A reinvented supply chain will be the backbone of decentralized health care

Building a better working world

Executive summary

The global health ecosystem of the future will revolve around individuals and their quest for lifelong wellness. Care will be more personalized and decentralized, delivered whenever and wherever the consumer is. In this rapidly approaching future, supply chain and logistics companies will emerge as the critical backbone and information-based nervous system of "anytime, anywhere" health care. The winners in this new health ecosystem will reimagine and reinvent their end-to-end global supply chain capabilities to enable real-time visibility with end-to-end temperature management and time-certain delivery commitments. They will better leverage the river of data that flows alongside the physical supply chain to design and deliver increasingly personalized care solutions. Data about the consumer, their unmet needs and ever-changing expectations, and the products, services and digital interactions that fill their lives will become a critical input to proactively and preventatively managing their health and wellness. These data-savvy logistics companies will collaborate with clinicians, biotechs, medical device manufacturers, consumer products companies and payers to create more compelling patient experiences that deliver better safety, quality and outcomes at a lower overall cost.

Key themes:

- B2B supply chain business models are being disrupted; the future of supply chain requires an end-to-end approach that encompasses all stakeholders: clinicians, medtech, pharma and biotech, lab companies, payers, emerging technology and data analytics companies, and wellness and health consumers (along with their family members).
- Capturing and analyzing detailed data on supply chain shipments, usage and returns, claims and clinical outcomes to provide real-world evidence on product efficacy represents an opportunity for logistics companies to inform delivery of the right product, to the right patient, at the right time, in the right dose and administered via the right route.
- Future supply chain and logistics winners will construct end-to-end, multi-modal delivery networks across a global ecosystem of owned assets, partners and collaborators, leveraging new technologies such as blockchain, AI and machine learning to ensure continuous improvement for secure, cost-effective delivery to the home.

Supply chain and logistics are the backbone of decentralized care

The health sector is witnessing drastic change in the way goods and services are delivered, largely due to the move away from episodic sick care and toward a focus on wellness and preventing illness. Along the way, health consumers are beginning to expect greater convenience, flexibility, self-direction and more-personalized experiences.

This shift requires a profound — and positive — change for health supply chain and logistics companies, as the expectation of "anytime, anywhere" care elevates the importance of their roles.

Driver of change — unsustainable cost

Exploding costs make it inevitable that today's models of care delivery are unsustainable. Aging populations, the rise in non communicable diseases and the inherent inefficiencies in care delivery are key drivers of increased costs. Between 2015 and 2030, the number of people in the world aged 60 years or above is expected to grow by 56%, reaching nearly 1.5 billion.[1] We are also getting sicker: treating chronic, non communicable disorders could cost US$47 trillion from 2010 to 2030.[2]

In response, health organizations — especially providers — are shifting to outcomes-based business models. Further, as more people become ill, the demand for at-home goods and services is rising, requiring new care logistics models.

Driver of change — consumers are the focus

Patients are the consumers of health care and are coming to expect the same level of service, convenience and technology-enabled solutions in health care as in other parts of their lives. Further, they expect better outcomes at more readily identifiable and reasonable costs.

The response is an increase in patient-centric supply chain models supporting the delivery of care when and where the consumer requests. Supply chain companies are facing pressure to create new efficiencies, improving demand planning and real-time inventory management.

Driver of change — technology

New technologies — and consumers' high adoption rates — are driving behavior change and becoming integral to all aspects of care. The evolution of technology in health supply chain and logistics is rapidly making the entire value chain more sophisticated and efficient. Examples include:

- Drone-based wireless technologies are used for inventory counting.
- Autonomous mobile robots and vehicles are designed to co-work with human warehouse workers.
- Autonomous trucks dramatically reduce delivery time and fuel costs.
- New generations of temperature monitoring products (such as smart boxes and smart sensors) are able to track elements such as variations in humidity, air pressure, shipment temperatures, light and shocks.

These technologies also offer new sources of data — and as a consequence require new and better ways of storage and communication. The volume of the world's health data is projected to balloon to 2.3 zettabytes (2.3 trillion gigabytes) by 2020 — growing 48% per year.[3]

Health megatrends are shifting the industry from ...

