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Executive Insights

# Optimizing patient length of stay in cardiology

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# Introduction

By 2030, more than 8 million Americans will have some form of heart failure, with the total direct medical costs of $53 billion.

**Source:**
American Heart Association

Heart failure takes a heavy toll not just on the health of populations, it contributes to the burden and cost of national healthcare expenditures. In 2016 cardiovascular diseases cost $555 billion to the US economy and are projected to reach $1.1 trillion by 2035[1].

By 2030, more than 8 million Americans (1 in 33) will have some form of heart failure, with the total direct medical costs projected to increase from $21 billion to $53 billion[2]. Additionally, heart failure is both a leading cause of hospitalization and readmission in the US, with around 25% of patients readmitted within 30 days[3].

With the transition from fee-for-volume to value-based healthcare, the demand for efficient and connected cardiovascular care grows. There are new challenges and opportunities for health providers, which need to keep their operational costs in check while providing the highest quality care, with the rise of chronic diseases and population ageing.

The cardiovascular care ecosystem should work to ensure that time in the hospital is always time well spent. The common problem is efficiency – both in the way hospital departments are managed and in the way clinical procedures are performed. Today, siloed operations and healthcare IT systems can at times translate into poor quality care, disconnected treatment pathways and rising costs. Healthcare leaders understand that cardiovascular care delivery no longer hinges on individual department performance but on intense collaboration and bridging gaps that exist among providers, between sites, and across time[4]. In the context of bundled payments for heart failure-related hospitalizations, there is a clear incentive for patient care teams and hospitals to reduce the length of stay[5]. No patient wants to stay in hospital longer than is absolutely necessary. But also, no patient should be discharged too soon.

[1]American Heart Association, 'Cardiovascular disease: A costly burden for America – Projections through to 2035'
[2]American Heart Association, https://www.ahajournals.org/doi/abs/10.1161/hhf.0b013e318291329a
[3]NCBI, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5436769/
[4] Advisory Board, https://www.advisory.com/Research/Cardiovascular-Roundtable/Studies/2012/Mastering-the-Cardiovascular-Care-Continuum
[5]JACC, http://heartfailure.onlinejacc.org/content/5/8/578

## Addressing cardiovascular care holistically

Philips believes that the complexity of cardiovascular care can only be overcome by looking at the entire cardiovascular patient journey – from healthy living through prevention, diagnosis, treatment and home care, with the patient as the focal point of that journey, and technology helping to move them from the beginning to the end as seamlessly as possible. This entails supporting the patient through each segment of that journey: helping health providers deliver a fast and accurate diagnosis; using data and insights to improve clinical and departmental performance; and, optimizing the care pathway so the patient can move between care settings and get quality care outside of the four walls of the hospital.

This paper explores the key ways Philips supports healthcare providers achieve this goal: optimizing the hospital length of stay for cardiovascular care patients by enabling performance improvements and efficiency gains – both in **clinical procedures**, **departmental improvements** and in **care pathway management**. When the physician has all of the information needed to make a fast, accurate diagnosis at the point of care, it can lead to reduced lab time, better workflows, potentially enabling them to see more patients each year. Through data capture and analysis clinicians can see very clearly what was not visible in their department before and free up capacity in their operations when needed, leading to costs savings and overcoming the burden they face with disconnected data and complex technologies. Ultimately, by ensuring that cardiovascular patients get quality care and support at all of the different parts of the care continuum healthcare providers can enhance the patient experience, potentially reduce the rate of readmissions to hospital, optimize the length of stay for cardiovascular patients and achieve better outcomes at lower cost.

# Enhancing diagnostic decisions

## Philips solution

Philips IntelliSpace Cardiovascular Image and Information Management System is a web-enabled image and information management system that provides advanced tools for physicians to access, analyze, and share cardiovascular images and information anytime, from virtually anywhere.

A patient's length of stay in a hospital depends on how quickly they are diagnosed and moved to the next stage of the cardiovascular care journey.

Patients and physicians experience immediacy, access and flexibility from the technology in their homes and cars, and expect the same in a clinical setting. Without quick access to that information, clinicians are slowed down in their ability to make a confident diagnosis and identify the optimal care or treatment pathway for a cardiac patient. They need the tools to efficiently guide that treatment and then confirm whether the treatment has been optimally performed.

