-term treatment, how is any of that meant to happen?

For some, the next step becomes possible. For many others, it turns into waiting. The symptoms remain. The diagnosis may become clearer. The path to treatment does not.

Time passes, and the cost of waiting rises with it. A condition that might once have been followed in the clinic becomes a heart failure, a severe coronary disease, a valve disease, or a rhythm problem that now needs urgent intervention. Some people keep searching from one place to another, hoping the next door will open more clearly than the last. Others delay because they know they may not be able to carry what comes after the diagnosis. Some prefer not to hear the full answer at all, because knowing what is wrong without being able to treat it can feel like another burden.

For others, the crisis arrives with frightening speed. A sudden, intense headache. Weakness in one arm or one side of the body. A face that suddenly looks uneven. Speech that becomes slurred or difficult. Disorientation. Loss of balance. In some cases, collapse. The person may already be in the middle of a stroke before anyone around them fully understands what is happening. Families lose precious time trying to make sense of the signs, deciding where to go, and reaching a facility that may or may not be ready to respond. Even then, imaging may be delayed, referral may be unclear, and the team or materials needed to act quickly may not yet be in place.

This issue sits within a wider burden of illness in Syria. WHO reported in 2024 that chronic conditions, including cardiovascular diseases, account for an estimated 50–70% of all deaths in the country (WHO Regional Office for the Eastern Mediterranean, 2024a). Years of conflict have also left Syria with a fragmented health system, making specialist referral, continuity of care, and long-term treatment far harder to sustain (Abbara, Marzouk and Mkhallalati, 2021; Al-Abdulla et al., 2025). By the time many people reach the right level of care, the disease is often more advanced, the intervention more difficult, and the space for recovery much smaller.


X-RAY

2. Fragile Walls

Cardiovascular burden, care gaps, and clinical need in Syria and the region

2.1 Cardiovascular disease in the Middle East

Cardiovascular disease remains one of the leading causes of death and disability across the Middle East. Analysis of Global Burden of Disease data for 1990–2021 identified ischemic heart disease, stroke, and hypertensive heart disease as the largest contributors to cardiovascular disability-adjusted life years across the region, while high systolic blood pressure, dietary risk, and high LDL cholesterol were the leading attributable risk factors (Soleimani et al., 2024). Earlier regional work also described a cardiovascular profile shaped by smoking, obesity, hypertension, diabetes, and poor long-term control of these risks, creating a sustained burden of coronary artery disease, heart failure, hypertensive cardiac damage, and stroke (Turk-Adawi et al., 2018).

Country patterns show how this burden takes different clinical forms. In Jordan, hypertensive heart disease has been especially prominent: Gao et al. reported an age-standardised incidence of 561.6 per 100,000 in 2019, while national burden analysis identified high systolic blood pressure, high BMI, dietary risks, and high LDL cholesterol among the leading contributors to cardiovascular DALYs (Gao et al., 2024; Al-Ajlouni et al., 2024). In Lebanon, the burden is especially visible in mortality, with cardiovascular diseases accounting for 47% of all deaths, including about 24% from ischemic heart disease and 9% from cerebrovascular disease (European Society of Cardiology, 2024). In Kuwait, obesity has become one of the clearest cardiovascular concerns. Adult obesity has been estimated at 48.3% among women and 36.4% among men, and cardiovascular disease is reported as the leading cause of death in the country (Global Nutrition Report, 2025; United Nations Interagency Task Force on NCDs, 2021). Tobacco remains another major driver of regional cardiovascular risk, and Turkey offers one of the clearest examples: WHO surveillance reported current tobacco smoking in 31.5% of adults, including 43.4% of men and 19.7% of women (WHO, 2018).

Conflict places this burden inside health systems that struggle to sustain specialist cardiac care. In Yemen, recent work has described a growing burden of cardiovascular disease alongside prolonged war, delayed presentation, weak surveillance, shortages of local expertise, and major constraints in cardiac surgery and interventional cardiology. A 2025 review identified ischemic heart disease as the leading cardiovascular cause of death in the country, accounting for more than 20% of total mortality (Mubarik et al., 2025; Basamed et al., 2025). Under those conditions, the progression of heart disease is shaped by whether a cardiologist can be reached, diagnostics are available, referral pathways function, and whether advanced services can be sustained long enough to intervene before disease becomes harder to treat, rather than by biology or risk exposure.

2.2 Cardiovascular disease in Syria

2.2.1 Burden and mortality

Cardiovascular disease was already a major public health burden in Syria before the conflict. One of the few population-based studies, conducted in Aleppo before the war, found that cardiovascular disease accounted for 45.0% of reported mortality over the preceding five years, and that 49% of cardiovascular deaths occurred before the age of 65 (Maziak et al., 2007). The evidence is dated and geographically limited, but it shows that Syria entered the crisis with a substantial cardiovascular burden before 2011.

The first years of the conflict were dominated by trauma, emergency surgery, siege medicine and acute infectious threats. As the crisis became prolonged, indirect mortality became more visible. In Northwest Syria, Alhiraki et al. (2022) found that from 2017 onward most conflict-related deaths were due to non-violent causes, showing how protracted conflict shifts health needs toward chronic disease, delayed emergencies and preventable deterioration.

Current national mortality data remain fragmented. WHO estimated in 2024 that chronic conditions, including cardiovascular diseases, diabetes, respiratory conditions, cancer and mental health disorders, account for 50–70% of all deaths in Syria (WHO EMRO, 2024). The Syrian Ministry of Health places cardiovascular diseases among the leading causes of mortality, particularly ischemic heart disease and stroke, and identifies noncommunicable diseases as a central burden for recovery planning (Syria MoH, 2025).



2.2.2 Impact of conflict on cardiology care

Cardiac care depends on continuity. A patient may enter the system through an outpatient clinic, an emergency department, a diagnostic service, a referral pathway, a catheterization laboratory, an operating room or an intensive care unit. During the Syrian conflict, this chain was weakened by attacks on health care, displacement, insecurity and fragmentation of the health system.

2.2.2.1 Fragmentation of the health system during the conflict

Fragmentation affected cardiology directly because advanced cardiac care depends on repeated appointments, functioning diagnostics, referral capacity, and follow-up. During the conflict, Syria's health system became divided into multiple subnational systems shaped by different governance structures, financing streams, humanitarian actors and referral pathways. Abbara, Marzouk and Mkhallalati (2021) and Al-Abdulla et al. (2025) describe a politicized landscape with multiple health systems operating within the country's borders, workforce shortages, financing gaps, inequitable access and growing reliance on private payments. Such fragmentation can turn geography into a determinant of care. Access to echocardiography, CT imaging, specialist consultation, catheterization, surgery or intensive care may depend on where the patient lives, which referral pathway is available, and whether the family can afford to travel or pay privately.

2.2.2.2 Attacks on health facilities

Cardiac care relies on the availability of well-equipped facilities to provide routine consultation, emergency response, procedures and follow-up. Attacks on health care damaged this pathway directly. SAMS and Physicians for Human Rights jointly reported 1,024 attacks on health care in Syria during the conflict (SAMS, 2022). Such attacks prevented many facilities from retaining, maintaining or safely operating the equipment required for advanced cardiac care.

Outpatient access is central to cardiology because many serious conditions first appear as manageable symptoms. Hypertension, worsening breathlessness, early heart failure, anticoagulation needs and device follow-up are often handled outside emergency care. Burbach et al. (2024) found that an attack on a health facility was associated with a 51% reduction in outpatient consultations on the following day, with significant reductions continuing for 37 days. In practice, a reduction of this kind can delay diagnosis, interrupt medicines and push patients toward later presentation with more advanced cardiac conditions and worsened prognosis.

Cardiac patients also depend on repeated contact with the health facility. Treatment plans often require records, prescriptions, imaging results, referral appointments and follow-up visits. Tarnas et al. (2024) found that attacks on health care were associated with increased displacement for up to three months after attacks. Such displacement can therefore break the clinical pathway before definitive care is reached. When patients are displaced, cardiovascular disease is more likely to be managed late, incompletely or only after emergency deterioration.

2.2.2.3 Workforce erosion

Syria's wider health workforce remains below the level needed for essential service delivery. The Syria National Health Compact reports approximately 1.5 physicians and 2.8 nurses and midwives per 1,000 population, below the WHO threshold of 4.45 health workers per 1,000 population (Government of Syria, 2025). Cardiology-specific data are limited. Around 400 doctors are reported to be registered in the Syrian Cardiovascular Association, but this does not show how many are currently practising inside Syria, how many provide advanced cardiac services, or how they are distributed across governorates (Al-Watan, 2023).