Volume to value-driven care	Hospitals to "everywhere" care	Diagnostics to prediction and wellness	"One-size-fits-all" to personalized care
Rather than fee for service, value-driven care shifts the focus to delivering the best clinical outcome relative to the optimal cost of care — with the right patient experience delivered by engaged and satisfied providers.	Consumer demand for convenience means new opportunities and new business models; already moving from high-cost centers to low-cost ones, care will be more "on- demand."	Availability of data and technology is moving rapidly from diagnostics to prediction.	Data is being mined to understand individual behavior, engagement style and tolerance to risk to deliver tailored medicine.

Supply chain and logistics organizations – the hub of anywhere care

Health is more connected, and delivered literally anywhere

According to the Centers for Medicare & Medicaid Services (CMS), almost US$103 billion was expected to be spent on home health care in the US in 2018. This is expected to reach nearly US$173 billion by 2026, growing at 6.7% by 2020,[4] which is higher than any other category tracked.

Platforms of care are being created around new technologies, enabling the growth of health care – everywhere. New patterns in pharmaceutical distribution are also emerging: companies are sidestepping drug supply chain intermediaries and reducing visits to doctors by simplifying prescribing and delivering drugs directly to patients. New companies are emerging that allow patients to order nonemergency medications directly from their computers and phones – for baldness, erectile dysfunction, birth control and other purposes.

Health care will have to reach the patient wherever they are physically located. Patients are accustomed to same-day delivery and on-demand access, similar to the experiences they have in media and retail. Supply chain organizations will have to position themselves as the medium of care delivery and will require innovative solutions for direct-to-consumer deliveries with a more flexible and speedy last-mile process.

Implications for supply chain and logistics:

- Increased pressure to add measurable value
- Higher need for complex logistics and inventory planning
- Increased demand for real-time track and trace, temperature control, time-certain delivery and documentation to ensure compliance

Personalized health care

Consumers are beginning to expect personalized health products and services, and the industry is responding. Health and life sciences organizations are investing now in research to understand what drives individuals' behavior: how engagement styles differ, and how tolerance for risk and uncertainty will impact the effectiveness of various communications. Companies are exploring ways to offer affordable DNA sequencing directly to consumers, opening the doors to truly personalized testing and treatment that could vastly improve patient outcomes for a range of diseases.

These shifts significantly increase the complexity for supply chain companies – and also reflect the value that supply chain companies could provide. Examples include:

- **Managing delivery of gene therapy treatments** – Infusing an immunotherapy "trained" in a lab to recognize and kill cancer cells, and then reinfusing it back into the patient may require five different shipments of three different materials at four different temperatures.[5] Supply chain organizations are uniquely suited for this type of highly specialized and time-sensitive transaction.
- **Micro-tracking and tracing** – Urgent or life-saving medical deliveries may require real-time information to track and trace individual "small" packages, manage time-certain delivery, maintain specialized documentation for compliance and complete other special handling. Logistics and supply chain organizations have an advantage in providing these services, as well as responding to ad hoc demand and managing network inventory.
- **Real-time data** – As reimbursements become more outcomes-based, real-world data will be essential (and will provide a vital source of data to evolving predictive analytic capabilities). Agility and the ability to adapt to increasing decentralization fueled by technologies such as 3D printing will be key.

Implications for supply chain and logistics:

- Increased pressure to add measurable value
- Need for visibility into an end-to-end cold chain service
- Growing interest in various specific services: medication safety and security; "chain of custody" track and trace; temperature monitoring; time-certain delivery; compliance documentation
- More complex logistics and inventory planning, demand forecasting and inventory management

Shift in focus to outcomes

The industry continues to shift from volume to value, largely the result of payers and regulators forcing reimbursement changes from fee-for-service to value-based care, reducing costs while improving quality and outcomes.

Regulatory authorities are implementing new methodologies for better traceability and compliance in the case of medical supplies. For instance, the Drug Supply Chain Security Act (DSCSA) states that by 2023, every entity in the pharmaceutical supply chain will be required to participate in an interoperable tracking system, and every individual unit (i.e., a pill bottle) will need to be traceable from start to finish. Similarly, by February 2019, the Falsified Medicines Directive (FMD) requires every prescription drug sold in the European Union to have an anti-tampering device and its own unique identifier in machine- and human-readable forms.