## An integrated view of the patient

Healthcare providers today are pressed to predict, prevent and deliver better care for an increasing number of cardiovascular patients. Yet, they do so faced with barriers at nearly every turn. Clinicians, who are seeing patients with higher acuity levels and more co-morbidities[6], are burdened with disconnected data and complex technology. To deliver quality end-to-end cardiovascular care, to optimize care pathways, all of the various sources of data need to be collated, integrated and leveraged to support the operational and procedural goals of the department. This is a difficult challenge given the innate complexity of most hospital IT systems and the lack of interoperability between them[7]. Clinicians are spending valuable time behind a computer, using multiple different IT tools to ensure they have the fullest picture of the patient's health.

Patients often move between different specialists, and have different tests and procedures performed at different locations of the hospital. This can impact the care pathway of the patient: it makes collaborating immensely difficult and physicians can't get a fully integrated view of how to manage an individual patient's health journey[8]. At the same time, patients are burdened with having to recall their care journey and test results. Both would benefit from a more collaborative and holistic approach to care: an approach that collects and organizes information in new ways.

Philips collaborated with clinical partners to address this challenge, by creating Philips IntelliSpace Cardiovascular Image and Information Management System, a tool which breaks down barriers in cardiovascular care with longitudinal views of the patient data and clinical and collaboration tools for multiple providers across locations. This solution brings multi-modality images and clinical tools such as EMR data, scheduling systems, and any web-based application, together in a single workspace to facilitate quick and confident insights and clinical decisions.

[6]NCBI, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3372969/
[7]Healthcare IT News, https://www.healthcareitnews.com/news/interoperability-shows-progress-its-slow-progress-best
[8]Philips Research blog - https://www.philips.com/a-w/research/blog/in-cardiology-could-improving-the-patients-timeline-hold-the-key-to-improving-care.html

## Philips solution

EPIQ CVxi with EchoNavigator streamlines communication between the interventional cardiologist and the echocardiographer during complex interventional exams to improve patient care while enhancing workflow.

## Treating patients through image-guided therapies

Optimizing care pathways means optimizing the time it takes to diagnose a patient. Around 10 or 15 years ago treating a patient with an aortic aneurysm would have required five days in the ICU, seven days in hospital and 30 days of recovery[9]. Today, the emergence of hybrid interventional suites has brought significant benefits to cardiovascular patients and practitioners, allowing multidisciplinary care teams to execute numerous clinical solutions in one convenient and practical setting.

Through image guided therapies there is the possibility to effectively treat patients with heart valvular disease and have them return home in two or three days[10]. “Traditionally patients who needed a new cardiac valve would have to undergo open heart surgery,” says Alexandra Gonçalves, MD, PhD. Senior Medical Director of Cardiology, Philips Ultrasound Business Group. “The last 10 years has seen an incredible evolution in less invasive therapies for structural heart disease, which wouldn’t have been possible if not supported by the advances in the ultrasound imaging, particularly by the 3D transesophageal echocardiography that Philips championed in 2007. Thousands of patients can now be treated less-invasively, through transcatheter therapies which dramatically reduce the length of hospital stay as it minimizes the time to recovery.”

[9]Interview with Dr. Barry Katzen, Founder of Miami Cardiac & Vascular Institute
[10]Interview with Dr. Barry Katzen, Founder of Miami Cardiac & Vascular Institute

"We help integrate the imaging system with the interventional device, supported by our software tools and services because this increases efficiency, decreases cost and improves outcomes."

**Atul Gupta,**
MD, Chief Medical Officer for Image Guided Therapy (IGT), Philips

## Quicker procedure times with iFR

In image-guided therapies of coronary artery disease, clinicians have been using a catheterization technique called Fractional Flow Reserve (FFR) to assess the severity of a blockage of the coronary artery, and to decide on the appropriate therapy.

In 2013, Philips introduced iFR as an alternative to FFR. Unlike FFR, iFR doesn't require the administration of medication, reducing patient discomfort, saving costs and improving ease of use. One study, published in the *New England Journal of Medicine* in 2017[11], compared the use of iFR and FFR using pressure guide wires and equipment from Philips. Results revealed that revascularization had similar outcomes after one year in terms of overall treatment and deferral, but that iFR can be performed quicker and with less discomfort for patients.