The shortage was shaped by years of violence against health workers and facilities. SNHR documented 857 medical personnel killed and 3,353 arrested or forcibly disappeared since March 2011 (Syrian Network for Human Rights, 2020). This violence contributed to large-scale departure from the health system. The IRC reported in 2021 that an estimated 70% of Syria's medical workforce had left the country (International Rescue Committee, 2021). Kallström et al. (2021) supports this link, finding that Syrian health workers who migrated described insecurity, generalized violence, detention risk and attacks on health care as major reasons for leaving.

The workforce that remained continued to work under severe pressure. Haar et al. (2024), in a separate SAMS-linked qualitative study, described fear, exhaustion and the need to continue care under unsafe conditions after repeated attacks on health care. In cardiac services, this reduces the pool of senior clinicians, procedural teams and supervisors available for patient care and future training.

2.2.2.4 Training decline

Conflict weakened the training pipeline for cardiac care. As training hospitals were damaged, access to medical faculty became more limited, and the learning environments became unsafe (Bdaiwi et al., 2023a), resulting in decreased clinical exposure, i.e. fewer opportunities to examine patients, follow cases over time, observe procedures, and learn under direct supervision.

Graduate medical education also lacks consistent standards. In a Syria-focused study, Sbei et al. (2025) found wide variation in curricula, oversight and assessment across 21 institutions. Only 57% reported formal curricula, 47.6% had formal training committees, and 19% had no structured final examination (Sbei et al., 2025). Another qualitative study found that postgraduate trainees often had limited access to supervisors, relied on themselves or senior peers for clinical learning, and perceived assessment as unfair or biased (Alfakhry et al., 2024).

The same applies to the wider cardiac team, including cath lab nurses, cardiac ICU nurses, perfusionists, anesthesia technicians, biomedical engineers, radiology technicians and device-care staff.

2.2.3 Current Landscape of Cardiology Care

The conflict-related drivers described above have left advanced cardiology care in Syria limited, uneven and concentrated. Publicly documented advanced cardiac services remain concentrated in a limited number of public and university hospitals, although capacity has expanded since 2025.

2.2.3.1 Access and geographic coverage

Damascus has the largest concentration, including Damascus Hospital for Heart Diseases and Surgery in Dummar, Damascus University Cardiac Surgery Hospital, the National University Hospital and Al-Mouwasat University Hospital. Across these institutions, reported services include cardiac surgery, adult and pediatric catheterization, coronary intervention, cardiac intensive care and selected advanced device procedures.

Outside Damascus, documented public capacity includes catheterization and electrophysiology services at Aleppo University Hospital; cardiac surgery and coronary catheterization at Hama National Hospital; diagnostic and interventional catheterization at Ibn Al-Walid Hospital in Homs; cardiac medicine and surgery at Tartous National Hospital; and diagnostic and therapeutic catheterization at Daraa National Hospital. Latakia Hospital for Heart Diseases and Surgery also remains a specialized public cardiac facility, but comparable advanced services are not available across governorates (Alameen Organization, 2025; WHO, 2021).

This geography leaves many patients dependent on referral, travel, waiting time and ability to pay. Public capacity remains weakened even within major centers, with staff shortages, equipment breakdown, missing consumables and patients often required to purchase medicines or supplies out of pocket.



2.2.3.2 Costs and affordability

Private open-heart surgery may cost around USD 10,000–15,000 according to estimates, far beyond what most households can absorb. World Bank data place Syria's GDP per capita at around USD 847 in 2023, while the Macro Poverty Outlook projected the lower middle-income poverty rate at 46.8% in 2025 (World Bank, 2024; World Bank, 2026). With the absence of a national risk pool and inadequate insurance coverage for most Syrians, As less than 5% of the population was insured as of 2023 (Al-Abdulla et al. 2025). The affordability barrier extends beyond surgery. Cardiovascular patients often need long-term medicines, while medicine availability remains uneven; Aljadeeah et al. (2025) found low availability of essential medicines for cardiovascular disease, diabetes in some parts of Syria.

2.2.3.3 Health service gaps

Several advanced services remain scarce or inconsistently available. In arrhythmia care, these include electrophysiology services, catheter ablation and pacemaker programming were largely unavailable and patients had to travel outside the country to get this service.

Many elected structural heart interventions, including minimally invasive cardiac surgery and pediatric cardiac surgery remain limited. Pediatric surgery is further constrained by shortages of specialized teams and dedicated pediatric ICU capacity.

In acute vascular care, stroke thrombolysis and mechanical thrombectomy are not consistently available, and post-procedure follow-up remains difficult to maintain. Advanced imaging is also limited, including cardiac MRI, MR angiography and contrast-enhanced CT, which restricts diagnosis, procedural planning and follow-up.

2.2.3.4 Quality of care and regulatory framework

Quality of care is affected by the gap between what clinicians know and what the system can deliver. Abdin et al. (2022) found high awareness of guideline-recommended cardiovascular care among physicians practising cardiology in Syria, but major gaps in delivery: more than 75% believed that over half of heart failure patients did not receive optimal medical therapy, and 90% believed that fewer than 10% of eligible patients received implantable cardioverter-defibrillator or cardiac resynchronisation therapy. These findings suggest a wider pattern of undertreatment, delayed referral, limited device access, incomplete follow-up and conservative management when advanced options are unavailable.

Regulation and oversight are part of the same quality problem. The Ministry of Health capacity to standardize prices, monitor outcomes, ensure infection control, or supervise junior practice, remains limited. It was not uncommon for patients to move between facilities without a clear referral pathway, or to reach emergency care after the treatment window for acute coronary syndrome or stroke has passed, or receive less than optimal treatment because the required device, medicine, specialist or follow-up system is unavailable.

3. Branching

Program growth and geographic expansion

The cardiology program began in 2013 with some surgical capacity near the northern borders, with some support for makeshift hospitals on the Turkish side in Reyhanlı. It then moved gradually inside Syria by supporting cardiology services in different secondary care facilities. A major milestone came in 2018 with the establishment of cardiology, cardiac surgery and ICU care at Bab Al-Hawa Hospital, creating a wider range of advanced cardiac services inside Syria.

Expansion later reached Al-Shifaa hospital in Afrin, where SAMS opened a catheterization laboratory for diagnostic and therapeutic procedures, the first such service in the region after more than a decade. At Al-Bab National Hospital, SAMS also established a second catheterization laboratory and supported cardiology consultations, keeping Al-Bab as a smaller but important operational center.

The next major milestone was the establishment of SAMS Heart Hospital in Idlib in 2024. The site had previously served as a specialized COVID-19 center and had strong ICU infrastructure, which was repurposed into cardiac ICU capacity. It was then supported with a modern biplane angiography system for catheterization procedures, catheterization laboratory capacity, diagnostics, laboratory services, advanced surgical equipment, extracorporeal membrane oxygenation (ECMO) capacity for temporary heart and lung support, and heart-lung machine/cardiopulmonary bypass support for open-heart surgery. Regular SAMS cardiology missions provided clinical care, knowledge transfer and oversight.

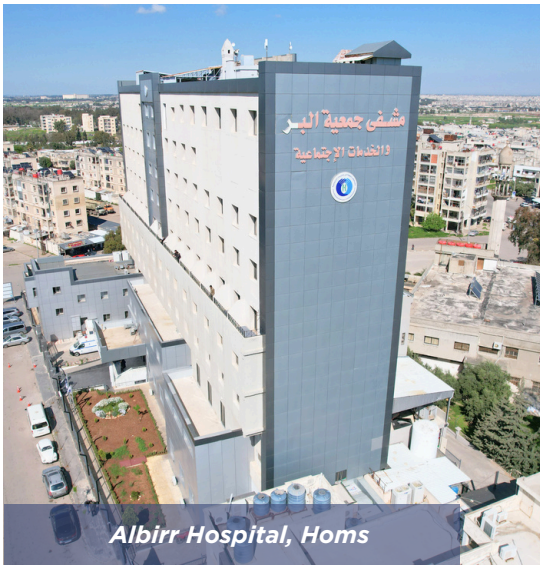
Expansion accelerated after the fall of the Assad regime on 8 December 2024. The end of the period in which hospitals had to operate under bombardment, siege and emergency conditions made it more feasible to work across wider areas of the country, reach public institutions and support services beyond the northwest. In 2025, SAMS began rapidly supporting key cardiology hospitals in Damascus with equipment and supplies. Homs entered the program in July 2025, adding surgical and catheterization activity in collaboration with Al-Birr Charity. Aleppo University Hospital received support in September 2025 for cardiology and neurology services related to stroke management. In Aleppo, SAMS also supported Omar Bin Abdulaziz Hospital, where catheterization, cardiac surgery and related services were activated in January 2026, including support for percutaneous coronary intervention and service continuity. Daraa followed in February 2026, while Deir ez-Zor cardiology center opened its doors on August 11, 2026.

