WHITEPAPER

# From critical care to confident delivery

Triaging patient-centric logistics with intelligent Transportation Management

infios

# Introduction

Healthcare supply chains pose significantly higher risks to public health and quality of life than those of other industries. Unlike retail logistics, where a delay might frustrate customers, a breakdown in healthcare logistics can mean the difference between life and death. With patient outcomes hanging in the balance, it is imperative to handle commodities such as organs, medical devices or pharmaceuticals with both sensitivity and urgency.

The risks intensify when factoring in the specific conditions under which these types of products must be shipped. Something as straightforward as refrigeration requirements—essential for many medications and pharmaceutical products—can severely limit shipping options available to healthcare and pharmaceutical transportation managers for shipment execution.

Even the transport of more routine healthcare supplies can become critical during sudden health crises. The global shortage of masks, gloves and other personal protective equipment in the 2020 COVID-19 pandemic underscored how quickly demand spikes can overwhelm traditional supply chains.

Technology adds another layer of risk to healthcare supply chains. Cybersecurity and personal data protection are constant concerns, with the U.S. Department of Health and Human Services (HHS) tracking reported breaches that impact 500 or more individuals. Its Office for Civil Rights Breach Portal reported 279 incidents of protected health information exposure in 2023—a number that more than doubled to 585 in 2024.[1] Hacking and other types of unauthorized access were the most common causes, affecting providers from doctors and hospitals to pharmacies, health plans and information clearinghouses.

Minimizing risks remains a priority across healthcare and pharmaceutical logistics, but eliminating it entirely is nearly impossible. Governments have responded with stringent regulatory requirements, including Good Distribution Practices (GDPs), to safeguard product safety and quality throughout the international supply chain. To comply, organizations are investing in advanced logistics solutions such as real-time temperature monitoring, temperature-controlled storage, specialized packaging, advanced tracking technologies and detailed documentation. While these measures help verify that product integrity remains intact at every point along the journey from manufacturer to patient, they also drive up costs and add complexity.

To reduce expenditures and boost efficiency without compromising product quality or timely delivery, healthcare organizations are accelerating adoption of digital supply chain technologies. A 2023 Global Healthcare Exchange (GHX) study found that 70% of U.S. hospitals and health systems plan to implement cloud-based supply chain management technologies by 2026.[2] These include software solutions such as Transportation Management Systems (TMS) with shipment visibility, vehicle routing and scheduling applications.

In healthcare and pharmaceutical supply chains, a TMS optimizes the transportation and delivery of medical supplies and equipment. By managing route planning, carrier selection, shipment tracking and delivery updates, it ensures secure, on-time delivery to providers and patients. This improves patient care by minimizing delays and maintaining product integrity throughout the supply chain.

The ultimate goal of digital transportation management solutions in healthcare is to simplify and streamline without sacrificing quality or reliability. The right TMS goes beyond basic functionality, addressing the unique complexities of healthcare supply chains, the multiple stakeholders operating within it and the broad range of commodities handled. This whitepaper highlights the essential capabilities of an optimal TMS—and how they enable healthcare organizations to best meet those requirements.

# Solving healthcare logistics challenges with intelligent TMS capabilities

The global healthcare and pharmaceutical supply chain is both complex and intricate. It involves a wide network of stakeholders—pharmaceutical and biotech companies, medical device manufacturers, healthcare facilities, retailers and suppliers of ingredient and components. On the transportation and logistics side, third-party logistics service providers (3PLs/LSPs), freight forwarders, carriers, freight brokers and customs brokers all play critical roles in ensuring safe, timely delivery.

Adding to the complexity of healthcare supply chain is the wide diversity of commodities handled. These range from biopharmaceuticals—vaccines, plasma-derived products and other biologics requiring stringent temperature control and specialized cold chain handling—to prescription and over-the-counter medications. The mix also includes medical goods and devices, like bandages, tongue depressors, pregnancy test kits, implants and surgical tools, as well as organs, tissues, blood and live laboratory animals.

Each stakeholder has unique transportation management and routing requirements, and every product type introduces its own complexities. A TMS designed for healthcare and pharmaceutical logistics must therefore provide core capabilities that synchronize operations, streamline transportation processes and enable seamless information-sharing across all parties.