The significant cost and capital associated with the physical supply chain means health care organizations are asking for more transparency on costs and looking for partners able to help them deliver on the value promise. According to a survey by Premier Inc., 73% of hospitals and health systems leaders surveyed are interested in value-based contracting in the health care supply chain.[6]

Implications for supply chain and logistics:

- Increased demand for home delivery
- Emerging need for predictive analytics to anticipate consumer needs
- Higher level of focus on safety, quality and compliance
- Required investment in cybersecurity to protect customers' privacy

Convergence: everyone is a health company

A plethora of non-health companies are entering the health industry as technology, data and consumer demand reshape how value is defined and captured. Weekly announcements of new acquisitions, mergers or partnerships underscore the interconnectivity of this continuous drive to orchestrate change.

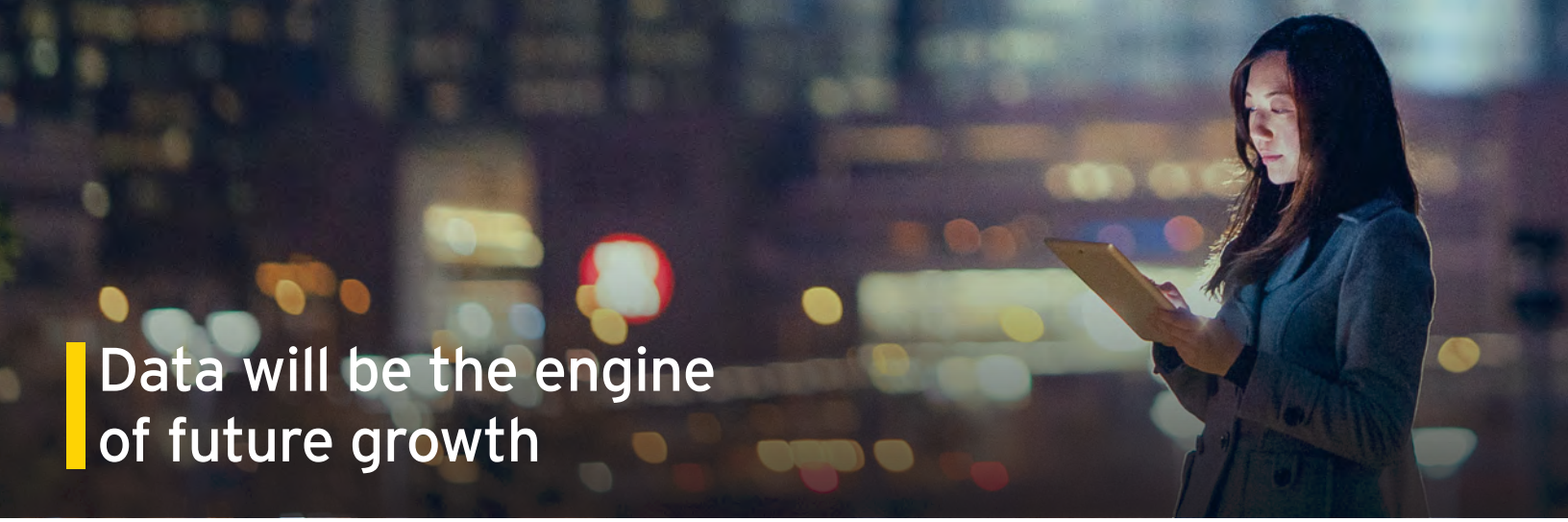
This "convergence" of nontraditional companies in the health field creates both opportunities and challenges for supply chain firms. Companies such as Amazon, Lyft and Uber, which already have well-defined supply chain and logistics strategies, must develop new relationships to ensure a continuous supply chain. Other entrants such as those in the fields of technology or wearable devices, may need a full range of logistics and supply chain services. Developing relationships (and partnerships) with the future stakeholders will be important. Other examples include:

- CVS Health, which in 2017 announced its acquisition of Aetna, one of the US' largest commercial insurers
- Five US health systems, led by Intermountain Healthcare, that publicized plans in January 2018 to create their own not-for-profit generics drug business
- Apple revealed a new feature to make individual health records accessible on the iPhone
- Amazon, Berkshire Hathaway and JPMorgan Chase, which announced a partnership to tackle rising health care costs for their US employees

These partnerships have been formed to change the way care is delivered today. They bring opportunities for supply chain companies to meet the capability gaps of new entrants.