This expansion shows a clear transition in the program's role. It began as a response to a referral crisis and grew into a broader platform for rebuilding advanced cardiac care inside Syria. The program now combines service delivery, large medical missions, training, simulation-based learning, support to cardiology trainees, development of electrophysiology and cardiac rhythm services, and gradual strengthening of hospital-based specialist capacity

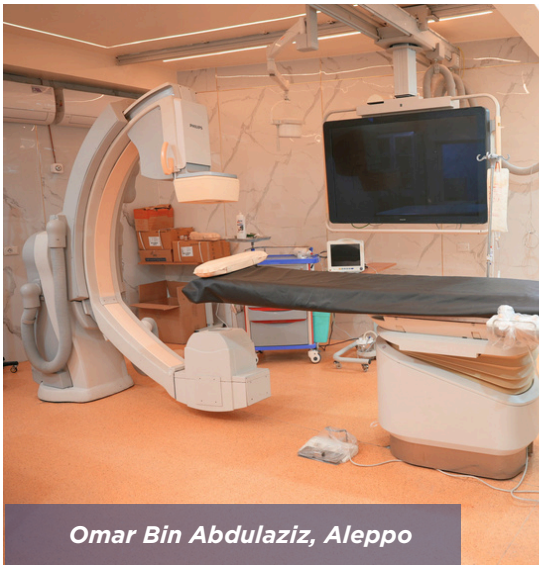




Al-Madina Hospital, Deir ez-Zor



Albirr Hospital, Homs



Omar Bin Abdulaziz, Aleppo



SAMS Heart Hospital, Idlib



Cath Center, Deir ez-Zor National Hospital

4. The Cardiology Ecosystem

The structure of the SAMS cardiac program

4.1 The Front Line

Cardiology consultations & clinics

Outpatient cardiology consultations are the main entry point into the program. They are used for triage, diagnosis, follow-up and referral into more advanced services. At SAMS Heart Hospital in Idlib, the clinic structure includes several focused pathways:

- General cardiology clinic: first-line assessment, triage and follow-up
- Electrophysiology (EP) clinic: rhythm disorders, device-related assessment and follow-up
- Pediatric cardiology clinic: assessment of children with congenital and acquired cardiac disease
- Coronary artery disease clinic: ischemic heart disease, angina and post-PCI follow-up
- Cardiomyopathy and hypertrophic cardiomyopathy clinic: assessment and follow-up of complex myocardial disease
- Valve clinic: assessment of valvular heart disease and referral planning
- Surgical clinic: review of patients referred for cardiac surgery

This clinic structure helps patients move toward the right next step, whether that is medical treatment, further imaging, catheterization, device care, surgery or continued follow-up.

Diagnosis-coded data from SAMS Heart Hospital help show the clinical profile seen through the cardiology service. These figures should be interpreted as recorded diagnosis entries, not as total consultation volume. They nevertheless show the dominance of ischemic heart disease, followed by heart failure, hypertensive heart disease, rhythm disorders and congenital heart conditions.



Diagnosis category	Recorded diagnosis entries
Chronic ischemic heart disease	795
Heart failure	121
Hypertensive heart disease	98
Other congenital malformations of heart	60
Abnormalities of heartbeat	50
Paroxysmal tachycardia	48
Other cardiac arrhythmias	42
STEMI / NSTEMI myocardial infarction	29
Cardiac arrest	21
Cardiomyopathy	15
Other recorded diagnoses	45
Total recorded diagnosis entries	**1,324**

Table 1. Main recorded cardiology diagnoses at SAMS Heart Hospital, 2024–2025

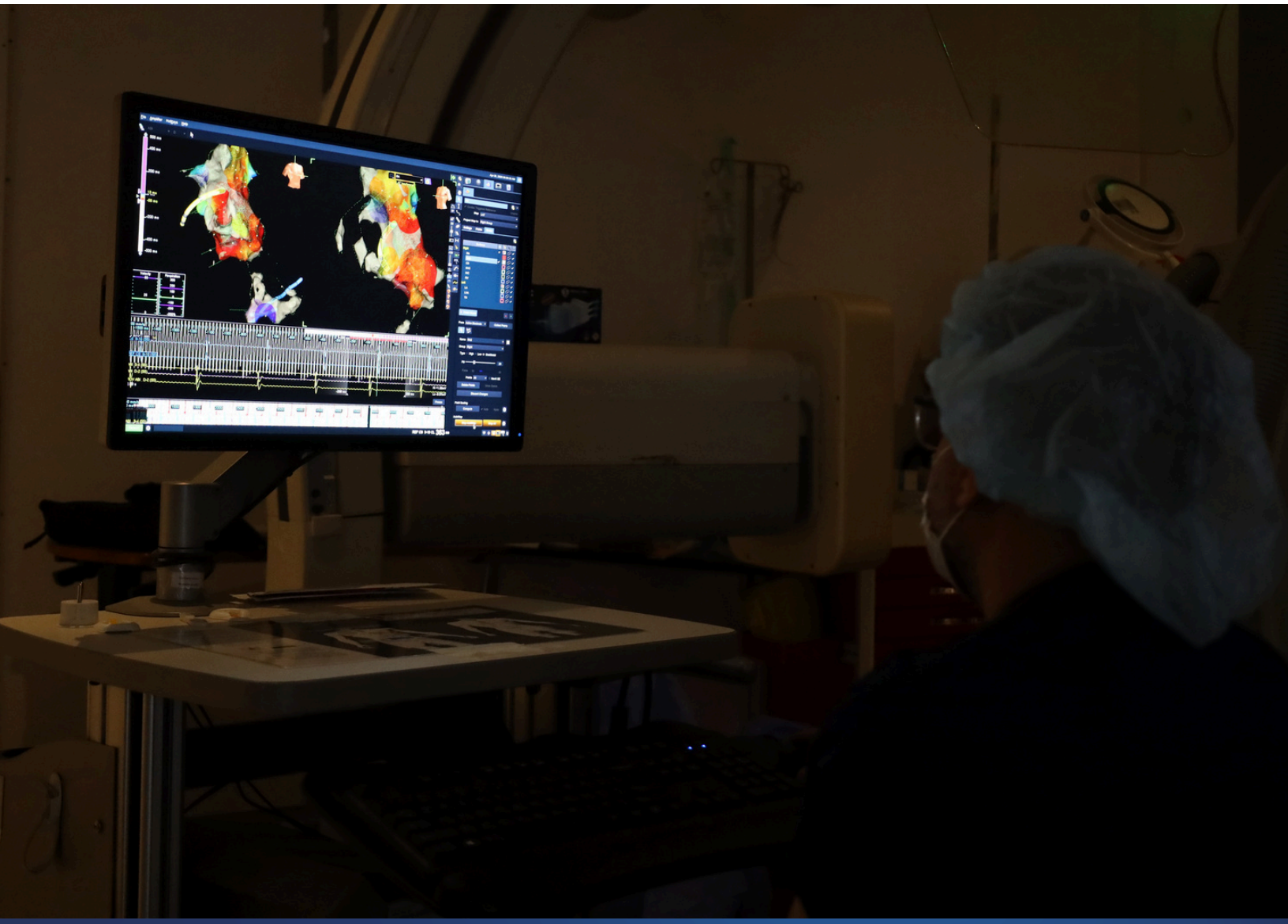
4.2 Pediatric Cardiology and Congenital Heart Care

Pediatric cardiology is an important component of SAMS's cardiac programme because specialist services for children remain scarce in Syria. Shortages of pediatric cardiac specialists, prolonged waiting times and limited critical care capacity restrict access to treatment, particularly for children with complex congenital heart disease.

SAMS's services begin with a specialized pediatric cardiology clinic at SAMS Heart Hospital in Idlib, assessing children with congenital and acquired heart disease. Clinical examination, cardiac imaging and specialist review guide medical treatment, follow-up and referral for catheter-based intervention or surgery. Coordination between cardiologists, surgeons, anesthesiologists and intensive care teams supports treatment planning according to each child's condition and the available resources.

Collaboration between visiting specialists and local teams has enabled treatment of complex congenital conditions. During one mission at SAMS Heart Hospital, 27 children received treatment, including a child with aortic narrowing, patent ductus arteriosus and a ventricular septal defect managed through catheterization. During SAMS's November 2025 Gratitude Mission, teams performed pediatric cardiac catheterizations in Aleppo and Al-Qalamoun and congenital repairs, including Tetralogy of Fallot correction and atrial and ventricular septal defect closure.

These services still require substantial support to expand safely and operate consistently. Priorities include dedicated pediatric intensive care capacity, specialized anesthesia and surgical expertise, trained nursing and perfusion teams, and reliable supplies of appropriately sized devices and consumables. Continued supervised training and specialist collaboration are essential to strengthen local capacity, extend the range of treatable conditions and maintain care between missions.



