DEPLOYING AUTONOMOUS ROBOTICS TO SUPPORT STAFF AND CRITICAL OPERATIONS

Ashley Rosier M.A.[1], Aniket Ramekar M.S.[2], Julie Doppler M.H.A.[2], Chris Tourney M.B.A.[2], Jill Ludowese Skinner[2], Christina Kirkham M.S.W.[3], Sarah Yeakel M.H.A.,M.B.A.[4], Stephen Fischer M.H.S.A.[1, 4]

[1]Bold. Forward. Unbound. in Rochester, [2]Strategy Department, [3]Office of Patient Experience, [4]Administrative Services

OBJECTIVES

Healthcare continues to be challenged by staffing shortages, which impact employee safety and the ability to care for patients. Autonomous mobile robots (AMRs) reveal promise in aiding with moving supplies and equipment across healthcare campuses.

Mayo Clinic formed a robotics and automation steering group in 2021 to assume responsibility for facilitating successful implementations throughout the Rochester campus. Robotics implementations, specifically those with the potential to be used for multiple purposes or by multiple departments (such as delivering supplies), require consideration of how the operation will impact the overall larger operational function of the hospital or clinic in which they are deployed. Additionally, Mayo Clinic seeks to implement robotics in a manner which enhances the patient and staff experiences.

ROBOTICS MISSION

To facilitate the successful implementation of robotics and automation throughout Mayo Clinic to support our staff, increase efficiency, improve quality, and optimize human-to-human connections.

ROBOTICS VISION

Enhance the Mayo Clinic patient experience and support Mayo Clinic staff through the innovative use of robotics and automation and to be recognized as a leader in robotic and automation integration in healthcare.

OPERATIONAL OBJECTIVE

Coordinate efforts across Mayo Clinic to establish processes that promote scalability, change management, and staff engagement.

FIGURE 1:
Floor cleaning robot (left) and supply delivery robot (right)

PLANNING

Operational partners were identified across the organization to facilitate coordination and provide direction for this early utilization of AMRs. These partners formed a steering group tasked with developing guidelines, reviewing changes, sharing information, and endorsing recommendations for robotics.

- End users (departments utilizing or interested in robotics)
- Administrative leaders
- Support functions including Information Technology (IT) and Healthcare Technology Management (HTM)
- Risk and Safety

IMPLEMENTATION METHODS

EARLY ROBOTIC USE CASES

Initial use cases were identified across six departments to operate in non-clinical functions, and four early projects were initiated for study in non-clinical functions. These projects were chosen because they represent utilization in non-clinical and clinical spaces, including inpatient and outpatient settings. The projects present an opportunity to evaluate the function of robots but also to understand the specific requirements for safe operation and testing of multiple concepts, and allow for measuring specific outcomes for both results and optimization.

Use Cases and Departments Involved

- Floor cleaning functions in Environmental Services (EVS)
- Food delivery from Food Services
- Equipment and supply transportation with Central Services and Supply Chain Management

ROBOTIC IMPLEMENTATION PROCESS

Initial robotic deployments involved the creation of a comprehensive strategy to enable the exploration and utilization of robotics in a phased approach. In addition to ensuring that the robot functions as described and expected, this strategy is designed to ensure that organizational risks and concerns are studied and mitigated appropriately. The progression of robotics implementations involves transitioning from proof-of-concept to pilot testing, followed by phased deployment implementation and optimization.

PROOF OF CONCEPT (POC)

A set of evaluations aimed at determining the feasibility and viability of a robot, including tests and evaluations to establish core functionality, potential use cases, and exploration of financial and operational implications.

Goals:

- Gain trust from staff, patients, and the public
- Ensure safe operations by assessing and determining guardrails and operational standards
- Inform required facilities and system integration strategies
- Assess Point of Origin (POO) to end user pathways

PILOT

A feasibility study or experimentation that is small-scale and short-term is intended to gather feedback and data on a specific use case. Before committing to a full-scale implementation, the pilot validates processes, workflows, values, risks, and other possible deficiencies.

Goals:

- Evaluate specific use cases (such as delivering specimens to the lab, moving equipment for processing, etc.)
- Prove effective capabilities through testing while maintaining a controlled environment
- Collect and analyze performance data to understand operational impact and prove success
- Identify any unknown or unplanned variables needing to be addressed before implementation

PHASED DEPLOYMENT IMPLEMENTATION

A series of implementations leading up to a large-scale deployment or an iterative roll-out of a large-scale implementation.