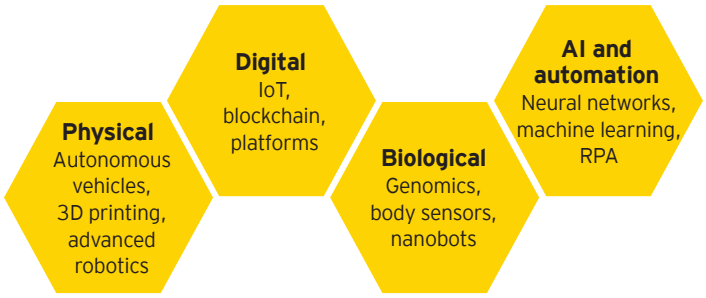
Implications for supply chain and logistics:

- Increased competitiveness
- New opportunities for data aggregation and insight sharing
- Deeper connections between stakeholders and customers, creating competitive advantages
- Partnerships with providers to link supplies and outcomes, providing greater insight into value and costs



Data will be the engine of future growth

Blending health care expertise with network and platform capabilities is proving to be a critical type of convergence between traditional and nontraditional players. Fusing the physical, digital and biological worlds is redefining innovation and blurring the traditional lines between industries.[7] In today's fluid environment, every company developing health care products and services is a data company, and therefore a technology company. Likewise, every technology company with access to health-related, consumer-generated information is a health care organization.



In fact, most of what influences health happens outside of medical practice. For health consumers, true value will come from integrating clinical and nonclinical data (lifestyle, environmental, genetic, etc.) enabled by mobile connectivity, inexpensive cloud storage, wearable and durable environmental sensors, and portable medical devices. Already, zettabytes of information are being collected across the supply chain, and every day, 750 quadrillion bytes of health care data are generated.[8]

This explosion of new types of data — and vastly more of it — will give supply chain organizations an opportunity to help clients sift through the noise. Predictive analytics and algorithms are crucial components of the solution, providing a holistic view of a patient's health and logistics needs. Today, organizations are able to predict the date and contents of a patient's next prescription drug order. Supply chain organizations able to effectively use, leverage and deliver on this type predictive data analysis will have an advantage in adding clear value. Customers will be focused on improving patient outcomes and safety, and on making better critical-care decisions. The ability to access, aggregate and analyze this data will help supply chain organizations stay ahead of the curve.

Health and life sciences supply chain areas where new age digital enablers are having an impact

IoT	Blockchain	Big data, advanced analytics and artificial intelligence	Robotic process automation	Cloud-based platforms and trading networks
▸ Shop floor visibility ▸ Real-time cold chain monitoring ▸ Smart packaging ▸ Product integrity and traceability	▸ Label management ▸ Prescription identity management ▸ Drug-quality tracking and verification	▸ Demand and inventory visibility ▸ Freight analytics ▸ Drug delivery optimization ▸ Network optimization	▸ Inventory management ▸ Work-order management ▸ Freight management ▸ Returns processing ▸ Contract management	▸ Integrated supply chain network ▸ End-to-end visibility

Optimizing the health supply chain and logistics of today

Many existing supply chain and logistics techniques and capabilities could immediately be deployed to increase efficiency for health organizations. Examples include:

- **Tighter control of inventory and delivery** – According to a recent Cardinal Health survey of surgical staff and hospital supply chain decision-makers, 27% of the respondents have seen or heard of expired product being used on a patient, and 23% knew of cases where a patient was harmed because of a lack of necessary supplies.[9] Supply chain providers and drug manufacturers are using big data and analytics to identify where and when deviations in temperature control are most likely to occur – in packaging, during cargo inspections or through any other exposure.
- **Optimizing environment control during transit** – Supply chain and logistics companies are helping global pharmaceutical companies alleviate losses stemming from temperature variations during product transit – an issue that costs them more than US$15 billion each year.[10] Supply chain organizations are using historical data to deploy optimal packaging designs and use cold chain facilities and transportation. Using advanced algorithms to mine real-time data, they can spot specific shipments where intervention is required immediately to save the product.
- **Providing visibility throughout the distribution chain** – A German life sciences group has launched an effort to automate its supply chain planning process, developing a self-driving supply chain powered by artificial intelligence.[11] The company is deploying "sensors" coupled with machine learning programs throughout its supply chain to gather data about inventory distribution practices and availability for every SKU, providing end-to-end visibility and improving agility in inventory and distribution processes.
- **Improving customer demand predictions** – A leading independent pharmacy distributor in the US has deployed an AI-driven data analytics platform on top of its existing cloud-based data warehouse. The technology has helped the company improve its customer service – and allowed it to reallocate supply chain staff from repetitive tasks to more-value-added activities, reducing its working capital.