4.3 Shared Decisions

Online case-study workshops

The program currently runs three regular online case-study workshops, each focused on a different group of complex cardiac patients. These sessions are held every other week and bring together clinicians from different specialties, including interventional cardiology, electrophysiology, cardiac surgery, imaging and intensive care.



The first workshop focuses on valvular heart disease, where cases are reviewed to assess severity, surgical risk, timing of intervention and whether the patient is better suited for surgical or catheter-based management.

The second focuses on ischemic heart disease, where fellows prepare cases for discussion around medical therapy, PCI, coronary anatomy, surgical referral and bypass decisions.
The third focuses on cardiomyopathy and hypertrophic cardiomyopathy, where cases require discussion across imaging, rhythm assessment, heart failure management, device indications, family risk and follow-up.

These workshops support both patient care and training. They allow complex cases to be reviewed before major decisions are made, while giving interns, fellows and junior doctors exposure to multidisciplinary reasoning that is still not routine in many Syrian training settings.

"We want fellows to learn that complex cardiac decisions are made as a team, not by individual specialties working in silos."

— Interview with **Dr. Hazem Al-Waer,**
senior cardiothoracic surgeon



4.4 Seeing the Heart
Diagnostics

Diagnostics form the next layer of the program. Key available services include:

- Catheter-based diagnostic assessment
- Transthoracic and transoesophageal echocardiography
- CT coronary angiography
- Electrophysiology assessment and testing
- Electrocardiography and rhythm monitoring, where available
- Cardiac laboratory testing, including cardiac enzymes, coagulation profile, renal function, electrolytes, lipid profile and other pre-procedure or follow-up tests

These services help clinicians understand the type and severity of disease before choosing treatment. They support decisions on whether a patient should continue medical therapy, undergo PCI, receive device therapy, undergo electrophysiology treatment, or be referred for surgery. In this way, diagnostics connect the clinic to the right next step in care.

SAMS is also preparing to build this diagnostic layer into training, including a planned fellowship track in cardiology and imaging/angiography-related practice. This would help develop physicians who can interpret cardiac investigations, participate in procedural planning, and support more consistent decision-making across the program.

4.5 Holding the Line
Cardiac critical care

SAMS established cardiac critical care capacity as part of the cardiac program. This includes monitored beds, trained nursing support, respiratory support, medication management, post-operative monitoring and rapid response to complications. The program also builds on SAMS' long experience with tele-ICU support in Syria since 2015, using low-cost video communication and online platforms to connect Syrian ICUs with Arabic-speaking intensivists abroad (Moughrabieh and Weinert, 2016). This approach is also supported by wider evidence from conflict-affected countries in the Eastern Mediterranean region, where telemedicine has been used as a feasible way to extend specialist expertise when local access to care is constrained (Parkes et al., 2022).

This capacity helps address the limited and expensive availability of cardiac ICU care in Syria. Few hospitals in Syria were able to provide reliable post-operative cardiac ICU monitoring, infection control, trained nursing care and rapid response to complications. Private ICU care may reach around USD 250 per night before medicines, laboratory tests and physician fees are added. SAMS critical care therefore helps reduce financial pressure on patients, supports safer recovery after procedures, and lowers the risk that patients are discharged earlier than clinically appropriate because of cost.

PATIENT STORY

A heart reclaimed by hope

For 13 years, Ahmad lived with a dangerous rhythm disorder caused by an accessory electrical pathway in his heart. At any time, his heart could lose its normal rhythm, forcing repeated emergency care and electrical shocks to bring him back from life-threatening episodes.

At 36, the condition had become part of his daily fear. He watched his children play but avoided running with them, afraid that physical effort might trigger another dangerous episode.

During a SAMS electrophysiology mission, the local team worked with **Dr. Waddah Maskoun** and **Dr. Mohamad Al-Homsi**, cardiac electrophysiologists from the United States. After reviewing the case, the team decided to perform catheter ablation.

The pathway was located on the left side of the heart, making the procedure technically demanding. The team reached the pathway and successfully ablated it, restoring a stable rhythm and removing the source of repeated danger.

"Today, when my child asks me to run with him, I will not apologize with a heavy heart. I will run with him without fear."
— Ahmad

Ahmad's story shows how electrophysiology can mean freedom from repeated emergencies, fear and the constant threat of sudden collapse. For Ahmad, it meant returning to his children as a father who could share their future with confidence.



Leading electrophysiology care at SAMS Heart Hospital

Dr. Ola Tamer, an electrophysiology specialist, now leads the electrophysiology clinic at SAMS Heart Hospital. Her work has been central to building practical rhythm-care capacity inside the program, particularly for patients with pacemakers and other implanted cardiac devices.

The clinic manages different pacemaker brands used across Syria, including device interrogation, programming, calibration and follow-up. This is crucial for patients who previously had limited access to regular device checks after implantation. The clinic now sees at least 30 patients per day, many of whom travel from different areas to receive rhythm assessment, pacemaker follow-up and treatment planning.

4.6 Restoring Rhythm

Electrophysiology and cardiac rhythm management

Electrophysiology is the part of cardiology that studies the heart's electrical system. It is used to diagnose and treat rhythm disorders, including atrial fibrillation, supraventricular tachycardia, conduction disease, recurrent palpitations, syncope, bradycardia and device-related problems. In Syria, this level of cardiac rhythm care was largely unavailable or very limited for many years.

SAMS developed its electrophysiology and cardiac rhythm management work with the support of prominent Syrian American electrophysiologists, including **Dr. Waddah Maskoun**, a cardiac electrophysiologist at Henry Ford Health in Michigan, and **Dr. Mohamad Al-Homsi**, a cardiac electrophysiologist at IU Health in Indiana and Assistant Professor of Medicine Practice at Indiana University School of Medicine.

The program grew from efforts that began in 2018, initially responding to the need for pacemaker follow-up. Pacemakers are not one-time procedures. Patients need regular device checks, often every six months or according to clinical need, to assess battery status, lead function, pacing thresholds, sensing, rhythm events and device settings.

Before this capacity was available, many patients had implanted devices but limited access to proper follow-up. SAMS gradually identified the different pacemaker brands used locally and secured the necessary programrs and technical equipment for the main device types. This made device interrogation, programming, calibration and follow-up available inside the program.

The service then expanded into full rhythm assessment. Patients are evaluated through the electrophysiology clinic, rhythm monitoring, device interrogation and full electrophysiology studies. These studies help identify the mechanism and origin of arrhythmias and guide treatment decisions.

Once the rhythm problem is defined through electrophysiology assessment, rhythm monitoring, device interrogation or a full electrophysiology study, the treatment plan becomes more precise. The team can distinguish between atrial fibrillation, supraventricular tachycardia, conduction disease or another rhythm disorder, and choose the appropriate pathway. Some patients can be managed with medication, including blood thinners or anticoagulants, alongside monitoring and follow-up. Others may need pacemaker adjustment, device replacement or new device implantation.

In selected cases, the electrophysiology study shows that the abnormal rhythm comes from a specific electrical focus or pathway. These patients may need catheter ablation, an electrophysiology procedure in which a catheter is guided to the heart and the abnormal tissue is treated using energy, usually heat and sometimes freezing. This type of rhythm treatment was previously unavailable or extremely limited in Syria, and SAMS has now started providing it within the electrophysiology program.

Case-study discussions are central to this work. Rhythm cases often require input from electrophysiology, imaging, interventional cardiology, heart failure care and sometimes surgery. These discussions help clarify diagnosis and treatment plans, especially for patients with atrial fibrillation, recurrent tachycardia, syncope, conduction disease, cardiomyopathy or device-related symptoms.

The electrophysiology clinic is now one of the most active subspecialty clinics in the program. According to the program team, it is the only dedicated clinic of its kind in Syria. The next step is to strengthen the fellowship pathway with a clearer curriculum, structured supervision, procedure logs and regular case review, while preparing to introduce three-dimensional mapping for more advanced ablation work.



4.7 Through the Arteries

Cath lab services and catheter-based care

The cath lab is one of the main treatment platforms in SAMS's cardiac program. It allows doctors to diagnose and treat heart and vascular disease through catheter-based procedures, often without the need for open surgery. Patients usually reach the cath lab through the cardiology clinic, emergency department, stroke pathway, or case-review discussions for complex interventions.

The platform serves several functions. It provides diagnostic coronary angiography for patients with suspected blocked arteries, percutaneous coronary intervention (PCI) with balloon widening and stent placement, temporary and permanent pacemaker implantation, selected structural heart procedures, peripheral vascular interventions, and neuro-interventions when stroke patients need catheter-based treatment.

SAMS's cath lab work has also become a pathway for advanced procedures that were previously very limited in many parts of Syria. This includes structural heart interventions, TAVI/TAVR, ablation, and device-based care.