## Tailored workflows for every shipment, stakeholder & scenario

A TMS used for managing the complexities of healthcare and pharmaceutical supply chains must be able to accommodate unique planning and execution requirements of what is being shipped, where and in what volumes. Achieving this requires a high degree

of configurability and flexible system architecture that enables multiple types of users—such as shippers or brokers—to operate within job-specific workflows.

The TMS should enable logistics teams to configure unique rules and automated workflows based on almost any variable—product type, stakeholder, shipment origin or destination, required documentation, temperature data, transportation mode and more. This minimizes the risk of errors associated with manual processes and ensures seamless, compliant data transfer as products move through multiple points and modes.

Additionally, the TMS should allow administrative users with appropriate permissions to modify workflows and rule sets easily. This flexibility enables the TMS to scale with business needs without costly custom programming, improving overall return on investment, keeping transportation costs low and minimizing the impact on the cost of patient care.

## Real-time, end-to-end visibility that powers proactive decisions

Visibility is one of the most critical capabilities of a TMS in healthcare and pharmaceutical logistics. Not only to the location of commodities in transit, but their condition, estimated arrival times and proactive alerts of disruptions. A control-tower interface provides end-to-end visibility across all modes and geographies, enabling healthcare organizations to monitor shipments in real time, anticipate delays and respond proactively to ensure patient-critical deliveries arrive on time.

Whether by land, air or sea, an optimal TMS provides continuous, real-time visibility into the location of healthcare or pharmaceutical shipments across the entire chain of custody. It should incorporate up-to-date location-based protocols and extensive security controls to reduce theft risk at load transfer points. This is especially critical for high-value or time-sensitive items—such as vaccines, transplant organs or medical devices—and requires a system that collects and disperses real-time location tracking data.

Real-time shipment tracking gives healthcare and pharmaceutical shippers precise visibility into the location of their medical products at all times. This supports improved inventory management and enables proactive responses to potential shortages. The TMS should alert personnel if a shipment's location status falls outside a pre-configured business rule, and more mature TMS solutions can automatically manage exceptions through dynamic routing or rerouting as needed.

## Seamless connectivity across your digital healthcare ecosystem

Stakeholders across the healthcare supply chain utilize a wide range of software systems and solutions to manage their organizations. Any number of connected technologies may be used across various parts of the supply chain to manage the movement of supplies and equipment—from raw materials to final delivery in hospitals, pharmacies, home care and other patient care settings.

To enable data sharing and synchronization, the TMS should remain system agnostic. That is, its architecture should support connectivity to and integration across virtually every enterprise resource planning (ERP), warehouse management system (WMS), customer relationship management (CRM), electronic health record (HER), order management system (OMS) and more via application programming interfaces (API) or other connectivity methods.

A TMS should also be able to consume a wide range of integrated data, including electronic data interchange (EDI) messages from carriers and freight forwarders, status reports from customs brokers and real-time ocean vessel information from the International Maritime Organization's Automatic Identification System (AIS). Further, the TMS must be configurable and adaptable to provide info into third-party visibility solutions, such as customer tracking portals. Ideally, it must connect to each of those systems in real time for seamless execution and communication of information.

## Protecting product integrity with smart environmental monitoring

Many healthcare products—such as vaccines and biologics—require temperature-controlled environments to remain effective. In healthcare and pharmaceutical settings, TMS can be configured to receive information from Internet of Things (IoT) sensors and other devices that monitor and document temperature, vibration, humidity and other environmental factors that could damage a shipment. This is critical for maintaining cold chain integrity and ensuring regulatory audit readiness.

This capability enables a logistics operations manager to take corrective actions to avert spoilage or loss of efficacy. It also prevents the shipment from incurring a loss or damage claim.