Customer engagement

- Developing platforms to interface directly with (and facilitate communication between) physicians, patients, distributors, hospitals and pharmacies for ordering, logistics, services and communication
- Creating secure and authenticated distribution channels (direct to hospitals, pharmacies, patients)
- Developing innovative product packaging (e.g., cost-effective, customer-centric and compliant with regulations)
- Creating a transparent mechanism that provides cost visibility to customers

Personalization

- Real-time tracking of chain of custody that meets or exceeds current regulatory, moral and ethical standards
- Enabling personalized medicine through upstream sample collection and downstream delivery
- Seamless and real-time integration with third-party systems

Data literacy

- Ability to capture and analyze structured and unstructured data to optimize performance and predict demand
- Capabilities to combine and use data from within and outside of the organization

Success hinges on coordination across an ecosystem of assets, partners and collaborators

Building a strategy for a wellness- and prevention-focused future

Although supply chain and logistics organizations are delivering services of clear value now to the health industry, future innovations are required to respond to the changes and the opportunity. Innovation efforts must focus on wellness and prevention outcomes – with a high degree of personalization – and be fueled by data. (See our life sciences publication When the human body is the biggest data platform, who will capture value?).

The disruption is real – and the solution multifaceted

According to the 2018 *EventWatch Supply Chain Disruption Report* by Resilinc, supply chain disruptions are at the highest rate in three years, with change coming from all directions – customers, consumers, regulators and other industry stakeholders.[12] The good news? Supply chain strategies and services are now seen by many companies as a differentiator, needed to effectively compete in the market.

Supply chain and logistics companies are responding to the call, moving from a linear model of bringing products and services to a dynamic model one where data resides in the cloud and is accessible to relevant stakeholders to act upon simultaneously when events occur. Specific drivers of innovation include:

Consumer demand driving speed and agility – New consumer habits and expectations are increasing the speed of orders.

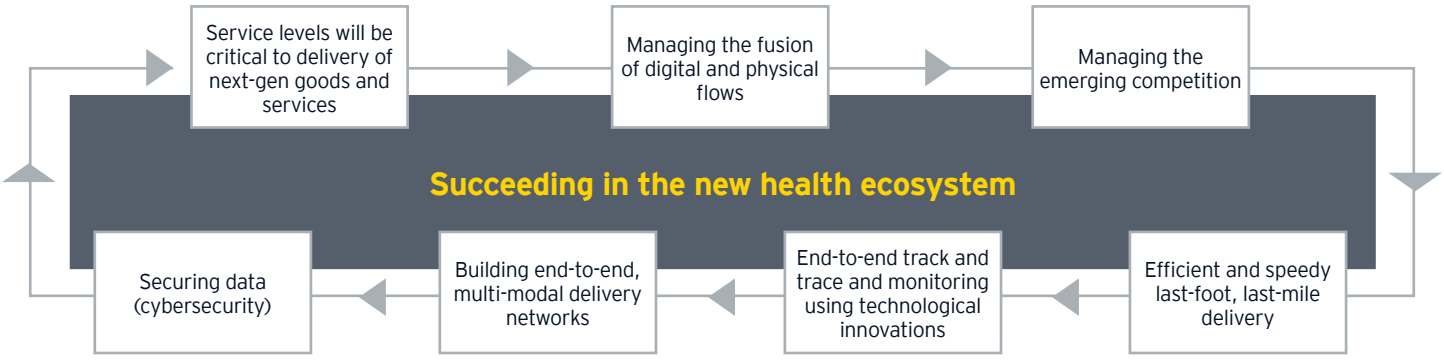
Value for cost – Buyers are pressuring the supply chain to perform financially in terms of costs and working capital.