Complex cases are prepared through imaging, laboratory testing, clinical review and multidisciplinary discussion before intervention. The interventional cardiology programme brings together visiting specialists and local physicians, including **Dr Hassan Al-Khawam, Dr Tarek Kabbany, Dr Ibrahim Kassas** and local cardiologist **Dr Ahmed Al-Omar**. Working alongside the wider catheterization laboratory, imaging, anesthesia, nursing and technical teams, they have contributed to complex case review, advanced interventions, knowledge exchange and the continued development of local capacity."

"Advanced cardiac care is never the work of one physician or one specialty. It emerges when cardiologists, surgeons, cardiac imagers, anesthesiologists, nurses, technicians and local clinical teams share their expertise and responsibility for the patient. The deeper purpose of these missions is to turn collaboration and knowledge exchange into lasting local capacity."

Dr. Ibrahim Kassas, MD,
Chair of the SAMS Cardiovascular Assembly



A Historic First for Syria

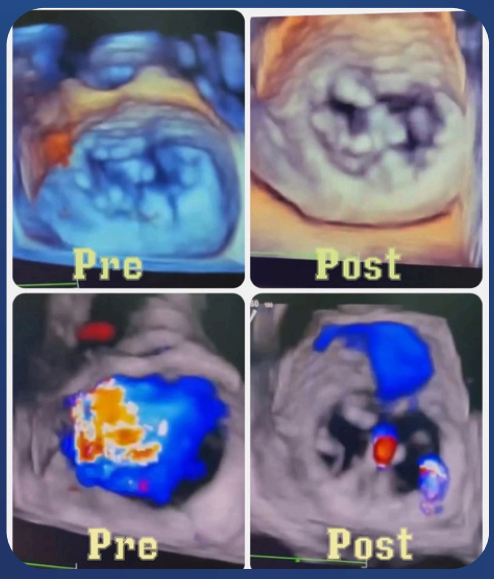
The country's first transcatheter mitral valve repair

On 23 April 2026, the multidisciplinary heart valve team at SAMS Heart Hospital in Idlib successfully performed Syria's first percutaneous transcatheter mitral valve repair using MitraClip. This landmark achievement marked the establishment of the country's first dedicated percutaneous mitral valve programme.

MitraClip offers a minimally invasive treatment option for selected patients with severe mitral regurgitation who may face a high risk from conventional open-heart surgery. Using a catheter-based approach, the team places a small clip on the mitral valve to improve closure and reduce the backward leakage of blood.

This complex, carefully planned procedure required detailed imaging, careful patient selection and close collaboration among a multidisciplinary structural heart team—including cardiac surgery, interventional cardiology, cardiac imaging and heart failure specialists, supported by anesthesia, nursing and technical teams. It reflects the team's commitment to bringing advanced, minimally invasive cardiac care to Syrian patients.

Beyond treating one patient, the procedure represented an important step in developing advanced structural-heart care inside Syria. It also demonstrated how visiting specialists and local physicians can combine expertise, transfer practical knowledge and establish local capacity for future procedures.





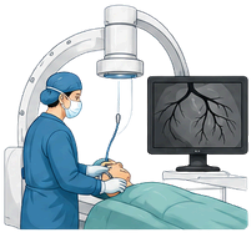
"SAMS gave me the platform to turn my skills into meaningful service. True happiness lies in serving others."

Dr. Hassan AlKhawam



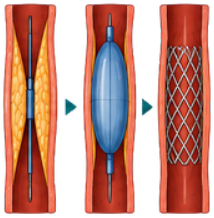
4.7.1 Selected key procedures

4.7.1.1 Diagnostic coronary angiography



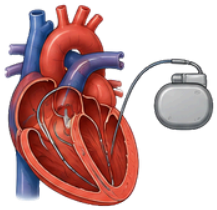
The most common cath lab procedure is diagnostic coronary angiography. This is used to see the arteries that supply the heart. A catheter is guided to the heart and contrast dye is injected so the arteries can be seen on imaging. The result helps the team decide whether the patient needs medicine, balloon widening, a stent, surgery or follow-up.

4.7.1.2 Balloon widening and stent placement



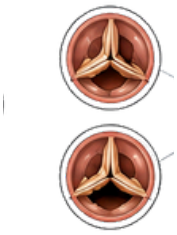
When an artery is narrowed or blocked, the team may open it from inside using a small balloon. A stent, or small metal support, may then be placed to keep the artery open. This is known as percutaneous coronary intervention, or PCI. It is used for selected coronary disease cases and urgent heart attacks, where restoring blood flow quickly can protect the heart muscle. In Idlib, SAMS-supported services recorded 541 PCI procedures and 453 stents in 2025.

4.7.1.3 Pacemaker placement



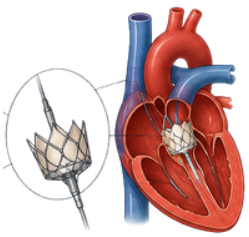
The cath lab also provides temporary and permanent pacemaker procedures. These are used when the heart rhythm is too slow or when the heart's electrical system is not working properly. The procedure requires careful placement of wires inside the heart, device testing and later follow-up. In Idlib, SAMS-supported services recorded 102 permanent pacemakers and 23 temporary pacemakers in 2025.

4.7.1.4 Valve procedures



Another advanced part of cath lab work is valve treatment. Some patients with severe valve disease can be treated through catheter-based procedures instead of open-heart surgery, depending on their condition, anatomy and available devices. These include selected procedures for aortic and mitral valve disease, such as valve replacement, valve repair or valve widening when clinically suitable.

4.7.1.5 Transcatheter Aortic Valve Implantation (TAVI/TAVR)



Transcatheter aortic valve implantation or replacement, known as TAVI or TAVR, is one of the most advanced procedures performed through the cath lab platform. In this procedure, a new aortic valve is delivered through a catheter and placed inside the diseased valve. It is used for selected patients who may face high risk with traditional open-heart surgery.

The procedure is delicate because the team is treating a moving structure inside the heart. The valve must be measured, selected, positioned and released accurately, while the team remains ready to manage bleeding, rhythm changes, pressure changes or the need for urgent support. For this reason, TAVI/TAVR cases are planned carefully and are usually grouped during specialized missions, with senior SAMS specialists working alongside local staff.

A TAVI/TAVR procedure may cost around USD 36,000 in Syria if available privately. SAMS's model reduces this barrier by combining volunteer specialist expertise with cost-sharing for patients who can contribute, while keeping care fully free for vulnerable patients.

By 2025, the cath lab pillar had become one of the highest-volume parts of SAMS's cardiac program. Rather than repeating the site figures in the text, the tables below show the scale and distribution of activity across SAMS-supported centers. The data highlight Idlib/SAMS Heart Hospital as the broadest procedural hub, including structural heart interventions, ablation, neuro-interventions and pacemaker work, while Al-Bab and Al-Shifa/Afrin extended diagnostic and coronary intervention services closer to patients. Together, these sites show how the cath lab pillar is developing from a single-center service into a regional platform for advanced cardiac and vascular care.



center	Total procedures	Diagnostic cath	Therapeutic coronary interventions	Peripheral interventions	Neuro-interventions	Structural interventions	Ablation	Permanent pacemakers	Temporary pacemakers
SAMS Heart Hospital / Al-Ziraa, Idlib	1,102	346	263	41	178	109	40	102	23
Al-Bab Hospital	594	250	343	0	0	0	0	0	1
Ash-Shifa / Afrin	308	194	90	6	0	0	0	18	0
Total	**2,004**	**790**	**696**	**47**	**178**	**109**	**40**	**120**	**24**

Table 2. SAMS-supported cath lab procedures by center, 2025



The urgency profile also differed between sites. Al-Bab recorded more emergency than elective procedures, reflecting its role in urgent coronary care. Idlib handled the largest overall volume and the most diverse case mix, including structural procedures, ablation, neuro-interventions and pacemakers. Ash-Shifa/Afrin provided an important regional service with a mainly elective and diagnostic profile.

center	Emergency procedures	Elective procedures	Total
SAMS Heart Hospital / Al-Ziraa, Idlib	279	823	1,102
Al-Bab Hospital	397	197	594
Ash-Shifa / Afrin	88	220	308
Total	**764**	**1,240**	**2,004**

Table 3. Emergency and elective cath lab procedures by center, 2025



PATIENT STORY

One heartbeat at a time





At 76 years old, Nashat Deeb Allah arrived at the National Hospital in Dara'a in critical condition, suffering from a complete heart blockage.

He was diagnosed with a life-threatening condition requiring a dual-lead pacemaker. The weight of the diagnosis was heavy, not only on his heart, but on the hearts of his family.
But fate had other plans. SAMS had recently equipped the hospital's catheterization unit. At the same time, a team of specialized cardiologists from the United States was visiting as part of a SAMS medical mission.