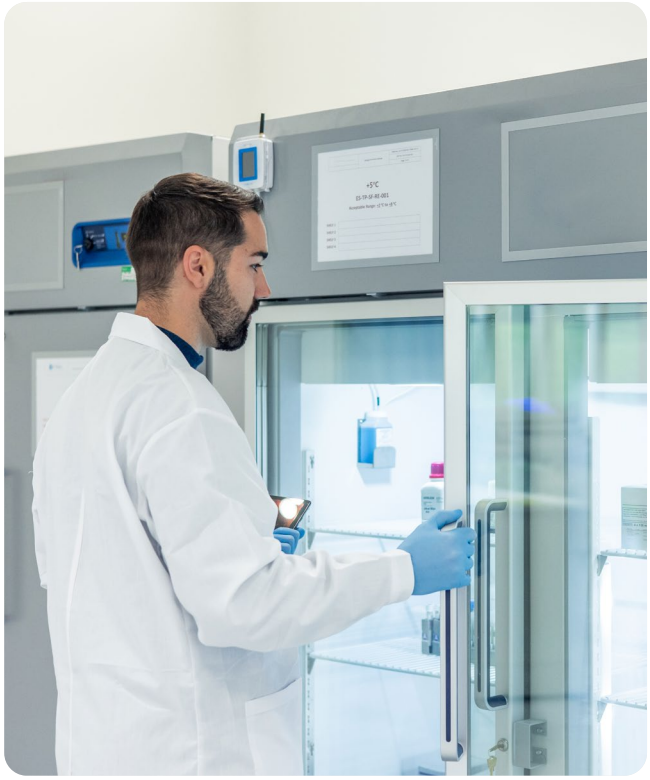
## Mode optimization at every mile with artificial intelligence (AI)

Like many other industries, healthcare supply chains are increasingly leveraging advanced capabilities in artificial intelligence (AI) to optimize transportation routes, dynamically match loads with carriers and reduce empty miles. This ensures cost-effective, timely delivery while adapting to real-world conditions like traffic, weather and demand fluctuations.

Given the inherent complexity of the global healthcare supply chain, integrating AI to streamline shipments across every mode of transportation—rail, truck, air, ocean and last mile delivery—from supplier through to end recipient is becoming table stakes for TMS.

Having a multi-modal optimization engine natively integrated within the TMS offers the benefit of immediate value-adds from the incorporation of AI. As an example, using agentic AI customer service features, TMS users can get immediate alerts for shipments at risk of delay or non-delivery and immediately deploy route adjustments based on inputs such as traffic, weather, fuel efficiency, mileage, new orders, returns and other criteria.

Through these functions, the TMS can optimize delivery routes based on factors like distance, traffic and delivery urgency, leading to faster and more cost-effective transportation. This ensures medications and equipment reach patients quickly and safely while reducing handling costs.



## Simplify global trade and customs compliance with automated cross-border intelligence

For companies importing and exporting shipments across a global healthcare supply chain, it is essential to seamlessly interact with local languages, currencies, physical units of measure, time zones and customs requirements. For this reason, TMS used to execute international and cross-border moves must offer comprehensive consolidation, translation and conversion of these factors, presenting them in the end user's native language preferences.

Additionally, healthcare logistics shipments must comply with strict regulations specific to different countries and regions. To streamline these multi-national customs clearance processes, TMS should ideally integrate with automated customs management tools that navigate these complex requirements. Doing so can significantly reduce the risk of customs and compliance delays by auto-generating required documentation for compliance checks, customs forms, tracking for regulatory audits and certifications. It also continuously updates and incorporates changes to forms, legislation, tariffs, fees and more. This facilitates on-time arrival while reducing the risk of non-compliance.

## Smart load matching to maximize efficiency and delivery reliability

To ensure delivery that is both reliable and cost-effective, healthcare supply chain operators need a TMS that can flexibly manage and optimize shipping by matching loads and carriers.