Since the introduction of iFR, which was recently incorporated by the European Society of Cardiology into its updated revascularization guidelines, it has been studied in nearly 15,000 patients and is used in more than 4,100 catheterization labs across the world.

With the right technology, specifically designed to increase diagnostic confidence and simplify workflow, physicians benefit from having all of the information at their fingertips, through intuitive interfaces, real-time visualization and data integration, in combination with high image quality. This has helped address a number of concerns for heads of departments, whose teams have limited time and resources to make care decisions and still deliver appropriate care.

"We are helping to integrate the imaging system with the interventional device, supported by our software tools and services," says Atul Gupta, MD, a practising interventional and diagnostic radiologist in Philadelphia who also is the global Chief Medical Officer for Image Guided Therapy (IGT) at Philips. "And we do that because it increases efficiency, decreases costs and improves outcomes."

[11]Davies, J.E., Sen, S., Dehbi, H.M., Al-Lamee, R., Petraco, R. ... Escanned, J. (2017). Use of the Instantaneous Wave-free Ratio for Fractional Flow Reserve in PCI. The New England Journal of Medicine, 376: 1824-34

The data demonstrated clinicians' use of Azurion resulted in significant time savings for the hospital, including a 17% reduction of the average interventional procedure time

## Case study: Reducing cath lab procedure times at St. Antonius Hospital

St. Antonius Hospital, a leading interventional institution in The Netherlands, was challenged with increasingly complex procedures, unpredictable demand, and growing patient waiting time, which prompted them to look for ways to make more impactful clinical and operational improvements in their interventional labs.

Through a comprehensive, independent, two-year study demonstrating the clinical workflow benefits of its next generation image-guided therapy platform, Azurion, St.Antonius Hospital investigated nearly 800 patient procedures to evaluate the platform's impact on the hospital. Detailed data was collected on all interventional exams in the existing lab for eight months prior to the installation of Azurion.

The data demonstrated clinicians' use of Azurion resulted in significant time savings for the hospital, including a 17 percent reduction of the average interventional procedure time[12], a 12 percent reduction of in-lab patient preparation time, and a 28 percent reduction of post-procedure lab time, meaning that preparation and wrap-ups were significantly more efficient. This increased efficiency led to a 25 percent reduction in planned cases finishing late, meaning a reduction in overtime expenses and increased employee satisfaction.

Overall, these improvements mean that St. Antonius now has the potential to treat one more patient per day – on an average of 6 to 8 patients per day, to help hundreds more patients each year. The reduced preparation, procedure and lab time resulted in fewer planned cases finishing after normal working hours and higher employee satisfaction.

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[12]Results are specific to St. Antonius Hospital and may not reflect the results achievable at other institutions.

Adaptive intelligence combines artificial intelligence and other technologies with knowledge of the clinical and operational context in which they are used.

## Decision support through AI

With more and more data being collected in hospitals — from new medical devices and equipment — the case for AI adoption is compelling. AI-enabled technologies can augment the physician's work by bringing all relevant patient information together — lifestyle, behaviors, physical characteristics, and multiple genetic and non-genetic biomarkers, as well as personal preferences — to support a precise diagnosis[13]. Based on predictive insights in patient populations, healthcare providers will be able to take preventative action for cardiovascular patients, reduce health risks, and save unnecessary costs.

The ability to combine large amounts of clinical data to generate a more holistic view of the cardiovascular patient will allow clinicians at any given time to make a well-informed, confident diagnosis, and – together with the patient – make responsible decisions about the care pathway, designed to yield the best outcome without wasting time, resources and money. Ultimately, this will transform how individual care is delivered and support the goal to reduce the length of stay.

"An AI-enabled tool could leverage data from the image-guided therapy system and know what steps are being taken in real-time."

**Atul Gupta,**
MD, Chief Medical Officer for Image Guided Therapy (IGT), Philips

On a departmental and enterprise level, the ability of AI to sift through large amounts of data can help hospital administrators to optimize performance, drive productivity, and improve the use of existing resources, generating time and cost savings. By extracting insights from data, AI-enabled solutions can support clinicians to optimize their workflows, including planning, procedure times, and selecting the right exam for the right patient. AI will help departments better understand which improvement actions — insights, recommendations, decision support — were successful, and which were not.