With their expertise and the advanced equipment made possible through SAMS support, the team stepped in. Not just to treat, but to offer hope.

Nashat's son, who had learned about the mission, advocated for his father. The team reviewed his case and approved him for a life-changing procedure: a coronary angioplasty with stent placement. This was the first of its kind at the National Hospital in Dara'a.

The surgery was a success. His eyes were full of happiness and gratitude. His son wore a shy smile that grew wider when the doctors shared the good news.

Today, Nashat's health is excellent, and his heart beats steadily. He returned stable, grateful, and smiling for a follow-up visit.

"I never thought I would see this day. Thanks to SAMS, I was given a second chance."

Through the generosity of supporters and the dedication of SAMS physicians, lives like Nashat's are not just saved, they are restored.

4.8 Open Hearts

Cardiothoracic surgery

Cardiothoracic surgery is the surgical arm of SAMS's cardiac program. It serves patients whose conditions cannot be managed through medicine or catheter-based treatment alone, including patients who need bypass surgery, valve repair or replacement, congenital heart defect repair, or other open-heart procedures.

SAMS built this service to reduce reliance on referral abroad and private-sector care. Before local capacity expanded, approximately 100–125 adult and pediatric cardiac surgery cases were being referred to Turkey each month through the Bab al-Hawa pathway. The establishment of surgical capacity inside Syria was therefore not only a technical expansion, but a response to a clear access gap for patients who had few realistic treatment options locally.

The service depends on a full pathway rather than the surgeon alone. Patients are usually identified through cardiology clinics, echocardiography, catheterization findings or case review. Surgical candidates are then discussed, prepared and prioritized. This includes assessing the diagnosis, operative risk, blood tests, imaging, required valves or grafts, anesthesia readiness, ICU capacity and post-operative follow-up.

SAMS's surgical model combines local teams with visiting specialists. Missions help manage complex cases, but they also support training and skills transfer. Surgeons, anesthesiologists, perfusionists, ICU teams, nurses, sterilization teams and technicians all form part of the service. The aim is to make cardiac surgery safer and more sustainable inside the supported hospitals, rather than leaving it dependent only on intermittent missions.

"The SAMS Cardiac Surgery Center in Idlib stands as a powerfultestament to the greatness of our people—their determination,resilience and ability to achieve what once seemed impossible.

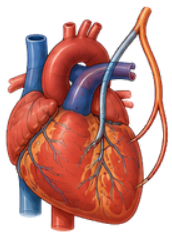
What began five years ago as an idea—a vision to establish a leading educational center capable of providing comprehensive care for the full spectrum of cardiovascular diseases—has today become a reality. It is a testament to the extraordinary determination, dedication and perseverance of our volunteers, physicians and the entire SAMS team."

Dr Bakri Kaakeh
Cardiothoracic Surgeon



4.8.1 Selected key procedures

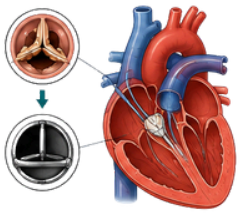
4.8.1.1 Coronary artery bypass grafting



Coronary artery bypass grafting, or CABG, is used for selected patients with severe coronary artery disease, especially when several arteries are blocked or when catheter-based treatment is not the best option. In this operation, the surgeon creates a new route for blood to reach the heart muscle by bypassing blocked arteries.

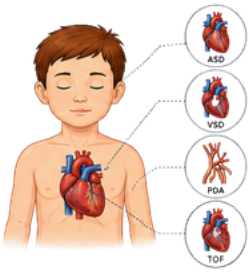
This is one of the core open-heart procedures in the program. It requires an operating room prepared for cardiac surgery, anesthesia, perfusion support, cardiac ICU care, blood products, surgical instruments and close monitoring after the operation.

4.8.1.2 Valve replacement and repair



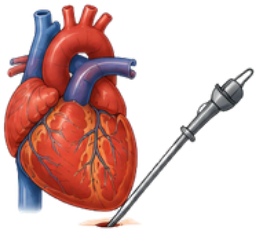
Some patients have severe valve disease that cannot be treated with medication or catheter-based procedures. These patients may need surgical valve replacement or repair, including aortic valve replacement, mitral valve replacement or mitral valve repair.
Valve surgery is delicate because the surgeon is working on structures that control blood flow inside the heart. The aim is to restore valve function while protecting heart performance and reducing the risk of complications after surgery. In selected cases, repair is preferred when it can preserve the patient's own valve safely.

4.8.1.3 Congenital heart surgery



The program also includes selected congenital heart procedures, such as atrial septal defect repair, ventricular septal defect repair, patent ductus arteriosus closure and Tetralogy of Fallot repair. These procedures are especially important for children who may otherwise wait for long periods or need referral outside the country.
Pediatric cardiac surgery is more constrained than adult surgery because it requires specialized surgical experience, pediatric anesthesia, smaller equipment, dedicated post-operative monitoring and pediatric ICU capacity. This remains one of the areas where further strengthening is needed.

4.8.1.4 Minimally invasive cardiac surgery



SAMS-supported work has also introduced and advanced minimally invasive cardiac surgery in selected cases. These procedures aim to reduce the size of the surgical opening and support faster recovery when clinically appropriate. They are technically demanding and require careful case selection, experienced surgeons, appropriate instruments and strong anesthesia and ICU support.

4.8.2 Surgical sites and activity

By 2025, SAMS-supported cardiac surgery was active in several locations. Idlib became the main surgical hub through Al-Ziraa Hospital, later transitioned into SAMS Heart Hospital. The center now includes two fully operational cardiac surgery rooms, a dedicated cardiac surgery ward and intensive care departments.

In Idlib, the surgical team performed 114 cardiac operations in 2025, with five recorded fatalities. Activity increased over the year, with the highest monthly volume recorded in July. The case mix was led by CABG, followed by mitral valve surgery, congenital procedures and selected aortic valve procedures.

Indicator	Figure
CABG share of operations	44%
Mitral valve surgery	13%
ASD repair	8%
Aortic valve surgery	7%
Tetralogy of Fallot repair	7%
VSD repair	5%
Aortic valve + CABG	4%
Aortic valve + mitral valve	1%
Other procedures	11%

Table 4. SAMS-supported cardiac surgery case mix in Idlib Heart hospital, 2025

Al-Bab remained an important surgical site. In 2025, the center performed 37 cardiac operations, with three recorded fatalities. The reported operation mix was led by CABG, alongside selected mitral valve, ASD and PDA procedures.

Homs entered the surgical program through Al-Birr Hospital after technical upgrades, including oxygenator and tubing-set improvements. Surgical activity began with five cardiac surgeries in December 2025, before expanding further in 2026.

center	Cardiac surgeries
Al-Bab Hospital	57
Al-Ziraa / SAMS Heart Hospital	226
Al-Birr Hospital	66
Al-Razi Hospital / Al-Dana	62
Total	**411**

Table 5. SAMS-supported cardiac surgery activity by center, 2022–April 2026

The surgical data show that SAMS Heart Hospital has become the main surgical hub, while Al-Bab, Al-Birr and Al-Razi/Al-Dana contributed to a broader surgical footprint. Together, these sites recorded 411 cardiac surgeries between 2022 and April 2026, showing how SAMS-supported cardiac surgery moved from site-specific activity toward a multi-center model.



PATIENT STORY

Rebuilding Hearts, Restoring Hope

After years of war and destruction, Syria is not just rebuilding its cities—it is rebuilding lives. But as communities rise from the rubble, another crisis is silently growing: heart disease is now one of Syria's leading causes of death.

For Ali, a 55-year-old displaced man, this reality nearly cost him his life. When he felt crushing chest pain, he sought help at a private hospital, only to be met with a devastating truth, he couldn't afford the treatment that could save him. With no options left, he asked to be sent home to face his fate.

But hope was waiting.

Ali was transferred to Al-Zaraa Hospital in Idlib, supported by SAMS, where doctors diagnosed him with a severe heart attack and life-threatening ventricular tachycardia. **Dr. Ahmed Ghazal** and his team acted immediately, performing an urgent catheterization and placing two stents to open his blocked artery. After 42 hours in the ICU, Ali was stable and alive.

"Words are not enough to express my thanks to the hospital staff who saved me, without any charge," he says.

At SAMS, we refuse to let medical care be a privilege. Our cardiology program is a beacon of hope, delivering critical screenings, life-saving interventions, and advanced cardiac surgeries.