Collaboration is key – To ensure service at critical "moments of truth" across the patient experience, supply chain companies must closely collaborate with health providers and payers to improve the safety, quality and outcomes of care delivery and assist with documenting compliance to protocols.

Supply chain and logistics are at the core of "anytime, anywhere" delivery

Managing the information supply chain flowing alongside the physical supply chain will be key. As data emerges as a critical corporate asset needed to realize savings and help explore new sources of revenue, supply chain companies are well positioned to master the art of predicting demand-and-supply fluctuations. A decentralized health ecosystem demanding real-time delivery means supply chain organizations will be at the center of a drive to the right integrate, aggregate, and analyze internal and external data. These predictive analytics will help develop accurate forecasts, minimizing inventory shrinkage or wastage.

Further, as the focus shifts from disease management to prevention, communication and collaboration with consumers will begin much sooner and be of a different nature, such as sending personalized food and supplements, or directly providing medicine and medical supplies, reusable sensors, diagnostic equipment or biological samples. This move is accelerated by health and life sciences organizations looking to practice "disintermediation"



(bypass wholesale) through just-in-time delivery of medical devices and surgical equipment. For supply chain organizations, this means increased demand for just-in-time responsiveness, agility and immediacy and documentation. Collaboration examples include:

- A British life sciences organization that is partnering with Alibaba to safeguard the medical supply chain and improve disease education and chronic disease management
- Mercy's supply chain arm and ROi, which are virtually collaborating to find ways to efficiently deliver supplies to patient homes[13]
- The formation of a consortium of drug companies, drug distributors and technology players to explore the use of blockchain technology

Leveraging data

Managing the information that flows alongside the physical supply chain will be the key to success. How supply chain companies use the huge new volume and variety of data will be a major strategic differentiator — especially with regard to patient safety, compliance and privacy. Here are a few expected trends:

- Data used as a corporate asset to realize savings as well as explore new sources of revenue
- Leveraging data (integrating, aggregating and analyzing) — to predict demand-and-supply fluctuations for decentralized delivery in real-time
- Predictive analytics used to develop accurate forecasts, minimizing inventory shrinkage or wastage
- Using predictive analytics to determine needs and timing of portable, reusable medical devices and services by geography and specific populations (e.g., elderly diabetics)
- Investments in data integration capabilities to ensure real-time data flows to support on-time deliveries
- Developing capabilities around direct-to-consumer integration with at-home robotics (e.g., Alexa, Google Home)
- Managing and owning data from home delivery lenses and sensors