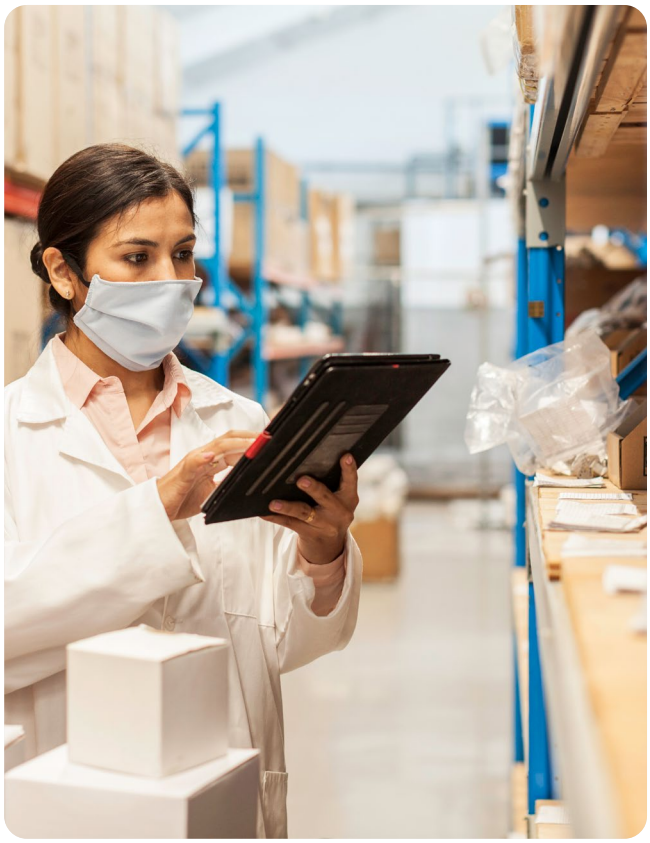
TMS is capable of handling any size shipment, from full ocean container or truckload to less-than-truckload (LTL), to parcel in an imperative. Key features should include carrier performance tracking, route optimization, cost comparison and dynamic rating capabilities. The rating function should cover all modes and geographies, such as parcel, multi-weight, LTL, volume, truckload, multi-leg truckload, multi-stop truckload, air, ocean, rail, barge, bulk, groupage, loading meters and multimodal shipments.

Modern digital freight marketplaces embedded in TMS offer even greater transportation optimization gains. This allows users to see and select capacity with guaranteed rates through an automated process that replaces manual tendering, booking and execution. This extended marketplace capability also helps capacity providers—including carriers and shippers with private fleets—match their empty equipment with immediate demand to remove empty miles throughout the transportation network.

## Securing sensitive data with enterprise-grade protection

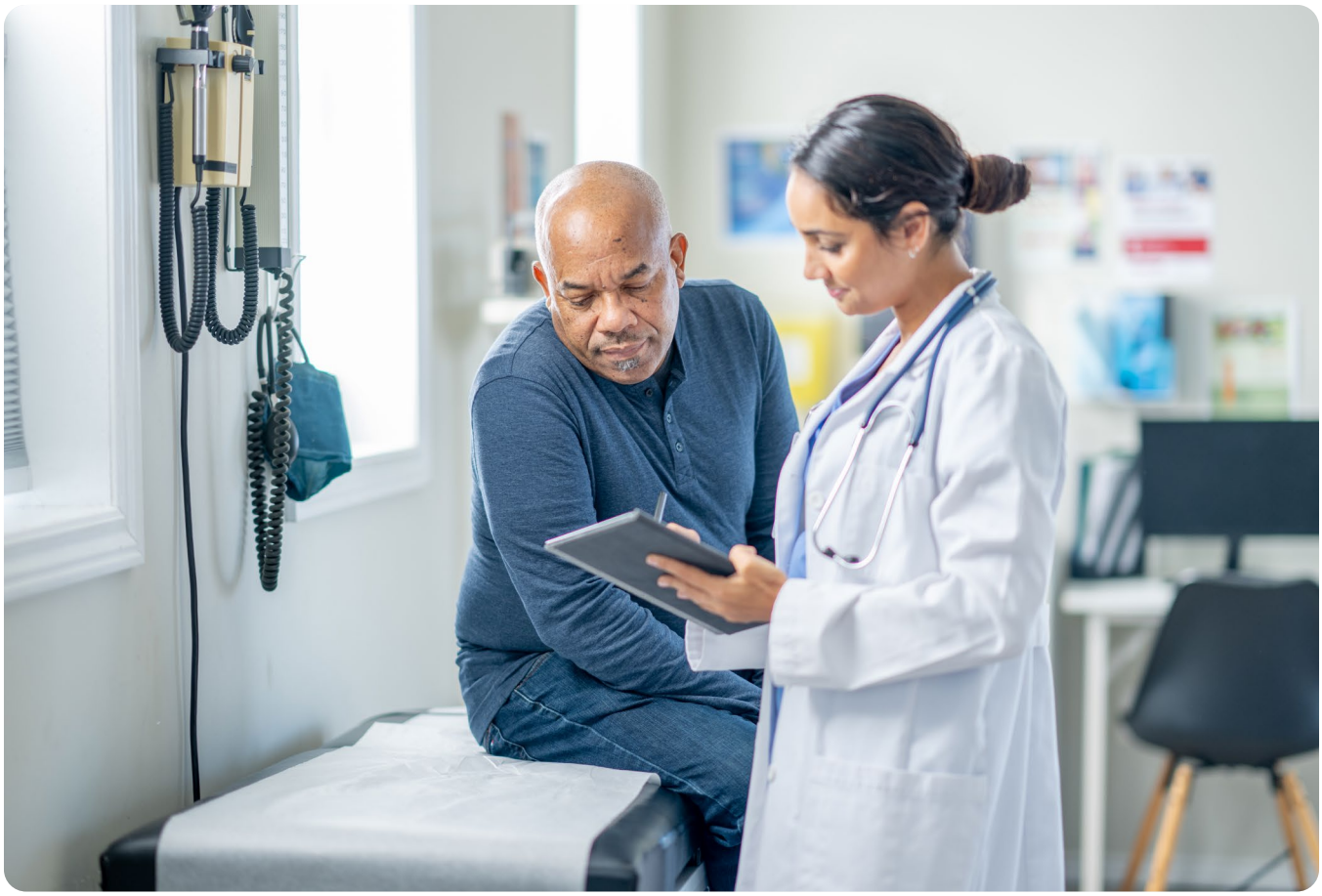
Healthcare and pharmaceutical services maintain volumes of personal patient data—a necessity given the types of services offered. These data sets are often shared across multiple internal and external vendor systems, as permitted by law, to ensure seamless operations. Yet this connectivity also heightens the risk of data compromise.