4.9 Time Is Brain

Stroke intervention and stroke units

Stroke care has developed into a distinct part of SAMS's advanced-care programme, built around one central principle: every minute between the onset of an ischemic stroke and treatment can affect how much brain function can be preserved. International guidance therefore emphasizes early recognition, rapid brain imaging, structured assessment such as the National Institutes of Health Stroke Scale (NIHSS), and treatment without delay for eligible patients (Powers et al., 2019).

The programme is led by **Dr. Maher Saqqur**, a Syrian stroke neurologist and Senior Consultant Stroke Neurologist at Hamad General Hospital in Qatar. His role extends beyond clinical guidance to developing the programme itself: helping identify and secure the equipment and devices required for stroke centres, supporting resource mobilization and funding, and working with teams inside Syria to establish the systems needed for acute stroke care.

At hospital level, the programme focuses on making this pathway work around the clock. A functioning stroke unit needs trained emergency and nursing teams, CT imaging, clear protocols, rapid clinical decision-making and referral links. The diagnostic pathway begins with non-contrast CT to exclude intracranial bleeding, followed when indicated by CT angiography to identify large-vessel occlusion and determine whether the patient may benefit from endovascular treatment.

In Idlib, **Dr. Ahmad Mutlak** serves as the programme's technical supervisor, supporting the clinical pathway and local team, while **Dr. Ibrahim Al-Assaad** is also part of the Idlib team and performs stroke interventions. Their work represents an important part of the programme's longer-term direction: developing local teams capable of providing advanced stroke treatment continuously, alongside the expertise brought through visiting missions.

Two acute treatment pathways are available for eligible patients with ischemic stroke. The first is intravenous thrombolysis, using clot-dissolving medicines such as alteplase (tPA) or tenecteplase (TNK) within appropriate treatment criteria and time windows. The second is mechanical thrombectomy for selected patients with large-vessel occlusion, in which the obstructing clot is removed through an endovascular procedure. Evidence from major thrombectomy trials has shown substantial improvement in functional outcomes among appropriately selected patients, including those treated within extended time windows based on advanced imaging and clinical criteria (Weinstein et al., 2018).

Visiting specialists have helped introduce and strengthen these advanced interventions. Among them is **Dr. Sami Al Kasab**, an Associate Professor of Neuroendovascular Surgery at the Medical University of South Carolina and Associate Medical Director of its Teleneuroscience Program. His clinical and academic work focuses on acute ischemic stroke, mechanical thrombectomy and systems that shorten the time between stroke presentation and treatment. His participation connects missions in Syria with experience from established comprehensive stroke systems in the United States.

Programme data show how this work has moved from a small beginning in Idlib toward a wider national footprint. Idlib recorded 6 cases in late 2023 and 111 cases in 2024. Between January 2025 and March 2026, the programme recorded 570 cases across supported sites, with activity expanding to Damascus, Aleppo, Hama, Tartous, Latakia and Homs. Across the full available period from November 2023 to March 2026, **687 stroke cases were recorded**.

center / site	2024	2025	Jan–Mar 2026	Total recorded cases
Idlib University / SAMS-supported stroke work	111	117	47	281
National Hospital / Damascus University	–	152	29	181
Aleppo University	–	111	14	125
National Hama Hospital	–	23	14	37
National Tartous Hospital	–	–	7	7
Latakia University	–	–	24	24
Homs University	–	–	34	34
Total	**111**	**403**	**167**	**681**

Table 6. SAMS-supported stroke program, November 2024–March 2026

The expansion is intended to create a connected stroke network rather than isolated procedural capacity. Local teams provide the continuous clinical presence, while senior specialists and visiting missions contribute advanced intervention, case review and training. As more centres develop the staff, imaging, medicines, equipment and referral pathways required for acute stroke care, treatment can increasingly be delivered closer to where patients first present.



5. Hands That Learn

Training and knowledge transfer

Training and capacity transfer in SAMS's cardiac program is organized around the practical skills needed to run advanced cardiac services locally. It includes simulation-based surgical training, supervised practice during missions, and repeated exposure for junior surgeons, fellows, anesthesiology teams, perfusionists, cath lab staff, surgical assistants, nurses and sterilization teams.

Simulation-based training has been especially important for cardiac surgery. Dr. Mustafa Al-Sabouni, MENA regional representative for established surgical equipment companies, including GEISTER Medizintechnik, PETERS Surgical Middle East and NEOS Surgery, has supported this training stream through his technical knowledge, equipment networks and familiarity with cardiac-surgery instruments. This has helped structure practical training around suturing, anastomosis, bypass techniques, aortic procedures, minimally invasive access, instrument handling, sterilization and operating-room preparation.

Around 15 surgeons have benefited from simulation-based surgical training, including senior surgeons, junior surgeons and residents. Around 50 health workers also attended training related to sterilization and instrument care in Idlib, Homs and Damascus. Interviewees also noted the need for year-round simulation centers, with an estimated cost of around USD 30,000 for a basic center.

Supervised practice is the second main channel. **Dr. Hazem Al-Waer** and colleagues have supported training in bypass surgery, valve surgery, minimally invasive cardiac surgery and complex aortic cases. Through this model, junior surgeons and SAMS fellows observe, assist and gradually take more active roles under senior supervision. One fellow described performing a minimally invasive cardiac operation for the first time under direct supervision after repeated exposure during missions.

Training in anesthesia and peri-operative care has also been central. **Dr. Yaser Wafai**, a cardiothoracic anesthesiology specialist in the Chicago area and Head of the Anesthesia/Pain Management Subcommittee with PCRF, has brought experience from multiple humanitarian surgical missions. In SAMS's cardiac program, his support has focused on anesthesia for open-heart surgery, minimally invasive surgery and TAVI/TAVR, as well as peri-operative monitoring, cardiac ICU care and the use of tools such as transesophageal echocardiography.

The training model also includes the wider team required for each operation. Cardiac surgery depends on surgical assistants, perfusion technicians, anesthesia technicians, nurses and cath lab technicians in addition to the surgeon and anesthesiologist. These cadres need repeated practical exposure, especially as services expand beyond the main hubs.

Several gaps remain. Training is still periodic, and local teams do not always have continuous exposure to complex cases. Interviewed clinicians noted that stronger referral pathways for selected complex cases would help trainees build experience faster, especially for aortic disease, minimally invasive surgery, pediatric cardiac surgery and advanced valve cases.

The current approach is gradual. Some services still require visiting expertise, especially complex valve surgery, minimally invasive surgery, pediatric cardiac surgery, advanced electrophysiology and selected structural interventions. The objective is to help local teams take increasing responsibility over time, while keeping senior specialist support for the most complex cases. As one senior surgeon described it, visiting specialists should “come like a coach,” not replace the local team.



6. Health Financing Model

"As Syria's public health system gradually recovers, SAMS's role should be to support models that are both specialized and sustainable. In cardiology, this means centers of excellence where patients who can contribute help keep services running, while vulnerable patients continue to receive care free of charge."

— Interview with **Dr. Amjad Al-Ras**,
Head of the SAMS Heart Hospital Board



Advanced cardiology is one of the most expensive service areas to sustain in a recovering health system. This made the cardiac program a practical place for SAMS to test how high-cost specialist care can remain accessible when emergency humanitarian funding alone is no longer enough.

This question sits at the center of SAMS's 2030 Vision for Health. As SAMS moves from emergency response toward early recovery, the proposed model is to develop centers of excellence that combine service delivery, training, referral, quality improvement and sustainable health financing. In cardiology, this means moving beyond one-off subsidized procedures toward a model that can keep advanced services running over time.

The wider financing environment makes this transition necessary. The 2025 Syria Humanitarian Response Priorities requested USD 3.19 billion for January–December 2025, while the World Bank estimates Syria's physical reconstruction costs at USD 216 billion, nearly ten times projected 2024 GDP (OCHA, 2025; World Bank, 2025). The National Health Compact also identifies health financing as a core reform area, including financial protection, reduced out-of-pocket spending, expenditure tracking and more sustainable financing arrangements (Government of Syria, 2025).

Within this context, SAMS has successfully piloted a cost-sharing model through the cardiology program. Patients who can contribute receive interventions at reduced prices and help cover materials and running costs. Vulnerable patients remain eligible for fully free care. Eligibility criteria for free care are set in collaboration with the Ministry of Social Affairs, helping make exemption decisions clearer and more accountable.

At SAMS's Idlib Heart Center, program data indicate that around 70% of patients paid reduced fees, while around 30% received care free of charge. Income generated through the reduced-fee model helped cover the center's operating costs and subsidize free treatment for vulnerable patients. Cost-sharing does not replace humanitarian or development financing, and care for patients who cannot pay still requires external support. Its value is that it helps centers of excellence remain operational between grants and reduces exclusive reliance on external funding, while protecting free access for the most vulnerable.