"Adaptive intelligence is best thought of as a personal assistant for physicians," says Dr. Gupta. "Our patients are getting older and sicker, and we now measure and image so much more than in the past. This results in data overload, so we need digital assistants like adaptive intelligence to help us with the monotonous tasks, which gives us physicians more time to diagnose and treat." For example, the long time spent dictating every step of an interventional or surgical procedure into the EHR is both time-consuming and creates staff dissatisfaction[14]. It can lead to mistakes too. "Mistakes mean the hospital is not documenting properly or billing properly, because coders are taking that often incorrect record to figure out what charges to bill," says Dr. Gupta. An AI-enabled tool could leverage data from the image-guided therapy system and know what steps are being taken in real-time, and autofill the interventional procedure into the EHR, allowing the physician to immediately edit and sign off the report when the procedure is completed.

[13]Philips Adaptive Intelligence position paper, https://www.philips.com/a-w/about/news/archive/standard/news/articles/2018/20180828-the-case-for-focusing-ai-in-healthcare-on-people.html
[14]Interview with Atul Gupta, MD, Chief Medical Officer for Image Guided Therapy (IGT), Philips

# Delivering operational improvement

"If you really want to move the needle in terms of healthcare outcomes and efficiencies you also have to look outside of the cath lab."

**Gerald Poetzsch**
Head of Cardiology Solutions, Philips

Today, through data capture and analysis clinicians can see very clearly what was not visible in their department before and free up capacity in their operations when needed, whether that is cath lab utilization, patient scheduling or inventory management.

To identify departmental inefficiencies and continuously improve is important for the financial sustainability of the department and the organization. It is also critical in a value-based healthcare system where reimbursements reward patient outcomes. Just as data and insights support physician decision making at the point of care, it also can drive efficiency across the department – improving workflows and departmental performance measurement – which could potentially impact the patient's length of stay.

## Workflow optimization with cardiology solutions

We are used to real-time improvement and real-time services today. Having become accustomed to the convenience of online banking, shopping and entertainment, patients are becoming less willing to accept poor service and complex, disconnected care from healthcare providers. By redesigning their processes and even their facilities to deliver a better patient and staff experience, the length of stay can also be optimized.

With a focus on patients and care providers, Philips consulting teams work with health systems to revise and design workflows, modify layouts and improve staff communication in their cardiac catheterization and electrophysiology labs. "If you really want to move the needle in terms of healthcare outcomes and efficiencies in cardiovascular care you also have to look outside of the cath lab," says Gerald Poetzsch, Head of Cardiology Solutions, Philips. "Cath Lab Managed Services is looking at what happens in that lab, but it is also looking at what happens around that lab."

Data from a minimally invasive procedure is aggregated through Philips Xper Information Management (Xper-IM), which tracks a patient's hemodynamics and also collects data related to the procedure.

## Case study: Improving cath lab productivity at Miami Cardiac and Vascular Institute

In the past, clinical data was captured manually – through log sheets and monthly updates – or not at all. The large volumes of data created in hospitals today doesn't necessarily make this challenge any easier, if the data is not organized in a way that can make decision making easy. Managing throughput, saving costs and driving efficiency in the cath lab at a time when patients are arriving in larger numbers and with complex disease profiles, becomes incredibly difficult.

This was the challenge for Miami Cardiac and Vascular Institute. They wanted to analyze their day-to-day lab operations to find out where productivity gains could be made. For the Institute, this started with identifying how clinical resources were being used and how time was being managed. The inventory that is part of a minimally invasive cardiac procedure is rich with data that can inform key clinical and business decisions. At the Institute, data from a minimally invasive procedure is aggregated through Philips Xper Information Management (Xper-IM). Philips Xper-IM not only tracks a patient's hemodynamics during a procedure, but it also collects data related to the procedure and documents the components of the procedure.

For example, you can see how long each procedure takes, how long it takes to prepare the patients, how long it takes to get the patient out of the room and prepare the room for the next patient. Inventory and resources used in the procedure are also managed through the Xper-IM system – each piece of equipment used is scanned during the procedure, and the Institute is able to track the cost per procedure on various aspects.

