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Perspective

The "Blue-Collar" Robots

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"Blue-collar" robots must reduce cost and improve error rates in hospitals to expand penetration.

Introduction

Although "white-collar" robots from Intuitive Surgical and Stryker MAKO have stolen the headlines due to their marketing clout and potential to achieve consistently reproducible surgical results, their "blue-collar" robotic cousins have toiled for years in the halls of hospitals with minimal fanfare.

But the situation may be changing as companies like Cardinal, McKesson and GE look to introduce – or expand the penetration of – blue-collar robots in hospitals. Pharmacy automation robots have triggered particular interest, given the promise of better outcomes – including reductions in medication errors.

And although white and blue-collar robots operate in different environments, with different expectation levels and different price points, there may be several common denominators – manufacturers for both still need to critically select the right applications (or indications), demonstrate clinical and/or economic value and offer a compelling marketing story that resonates with hospitals and physicians.

Accelerated adoption of blue-collar robotic automation will largely depend on whether hospitals can be convinced the technology addresses their major concerns in a meaningful way, including reducing cost and improving efficiencies, error rates and outcomes. In turn, manufacturers of blue collar robots must deliver on those promises (and reduce their own costs), as they look to expand the number of service robots deployed in US hospitals from about 500 – to what venture capital firms' project to be 10,000 in 2018.

This is the fourth in a series of articles on robotic surgery, other articles include:

- Computer Assisted Surgery: Unintended Consequences
- Chronology of a Transaction: Stryker Corporation, MAKO Surgical and Pipeline Biomedical Holdings
- Robotics: The Latest On The da Vinci Surgical System

What Are Blue-Collar Robots?

Blue-collar robots are typically “service robots”, equipped with a sophisticated brain and an unlimited tolerance for menial tasks, designed to provide reliable delivery and logistics services to various hospital departments, including: pharmacy, laboratory, environmental services, dietary, blood bank and linens/laundry, among others.

Robotics companies are focused on platform’s which automate and manage the internal supply chain logistics of hospitals. For example, one specific robotics company offers a software system used by hospital pharmacies to track and control medication deliveries to ensure chain-of-custody and secure delivery.

What Features Do They Have?

Today’s blue-collar robots are about 7 feet tall, 20 inches wide and weigh approximately 55 pounds. The robots may haul up to 500 pounds and can operate continuously for up to 12 hours through several 12-volt batteries. It takes approximately two hours for a robot’s battery to charge.

Programmers can teach the robot to say hundreds of phrases – and in several languages. The robot also uses warning tones and lights to signal that it is starting, stopping or backing up. When it detects an object or person in its path, the robot stops 18 inches from that obstacle and waits to see if it moves. If the object doesn’t move, the robot gives a verbal command, “Waiting to proceed”. If the obstacle remains after several more seconds, the robot steers around it and continues on its way.

How Do They Know How To Get Around A Hospital?

Some blue-collar robots are autonomous and engineered to be compatible with existing infrastructure. During the installation for one specific robot from Aethon, company personnel constructed a laser map of the hospital floor plan to create pathways and endpoints and set up rules-for-the-road to guide the robot in its travels within a chaotic hospital setting. With this map in memory, the robot uses a scanning laser and 27 infrared and ultrasonic sensors to detect and model the environment in real-time to maintain accurate position and avoid obstacles. The use of odometry, laser sensors and map calculations provides highly accurate navigation – even in tight spaces.

The robot communicates through the hospital wireless system to control elevators, automatic doors, and remote signaling devices as they travel from an originating department to one or multiple departments before returning to a home-base docking station for charging. Through this wireless connection and a full-time Virtual Private Network connection to all hospitals, company support personnel can monitor and see all robot sensor readings in real-time and control and conduct trouble-shooting of the robot remotely.

What Are The Benefits?

The key benefits seem to be reducing costs and improving efficiencies, error rates and outcomes. Blue-collar robots may perform a variety of tasks (politely and on a 24/7 basis) that are labor intensive and cause injuries – such as waste disposal and laundry – or are security sensitive – such as delivery of pharmaceuticals to a nursing ward. As America's elderly population grows, the country's health-care system is facing cost pressures and a potential shortage of doctors and nurses. Many administrators are hoping to delegate some of the less glamorous hospital work onto the robots.

To illustrate, administrators point to a recent Harvard Business School study of nursing workflow indicating that nearly 50% of operational breakdowns are the result of supply problems and inefficiently designed processes. Further, a study by an assistant professor at the University of Arkansas found one University hospital could save as much as $218,000 a year if it replaced 15 human couriers with robots, which would help pay for themselves in just over three years.