This model is especially relevant for cardiology because the cost structure is driven by materials as well as staff time. Stents, valves, pacemakers, catheters, oxygenators and ICU supplies must be available before care can be delivered. A center of excellence therefore needs clinical expertise, but also a financing mechanism that keeps supplies, equipment and maintenance predictable.

7. Continuous Education and Capacity Building

> ***"We do not want to come to Syria, operate and leave. Those who return need to bring all the support they can, but keep humble, they should not come as bosses. They should come as coaches."***
>
> — Interview with **Dr. Hazem Al-Waer,** senior cardiothoracic surgeon

SAMS is now focusing on localizing its cardiac program. The main route is structured education: residency-linked training, fellowships, supervision by senior specialists, and gradual transfer of skills to local teams. In countries with established cardiovascular training systems, this process usually takes several years after core medical or surgical training.

Dr. Mohamed Khair, who supervises medical education and residency work at SAMS Heart Hospital, described this transition clearly. Earlier training depended more on remote education and local supervision. The program is now moving toward a more structured learning environment inside a functioning cardiac center, with residents and fellows exposed to outpatient care, diagnostics, cath lab work, cardiac surgery and post-operative care.

This is being linked to national training structures. SAMS is collaborating with the newly restructured Syrian Board of Medical Specialties to define clearer criteria for curricula, supervision and evaluation. The residency and fellowship model is also being strengthened through tools that are standard in specialist education, including logbooks, case documentation, competency milestones, protected teaching time and recognized assessment. These steps would allow SAMS's current learning environment to become part of a durable education system rather than a sequence of separate training opportunities.

Clinical volume supports this model. **Dr. Omar Riya**, a cardiology resident, noted that daily procedures and the presence of experienced visiting specialists create a strong learning environment for residents and fellows. This reflects a broader principle in specialist training: procedure-based fields require repeated supervised practice over time. In the United States, for example, interventional cardiology follows internal medicine residency and cardiology fellowship, and formal training is built around supervised catheter-based experience before independent practice (ACGME, 2024).

SAMS's approach also includes training of trainers (ToT). Dr. Al-Waer emphasized that the value of missions should extend beyond individual operations. His aim is to transfer knowledge in a way that allows training to continue throughout the year, even after visiting teams leave. This means supporting local trainers, peer review, multidisciplinary planning and gradual progression from observation to assisted practice and then to greater local responsibility.

The purpose is gradual localization. As more residents, fellows, technicians, nurses and trainers are developed locally, SAMS-supported centers can depend less on missions for routine advanced care. Visiting experts would still remain essential for complex cases, quality review and continued professional development, but the center of gravity would move steadily toward local teams.



PATIENT STORY

A pulse reborn





Yaman, a six-year-old boy from Kafr Yahmoul in northern Idlib, had lived since infancy with severe congenital heart disease. His family moved between clinics and hospitals in Aleppo and Damascus, but they were repeatedly told that his case was too complex.

Yaman had three cardiac defects: narrowing of the aorta, a patent ductus arteriosus, and a ventricular septal defect. His pale face, blue lips and limited ability to play reflected the burden his heart carried every day.

During a SAMS medical mission at SAMS Heart Hospital in Idlib, **Dr. Basil Narjis** reviewed Yaman's case with the local team. The decision was made to attempt correction through catheterization, avoiding open-heart surgery.

"It was both a medical and a humanitarian challenge. Correcting three defects in one child through catheterization, without opening the chest, is extremely rare."
— Dr. Basil Narjis

The procedure was completed successfully as part of a mission that treated 26 other children. For Yaman's mother, the change was immediate and emotional.

"He suffered from the day he was born. He used to watch other children run and go to school while he stayed still. Today, they gave me back my son."
— Yaman's mother

Yaman's story shows what advanced catheter-based care can mean for children who would otherwise face years of referral, delay or no treatment. For his family, the procedure was the moment their child was finally able to return to childhood.

8. The Next Rhythm

Future priorities and plans

"Idlib Heart center has shown that a center-of-excellence model can work. The next step is to replicate this experience across Syria, with trained teams, reliable supplies, clear referral pathways and a realistic financing model."

— Interview with **Dr. Mohamed Al-Zoubi**, Manager of SAMS Heart Hospital



The next phase of SAMS's cardiac program should focus on consolidation and planned expansion. The program has already shown that advanced cardiac care can be delivered inside Syria. The next question is how to keep these services reliable in the main hubs while extending access to other regions without weakening quality.

The first priority is to stabilize the center-of-excellence model. Idlib/SAMS Heart Hospital has become the main advanced hub, with cardiac surgery, cath lab work, electrophysiology, stroke intervention, ICU development and high-volume outpatient care. This role should be strengthened through predictable supplies, maintained equipment, trained support teams, clear referral criteria and routine quality monitoring.

The second priority is careful geographic expansion. Homs, Aleppo, Daraa and future sites such as Deir ez-Zor can reduce the need for patients to travel long distances for care. However, each new branch needs a minimum package before services expand: trained staff, working equipment, reliable consumables, monitored beds, referral links and a plan for managing complications. Expansion should follow readiness, not only demand.

The third priority is supply chain reliability. Advanced cardiac services depend on materials that must be available at the right time. This includes stents, balloons, catheters, pacemakers, valves, oxygenators, tubing sets, sutures, ACT kits, thrombolytic medicines and ICU materials. Stock shortages, unpredictable delivery dates or even missing sizes can postpone procedures even when the team and equipment are ready.

The fourth priority is stronger critical care and peri-operative support. More complex cardiac surgery, valve interventions, stroke care and cath lab procedures require anesthesia teams, monitored beds, cardiac ICU capacity and trained nurses. Pediatric and surgical ICU capacity are especially important if the program is to move gradually toward more complex pediatric and adult cases.

The fifth priority is high-risk infrastructure. A hybrid cath lab or hybrid operating-room environment would support selected complex procedures where catheter-based treatment may need rapid surgical backup. ECMO and other advanced support tools also require trained teams and patient-specific disposable sets, not only machines.

The sixth priority is sustainable financing. The cost-sharing model piloted in Idlib shows how centers of excellence can protect free care for vulnerable patients while asking those who can contribute to pay reduced prices. This model should be monitored, refined and adapted as services expand to other geographies, so that affordability and service continuity remain part of the same system.

This is the path from mission-supported services toward durable cardiac centers that can serve Syria's early recovery.



9. A Pulse Restored

Conclusion

SAMS's cardiac program shows what becomes possible when specialist expertise, local teams and hospital systems grow together. It has helped bring advanced cardiac care back inside Syria, closer to patients who once had few options beyond referral abroad, private care, or waiting without treatment.

The value of the program is seen in practical moments: a patient receiving a stent in time, a child being assessed for heart surgery, a person with valve disease finding a treatment pathway, a stroke patient reaching urgent care, or a pacemaker patient returning for follow-up. Together, these moments show more than service delivery. They show confidence returning to Syrian hospitals.

The program is still developing, and several needs remain: reliable supplies, stronger training pathways, critical care capacity, sustainable financing and clearer referral systems. These needs should be seen as part of the next stage of growth, not as a limit on what has already been achieved. The foundations are now in place: functioning cardiac hubs, regional expansion, advanced procedures, trained local teams, and a model of collaboration between Syrian and Syrian American specialists.

The next chapter is to protect this progress and help it reach more communities. Syria's cardiac patients need services that are safe, local and trusted. Its doctors and nurses need the tools and training to carry those services forward. And its hospitals need the support to become places where even the most complex heart conditions can be treated with dignity. This is part of restoring the pulse of a health system - one heart at a time.

"All I hope is to have a fully integrated, high-level cardiac center in Syria, comparable to leading regional centers, and able to serve patients from inside Syria and also its neighboring countries."

— Interview with **Dr. Yaser Wafai,** cardiac anesthesiologist



PATIENT STORY

A Heartbeat of Hope: Dalal's Journey Back to Her Children

Mrs. Dalal, 64 years old, left the city of Aleppo amidst the sound of clashes one night last week, carrying her memories and the pain of being separated from her children, whom she hadn't seen in seven years. This was after she experienced severe chest pain that nearly cost her life. She was immediately transferred to Al-Zaraa Hospital in Idlib after being referred from the University Hospital in Aleppo.

It was found that Dalal was suffering from a serious heart attack due to a blockage in one of the main coronary arteries, which required urgent medical intervention to open the blocked artery. However, the shortage of equipment and doctors in Aleppo's hospitals prevented the necessary treatment.

Thanks to the efforts of SAMS, Dalal underwent an emergency procedure using special medical stents, which saved her life. After the successful operation, she was transferred to the intensive care unit to monitor her health condition until she was discharged in good health.

SAMS not only saved Dalal's life but also restored her hope of reuniting with her children, highlighting its humanitarian role in bridging the gap in medical services in the most challenging of circumstances.





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