At Augusta Health reduced average length of stay from 6.11 days to 5.95 days resulted in savings of $3.37 million.

At Westchester Medical Center Health Network[15], hospital staff worked with Philips consultants to optimize cardiology services including strategic guidance and hands-on implementation support, which led to lower costs, enhanced patient experience, improved staff satisfaction and a 20% reduction in patient wait times. By collaborating with Philips they were able to reduce purchased supplies to align closer to demand. A total saving of $1 million was achieved on catheters, sheaths and guidewires by only purchasing what was actually needed. Another $675,000 savings were achieved by removing unused items from stock. Another 10% savings were achieved by improving inventory management procedures to match utilization with ordering of common high volume supplies.

Philips recommended a new Care Facilitation Organization to Augusta Health in the US combining case management, social work, utilization review, discharge planning, and bed management. A multidisciplinary, enterprise-wide approach was developed to enhance inter-department care coordination, increase patient throughput, increase capacity, and improve navigation processes and overall patient satisfaction. A reduced Average Length of Stay from 6.11 days to 5.95 days resulted in savings of $3.37 million[16].

[15]Philips Consulting case study, https://www.usa.philips.com/healthcare/consulting/articles/customer-story/transforming-care-at-westchester-medical-center
[16]Philips Consulting case study, https://www.usa.philips.com/healthcare/consulting/articles/customer-story/augusta-care-facilitation

# Optimizing care pathways

"The ultrasound provides critical information for the diagnosis of cardiac patients so treatment can be promptly optimized and, potentially, the length of hospital stay can be reduced."

**Alexandra Gonçalves,**
MD, PhD. Senior Medical Director of Cardiology, Philips Ultrasound Business Group

Being episodic, cardiovascular disease requires care and support for patients at all intervals in the care continuum – from their admission to the emergency department, through their clinical procedures, and, in recovery.

Through fast diagnostic support at the point of care, decisions can be made faster than before to get the patient through the care pathway. This is critically important with cardiovascular patients because every second is incredibly precious, particular in an emergency situation. It's even more precious when a patient is unstable or even "coding" — when a patient stops breathing or their heart stops beating — or during times when the emergency department is overburdened with patients and immediate action needs to be taken. Through an automated early warning scoring (EWS)[17] system clinicians can identify the subtle signs of deterioration and take action hours before a potential possible cardiac event. In one case this led to a clinically significant reduction in patient codes[18].

Philips eICU offers health systems a cost-effective approach to staffing their ICUs by supplementing their intensive care teams with centralized, remote monitoring from skilled intensivists combined with proprietary algorithms and clinical decision support. This solution allowed Emory Healthcare to save an estimated $4.6 million in just 15 months. Other hospitals using similar programs have seen a reduction in mortality of 20% and reduction of length of stay by 30%[19,20,21].

## Role of ultrasound in physical exams

Immediate access to high-quality ultrasound has the potential to enhance care of the cardiology patient in many settings. "In the emergency room, it is being increasingly adopted for immediate diagnosis and to support the decision for the right treatment pathway. This helps the patient go to the next stage of their care journey faster," says Dr. Goncalves. In the private office, when admitting a new patient, with the help of Philips Lumify[22] a cardiologist can decide if a comprehensive echo exam needs to be scheduled to complement the clinical evaluation and decide if a comprehensive echo exam or any other clinical studies will be required.

"The ultrasound is becoming a critical complementary step of the physical examination," Dr. Goncalves adds. "It provides critical information for the diagnosis of cardiac patients so treatment can be promptly optimized and, potentially, the length of hospital stay can be reduced."