As robots politely transport medications, meals, linen, equipment and supplies more safely, securely and promptly – hospital employees can focus on higher-value activities – and hospitals can counteract financial and staffing shortages.

Have The Robots Been A Commercial Success?

To date, robotic couriers have struggled to achieve widespread acceptance in hospitals; as a result, commercial success has been limited. It is estimated that 500 health-care service robots are currently being used in US hospitals.

Adoption to date has generally been limited to academic medical centers and large health systems, which have the scale, budget, and operational mobility to invest in the technology.

What Do The Robots Cost?

Hospitals typically lease or rent the robots with leases available for between $1,500 and $5,000 per month, depending on model and accessories. Purchase price of the robot is between $75,000 and $150,000 each, again depending on model and accessories.

Are There Any Success Stories?

Shock Trauma, located at the University of Maryland Medical Center, has been using a blue-collar robot to streamline the delivery of patient medications to nurses stations and patients more quickly and efficiently. The Manager of Trauma Pharmacy claimed that "when the robot makes deliveries, the pharmacy staff can spend more time preparing medications and answering questions from doctors, nurses and others on the patient care team".

Shock Trauma has designated one specific elevator – not involved in transporting patients – for the robot to use. When the robot arrives at the nurses' station, someone must enter a code to unlock the medication drawers. As an added security measure, each drawer has a specific key, so a nurse can only open the drawer for his or her particular station. One robot also incorporates a fingerprint scanner. Another offers a secure container that can safely transport controlled substances and personal health information. Most robots have an alarm to prevent tampering.

Once the nurse has finished unloading the medications and locking the cart, he or she presses a "Go" button at the top of the robot, and it proceeds on its route. If no one attends to the robot after several minutes, it moves on to its next stop and sends a voice alert back to the pharmacy saying "Delivery not accepted". Pharmacists' then call the nursing station to follow up. The robot automatically locks the drawers if someone forgets.

Shock Trauma's Director of Pharmacy Services claims "with growing personnel shortages in both pharmacies and nursing, we hope the robot can take over some of the load of delivering medications, allowing us to have some time to work on other things". The University of Pittsburgh Medical Center (UPMC) acquired 20 Aethon robots for linen, trash and food services at its Presbyterian and Shadyside hospitals. UPMC's VP of Facilities and Support Services said the hospitals "had high turnover and many worker injuries in those positions". He added, "It's definitely showed a cost savings. They (the robots) are really replacing work that the employees did not enjoy doing. That's why they've been successful".

Silicon Valley's El Camino Hospital deployed 20 Aethon robots when the hospital moved to a larger facility in 2009 – which was less than half as expensive as hiring staff, according to the facility's Chief Of Administrative Services (CoAS). When the five-year lease expires this year, El Camino plans to either buy the fleet or commit to another lease. The CoAS added that "the doctors and nurses love the droids".

Other hospitals who have deployed blue-collar robots include: Florida Hospital in Orlando, Scottsdale Healthcare Shea Medical Center in Scottsdale, Memorial Sloan Kettering Cancer Center in NY, Montefiore Medical Center in NY, The Michael DeBakey Veteran's Affairs Medical Center in Houston, St. Mary's Medical Center in Long Beach, CA

Who Are The Companies Offering Blue-Collar Robots?

- Aethon makes the TUG
- Cardinal Health makes the HelpMate
- California Computer Research makes the RoboCart
- Swisslog Healthcare Solutions/North America makes the RoboCourier
- McKesson makes the Robot-Rx
- GE Global Research is working with the Veteran's Affairs Department to develop an intelligent system that will sort, sterilize and track surgical instruments. Launch is expected in 2015.

Any Potential Applications In Orthopedics?

By using bar-code scanning and RFID, or radio-frequency identification, blue-collar robots may be able to assist orthopedic companies and hospitals in ensuring that implant and instrument systems are inventoried, sterilized, delivered to the operating room in a timely manner, returned to central supply immediately following surgery, and billed.

GE Global Research is currently developing an intelligent system that will – at least initially – sort, sterilize and track surgical instruments.

In addition, telemedicine-based robotic technologies are connecting orthopedic surgeons and patients in ways that previously didn't exist. Beyond simply providing an orthopedic surgeon with the ability to directly interact with patients from virtually anywhere in the world, the "tele-presence blue-collar robots" can also offer real-time access to important clinical data, enabling a range of new workflow improvements for surgeons and nurses. These robots may also be integrated with live patient data from an electronic medical record and can be equipped with the ability to connect with orthopedic diagnostic devices.

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