At first glance, it seems logical that patient information must be shared across healthcare systems, specialists, pharmacies, outsourced laboratory functions and other stakeholders related to patient care. This sharing can create convenience—enabling coordinated care plans and a more seamless patient experience. Yet the tradeoff is evident in the surge of reported healthcare data breaches. According to its Office for Civil Rights Breach Portal, there were 279 breaches of protected health information in 2023, a number that more than doubled to 585 in 2024.[1]



Just a few degrees of separation exist between first-party patient data and related healthcare data sets that track regulatory compliance, inventory records and transportation plans of medical supplies, equipment and pharmaceuticals. These lines blur further when last-mile deliveries of medications and healthcare items cross the divide between commodities and consumers. As a result, systems not traditionally associated with sensitive health data—such as TMS—have become attractive targets for threat actors. This makes stringent security requirements for transportation data systems imperative. To minimize these threats, a TMS should meet **SOC 1 Type I** and **SOC 2 Type I and II** compliance standards, demonstrating that its security controls have been audited and independently certified to protect customer data at the highest levels.

Additionally, TMS providers should maintain a comprehensive information security program aligned with the **ISO 27001** framework. This program includes security controls for both systems and data, ensure regular backups of project documents and other critical business data with replication across availability zones and provide cybersecurity attestation documentation to support healthcare and pharmaceutical supply chain organization audits.



## Partnering for success with expert support and strategy

To ensure organizations gain maximum value from TMS investments, vendors should go beyond implementation by continuously aligning with industry-specific business cases for transportation management within the healthcare vertical and provide ongoing consultation that accelerates deployment and unlocks full solution value.

The following capabilities and vendor offerings within a TMS can help users in healthcare and related industries achieve maximum return-on-investment (ROI):

- Dedicated customer success representative or team.
- Cloud-based deployment to ensure expansion of capabilities with future technology releases.
- Global support for transportation operations including deployment in multiple countries, currencies, languages and units of measurement.
- Platform-agnostic integration of multiple systems and software including WMS, OMS, last mile routing and scheduling, ERP, freight audit and payment, customs compliance and shipment visibility, to name a few. This creates a seamless experience across a holistic supply chain execution ecosystem.
- Support for multiple modes of transportation and execution across the entire shipment lifecycle.
- AI-enabled automation and insights that allow users to focus on higher-priority tasks that require human intervention.
- Configurable architecture and role-based administration that scales as business needs grow in volume and complexity.
- Software and data security protocols that protect sensitive personal and operational information.

# Building long-term trust with healthcare and pharmaceutical companies

The coronavirus pandemic underscored the critical role of healthcare and pharmaceutical supply chains in global health and disease prevention. In its early stages, the pandemic exposed significant gaps in inventory management and transportation operations within global healthcare supply chains.

