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B-036 Paving the path for autonomous mobile robots (AMRs) in the clinical laboratory: A pilot study of Collaborative Robotics (Cobot) Proxie robot for cart movement at Mayo Clinic Laboratories

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BACKGROUND: The use of autonomous mobile robots (AMRs) to move materials/supplies is long-standing in manufacturing/warehouse settings and is expanding into hospitals and clinical laboratories. The recently launched Proxie robot (Collaborative Robotics i.e. Cobot) is an AMR that can autonomously move existing carts between defined locations. However, AMRs pose new challenges compared to traditional lab automation. The aims of this study were to: i) perform functional validation to verify Proxie*s manufacturer performance specifications within the laboratory, ii) assess the risk of using Proxie to deliver laboratory specimens, and iii) pilot the use of the Proxie robot to autonomously deliver loaded carts from the Pathology case intake area to the sorting station at Mayo Clinic Laboratories.

METHODS: Functional validation of Proxie consisted of verifying manufacturer's performance specifications for the following robot parameters (5 test runs): maximum speed, emergency-stop, and ability to maintain localization, travel autonomously, stop and/or avoid moving/fixed objects, and park/unpark. Risk assessment for the robotic use case was performed by a multi-disciplinary team utilizing an AMR risk assessment tool developed by the institutional robotics group. Hazards were categorized as mechanical, electrical, noise, ergonomic, environmental, material/substance or combination risks. Injury severity, exposure(frequency), and avoidance scores were assigned to each hazard to determine negligible-, low-, medium-, high- or very high-risk levels. Proxie's workstream was evaluated weekly over four weeks by measuring number of cart deliveries, total time/miles traveled, % autonomous deliveries(goal >80%), % on-time deliveries, average±standard deviation(SD) time (min:sec±min:sec) for delivery/return trips, and dwell times at intake/sorting stations.

RESULTS: Manufacturer's performance specifications were verified in 100% of test runs. Proxie traveled at human walking speed, stopped within 1 second of emergency stop being enabled, maintained localization, and traveled autonomously for =5 consecutive workflow cycles. Proxie navigated through spaces =4' wide along fixed pathways and stopped safely when encountering obstacles. Proxie navigated around people and carts in the main 6' hallway if they were blocking <2' hallway width. For objects blocking >2', Proxie stopped and resumed motion after the object moved. After task completion, Proxie side-shifted into the AMR parking space stopping no closer than 7.8" from any object. Twenty-four potential hazards were identified through the risk

assessment tool with all risk levels scored as negligible or low. Proxie completed 304 cart deliveries/returns operating 17:35 hours and traveling 11.5 miles during the pilot. The % autonomous deliveries for week 1-4 was 82%,88%,91% and 88%, respectively with =99% on-time deliveries. Delivery from pathology case intake to sorting station averaged 5:43±0:25 min and return trips averaged 3:32±0:34. Proxie dwell times were 13:10±0:33 and 37:34±0:23 min at the pathology intake and sorting stations, respectively.

CONCLUSIONS: The Proxie AMR was capable of successfully and autonomously moving carts with laboratory specimens between the pathology intake and sorting stations of the laboratory during the pilot study. Adding Proxie to this workstream translated to eliminating 5,800 steps and 4 hours 24 min of human cart-pushing per week. Incorporating Proxie into laboratory operations as a cart-moving AMR would increase efficiency and allow laboratory staff to focus on technical, non-repetitive work.