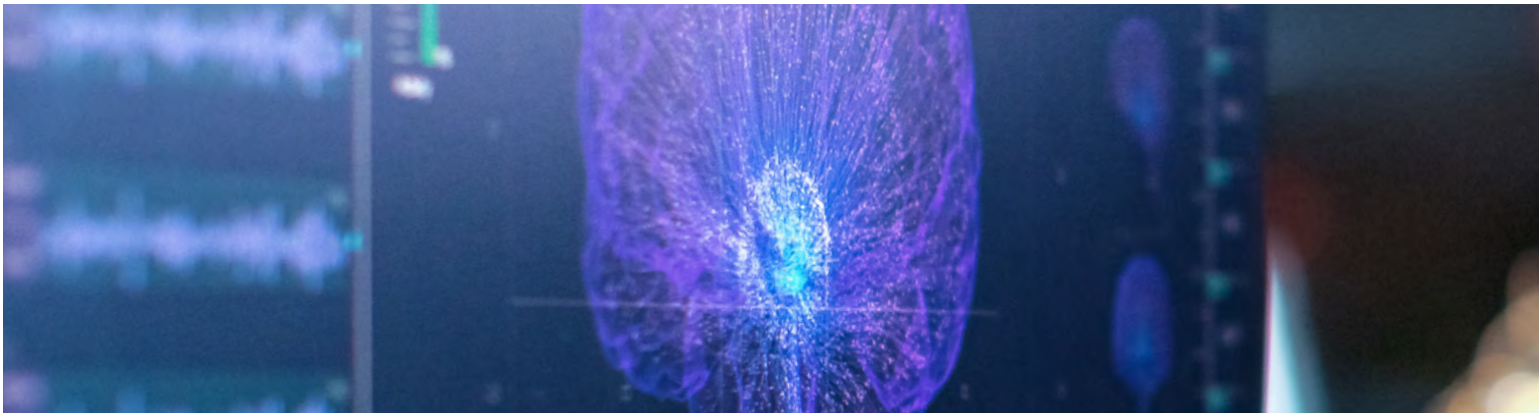
Securing data

As the proliferation of data and use of digital technologies increase in the health care supply chain, companies must prepare to address cybersecurity risks. As more sensors and devices connect to health and wellness platforms, there will only be more vulnerable entry points. Viewing cyber attacks as a critical business risk and implementing appropriate security and privacy policies can prevent both targeted and untargeted attacks. As business models evolve in the health logistics space, supply chain and logistics companies need to keep the focus on both securing current operations and developing a solid prevention and cybersecurity plan to address the new risks.

Managing the emerging competition

The old supply chain model of "stack-it-high" services delivered to a hospital or diagnostics center is being replaced by home delivery, order and pickup at store or delivery station, and other models. Recent entrants to the market have new supply chain models designed expressly to align with consumer needs. These firms make advanced products available quickly with limited capital investment and are utilizing their own storage facilities, delivery capabilities and supply chains.

Supply chain companies could learn from this and other industries to reinvent their core offerings, garnering ideas on how to respond to the shifting, decentralized care delivery model. Retailers, PBMs and grocers are providing consumers with faster, more efficient and more scalable solutions for same-day, last-mile deliveries. New delivery service companies, such as Roadie, are providing "on-the-way" delivery service that puts extra space in passenger vehicles to work by connecting people with items to send with drivers heading in the right direction. These examples illustrate the new thinking supply chain organizations must adopt to flexibly and effectively respond to new demands in care delivery.



Keeping an eye on compliance

Regulatory scrutiny on safety and compliance is increasing with the emergence of new business and care delivery models. Since regulations differ in each country, compliance is a complex problem for supply chain organizations. For instance, in the EU, 80% of pharmaceutical products require temperature-controlled transportation.[14] Possible supply chain solutions for complying with regulations, improving assets planning and utilization, and reducing bottlenecks include:

- Temperature monitoring and location to offer end-to-end visibility across the supply chain
- A distributed ledger system combined with other technologies, such as IoT, to provide a real-time track-and-trace and secure documentation of storage temperatures at every point in a product's journey
- Increased transparency regarding product genealogy
- The ability to flex delivery through various identification technologies and processes, cloud platforms, analytics and cross-entity trust schemes; for example, sensors could measure localization, acceleration, humidity and temperature and communicate automatically with a reviewer unit to share data remotely
- Tracking inventory in motion
- "Just-in-time" delivery of medical devices, surgical equipment and even health services

Conclusion

Success in the future health ecosystem will come from an agile strategy that combines the ability to become ruthlessly efficient at the business of today while developing capabilities for a consumer-centric, decentralized and data-driven future — and doing so faster than competitors from other sectors. With predictive analytics, robotic process automation and intelligent algorithms, when combined with emerging technologies such blockchain and 3D printing, companies will position supply chain as the backbone of new health ecosystem. The highway of information that runs alongside the supply chain will be invaluable to health stakeholders including drug manufacturers, providers and payers. Harnessing the power of data, the supply chain industry can reshape itself around the empowered patient-consumer.

There are three focal points that serve as key differentiators for supply chain companies. The first is to be an essential part of the decentralized "care anywhere" vision for health. When the consumer is at the center of a vortex of products and offerings, and care is a delivery away, moving upstream of delivery and logistics may be the only way to compete with the juggernauts of online retail. The second is to use the predictive analytics that streamline supply chain processes to help health stakeholders achieve just-in-time delivery with no waste, and provide track-and-trace capabilities that create an auditable data trail. This is also essential to support claims required in any value-based payment model, and it positions supply chain companies to be strong partners of providers, pharmaceutical companies and payers. The third focus is to secure the supply chain and apply that capability to the Internet of Medical Things, including the connected home, wearable sensors and portable medical devices. By building on their strengths and expanding current capabilities in a few areas, supply chain companies can position themselves to be essential players in health.

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