[17]Philips customer story, 'Reducing codes on the ward', https://www.usa.philips.com/healthcare/nobounds/saratoga-reduces-adverse-events
[18]Philips customer story, Saratoga Hospital, https://www.philips.co.uk/healthcare/nobounds/saratoga-reduces-adverse-events
[19]Lilly C.M. et al., Hospital mortality, length of stay, and preventable complications among critically ill patients before and after Tele-ICU
reengineering of critical care processes," Journal of the American Medical Association, vol. 305, no. 21, pp. 2175–2183, 2011.
[20]Lilly C.M. et al. TeleICU: Experience to Date, Journal of Intensive Care Medicine, September 13, 2009; 1-7
[21]New England Healthcare Institute, Critical Care: Critical Choices: The Case for Tele-ICUs in Intensive Care. December 2010
[22]Philips Lumify, https://www.lumify.philips.com/web/

The average length of stay for heart failure-related readmissions over 12 months was reduced by 67% under telemonitoring support

## Lowering costs through telehealth

Keeping people healthy at home has become a greater priority for health systems since the reimbursement system began rewarding providers for shifting care to lower cost settings and penalizing them for 'avoidable' readmissions and utilization. For people living with a chronic disease or returning home after hospital treatment, connected health technology can support recovery or a necessary change of lifestyle.

Telehealth and care management programs can help lower costs within the hospital walls as well as provide ongoing care to keep patients healthier in their homes. One example is the eIAC ambulatory telehealth program for elderly people living with multiple chronic conditions, which is built upon a population management software platform designed for monitoring and delivering care to the most complex patients at home. Thousands of patient years of data enables an intelligent technology that can identify when a patient needs assistance or is at risk for emergency transport to the hospital in the upcoming 30 days.

### Case study: Using telehealth to reduce length of stay at Changi General Hospital

To help patients learn how to better manage their heart condition at home, reduce the risk of readmission and premature death, Philips partnered with Changi General Hospital (CGH) in Singapore to pilot the Heart Failure Telehealth Program[23]. This integrates three elements of care: tele-monitoring, tele-education and tele-care support via tele-nurses from Changi General Hospital Health Management Unit. 150 heart failure patients from CGH were enrolled in the program between November 2014 and March 2016.

As a result of the telehealth program, patients had improved knowledge, improved confidence and ability to maintain their heart failure condition. In addition to the timely detection of changes in patients' clinical condition, the average length of stay for heart failure-related readmissions over 12 months was reduced by 67% under telemonitoring support compared to patients who only received support via phone calls (2.2 days vs 6.6 days).

[23]Philips news center, https://www.philips.com/a-w/about/news/archive/standard/news/press/2018/20180125-telehealth-program-by-changi-general-hospital-and-philips-empowers-heart-failure-patients-to-be-more-confident-and-involved-in-managing-their-heart-condition.html

# Partnering in cardiovascular care

"Our cardiovascular solutions and services are designed to help you improve clinical outcomes while optimizing the hospital stays of cardiovascular patients."

**Gerald Poetzsch,**
Head of Cardiology Solutions,
Philips

By partnering more and more with hospitals to design and build new business and care models, through long-term strategic partnerships, Philips is continuously innovating in cardiovascular care.

From emergency care, acute care, and diagnostics, to treatment and home care, Philips supports earlier, more confident diagnoses to optimize the path to treatment and recovery, and establish ongoing care management with solutions that integrate patient data and programs to improve care delivery and reporting.

Complementary to Philips' advanced cardiac equipment and systems, data analytics, intelligent applications, consulting and telemedicine solutions help standardize best practices, manage risk and smooth patient transitions from acute to non-acute settings and the home for better individualized care while managing costs. "From definitive diagnoses to minimally invasive interventions to health information management, our cardiovascular solutions and services are designed to help you improve clinical outcomes while optimizing the hospital stays of cardiovascular patients," says Mr. Poetzsch.

## Less waste, optimized stays

As complex as the cardiovascular care journey is for patients, there are clear ways that healthcare providers can ease both the burden on physicians and the passage of the patient through the cardiovascular care continuum. Time and costs can be saved through more accurate and faster diagnoses and by using the data within their IT systems to improve clinical workflows and departmental performance. With the right information in the right place at the right time departmental operations can be greatly improved. By leveraging all of the data available to them, the physician and health providers can be more efficient and effective in what they do, overcoming the burden they face with disconnected data and complex technologies.

Ultimately, by ensuring that the patient gets quality care and support at all of the different parts of the cardiovascular care continuum health providers can potentially reduce the rate of readmissions to hospital, optimize the length of stay for cardiovascular patients and achieve better outcomes at lower cost. And the possibility of helping hundreds of more patients each year can be realized.




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