Conversely, the unprecedented speed of vaccine distribution highlighted how proven technologies like TMS can enable rapid scaling and expansion of transportation operations worldwide. Lessons learned—both good and bad—as a result of the pandemic delivered both cautionary and encouraging lessons, spurring healthcare leaders to scrutinize supply chains more closely and commit to greater resilience and readiness.

A broad range of well-known companies in the healthcare and pharmaceutical transportation space rely on TMS to reduce expenditures and boost efficiency without compromising product quality or timely delivery. Here are a few examples:

## 1. TMS integrated with last-mile route optimization saves retail pharmacy services provider $1.5 million annually

In 2019, the largest retail pharmacy chain in the United States needed a streamlined solution for order fulfillment and parcel delivery to replace eight disjointed software products used across its business. The company chose the MercuryGate TMS and Vehicle Routing & Optimization solutions—now part of Infios—to manage shipments of prescription medications, healthcare, wellness, beauty and personal care products, equating to $65 million in freight under management.


This consolidation delivered $1.5 million in annual savings. Since then, the company has expanded its use of Infios TMS across four additional business areas, including execution of shipments from its distribution centers to stores via private fleet.

## 2. Global pharmaceutical logistics supplier gains shipment visibility and dynamic routing with TMS

In 2016, a global supplier of specialty logistics services for pharmaceutical companies' clinical trials and commercial supply chains adopted TMS technology to replace an internally built system.

Upon selecting and implementing Infios (formerly MercuryGate), the company gained end-to-end shipment visibility and dynamic routing across depots in more than 50 countries. The TMS also optimizes transportation and storage of time- and temperature-sensitive products and coordinates seamless delivery of biopharmaceutical products worldwide. With over $667 million in freight managed within the TMS, the company is exploring expansion to include Vehicle Routing & Optimization and back-office solutions to manage its private fleet, courier network and agents. Since the initial implementation, the company has reduced cold chain spoilage by 32% and improved on-time in-full (OTIF) performance by 18%.

## 3. Pharmaceutical distributor uses TMS to manage $82 million in freight under management

In 2018, one of the largest healthcare companies in the U.S. deployed Infios TMS (formerly MercuryGate) to streamline its pharmaceutical distribution network, which delivers drugs to national, retail chain and independent pharmacies, as well as hospitals, health systems and clinics. Its distribution centers cover all 50 states, with transportation moves executed via rail, less-than-truckload (LTL) and full truckload. Today, the company manages over $82 million in freight within Infios TMS across four of its five business areas, and coordinates back-office order management and order routing via courier.

## 4. Mölnlycke Healthcare unlocks efficiency with unified freight operations using TMS

Mölnlycke, a global medical products and solutions company, needed a way to manage its vast logistics footprint and address challenges caused by disjointed operations. The company selected Infios TMS to provide a singular, unified solution for its global operations. Throughout the selection process, Infios demonstrated a flexible, client-focused approach that clearly showcased its competence and ability to implement the solution effectively.

The platform combined ease of use, advanced global capabilities and onboarding processes that exceeded Mölnlycke's expectations. Today, an enterprise control tower enables end-to-end visibility across transportation operations, empowers Mölnlycke to make data-driven decisions, improve carrier management and deliver timely reporting for internal stakeholders.

READ THE FULL CASE STUDY

## CONCLUSION

The healthcare and pharmaceutical supply chain demands precision, agility and unwavering reliability. With patient outcomes at stake, logistics professionals must navigate regulatory complexity, temperature-sensitive products and global distribution challenges. A transportation management solution designed for healthcare operations delivers the visibility, AI-powered shipment and route optimization and seamless execution across all modes and geographies needed to meet these demands.

As part of a holistic supply chain execution suite, a mature TMS helps healthcare organizations reduce costs, enhance compliance and fulfill delivery promises. From real-time tracking and dynamic routing to secure data management and last-mile coordination, transportation management systems ensure that each shipment contributes to better patient care. Trusted by leading global brands, Infios TM (formerly MercuryGate) and its broader supply chain execution suite are redefining what's possible in healthcare logistics.

Ready to transform your healthcare logistics operations? Discover how Infios can help you deliver with confidence.

CONTACT US

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