Goals:

- Complete deployment in areas required for operational deployment
- Informed deployment planning, including timeline, financial impact, change management, and communication
- Ensure successful implementation and deployment

OPTIMIZATION

Focused efforts on fine-tuning and enhancing various aspects of robotic operations to maximize efficiency, effectiveness, return on investment and overall performance.

Goals:

- Maintain operation of deployments
- Optimize efficiency and effectiveness of deployments through continued improvement
- Improve impact on operational outcomes, including return on investment (ROI)

RESULTS

Random-selection interviews were completed with patients in the cafeteria and lobby space while the robots operated. A total of 63 patient responses have been collected; 31 interviews were completed for the autonomous floor scrubber, and 32 interviews were completed for the food services robot. Completing patient interviews has become a standard part of POCs and pilots. Understanding the patient perception of robot utilization will help determine where early efforts can be focused. Patient perception is a factor in the overall patient experience and perception, and patient perspective on utilization can guide the location and function of early pilots. In addition to the perception of utilization, patients were surveyed about the effectiveness of the robot in performing its function.

FIGURE 2
Patient's physical comfort around robots (n=63)

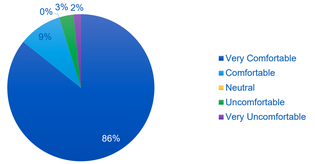


FIGURE 3
Patient's comfort with robotics in healthcare (n=63)

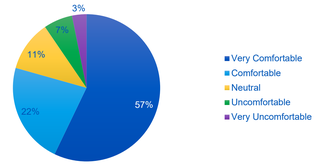


FIGURE 4
Patient perception of concerns with robot use (n=22)

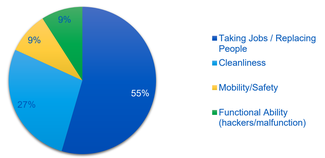


FIGURE 5
Robot impact on mealtime experience (n=32)

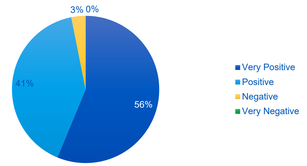
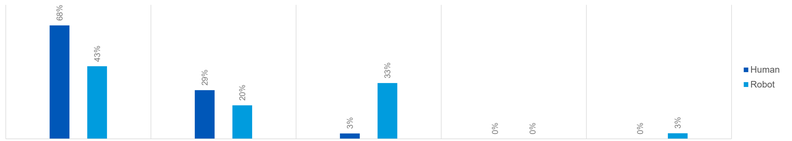


FIGURE 6
Comparison of confidence in cleanliness (n=30)



LESSONS LEARNED

Ongoing robotic POC and pilot testing continues to reveal lessons learned, additional considerations, and many opportunities and possibilities to supplement the healthcare landscape with robotics.

OPERATIONAL IMPACT

Collaborating with staff members to understand workflows before integrating robots is essential. This allows the workflow to be evaluated for efficiency and optimization prior to robotic supplementation. It also allows staff members to participate in the robotic evaluation and testing, assisting with ownership of the new workflow and change management.

A comprehensive testing plan that is created before initiating of POC and pilot testing enables the team to understand the limitations and variations in performance. The steering group has reviewed and evaluated this testing plan, offering multidisciplinary input on test objectives and parameters to ensure alignment. It can be used as a communication tool to share test plans across the organization.

Setting standard operational metrics to be collected across all testing and implementation enables the organization to understand how success and performance can be evaluated. This creates shared ownership in performance and allows each robot and use case to be similarly evaluated in performance and effectiveness.

Determining operational standards, such as no-go zones, travel speed, other safety features, and standard integration features, optimizes the performance of all robots in use. It ensures that any robot operating on campus will function similarly, offering staff and patients confidence that robots are being operated safely.

COMMUNICATION

Identifying stakeholders early in planning and continuing to assess impacted stakeholders as work progresses is essential to successfully notifying and sharing results across the organization. Early stakeholder involvement also aids in identifying potential issues, risks, and concerns early in the planning process, I which proactive mitigation can occur. When testing commences, providing frequent updates on the status and results to the identified stakeholders helps in continued support and issue resolution.

CHANGE MANAGEMENT

Change management is an essential component of success in robotic implementations; therefore, significant effort is required to develop and execute change management plans. Comprehensive training plans are also required to support staff operating robotics, ensuring the basic operational function is well known when issues arise. Staff and patient experience surveys are another element of change management planning that can be utilized to understand sentiment regarding robotics and will drive continuous improvement of workflows and utilization.

FIGURE 7
Food service robots

FIGURE 8
Equipment delivery robot