

Wheelchair mounted robotic arm – Kinova Jaco2

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Policy contains: Kinova Jaco2, robotic arm.

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Coverage policy

The wheelchair-mounted Kinova Jaco2 robotic arm is investigational/not clinically proven and, therefore, not medically necessary.

Limitations

No limitations were identified during the writing of this policy.

Alternative covered services

Standard wheelchairs.

Background

Since about 2000, robotic arms have been developed to assist patients with upper extremity disorders in completing activities of daily living. Several of these are now commercially available. By 2016, more than 200 units had been sold in more than 25 countries (Campeau-Lecours, 2016). However, many robotic arms use joysticks for control, which only allows patients to perform daily activities on a limited basis (Arif, 2022).

One advanced assisted arm is the Kinova Jaco2, first offered by Kinova, Inc. (Broisbriand, Quebec, Canada) in 2008 (Routhier, 2014). This model is a wheelchair-mounted robotic device weighing 3 kg. The arm is composed of six interlinked segments (corresponding to shoulder, elbow, and wrist), including a three-fingered hand. A joystick or other control interface (e.g., sip and puff, head control, head array) allows the user to move the robot's

hand in three-dimensional space. The user can also modify the orientation of the hand, along with controlling gripping by opening and closing the hand with two or three fingers. An external button may be used to switch between modes of control (Routhier, 2014; Sauzin, 2017).

Tasks such as pushing an elevator button or eating require the user to toggle through multiple modes and access multiple motion commands. The Kinova Jaco2 allows the presetting of positions and trajectories to optimize time and effort needed to complete the task (Campeau-Lecours, 2016).

The Kinova Jaco2 allows the patient more control with normal activities; decreases reliance on others while encouraging self-empowerment; and can lead to improved safety. It is intended for people with disabilities who have limited mobility in their arms and upper extremities and are able physically and cognitively to safely and independently control a motorized wheelchair through a joystick, head-mounted control, or other technological controls (Kinova Robotics, 2024)

Findings

Guidelines

No guidelines from professional medical societies specifically mention the Kinova Jaco2 robotic arm.

Evidence review

The evidence consists of small case series of mobility and user satisfaction with the Jaco robotic arm. An early study of the Jaco robotic arm (n = 31) showed most participants could accomplish tasks on their first attempt, and that caregiving time could be reduced by 41% (Maheu, 2011).

A study (n = 14) of persons with upper body disabilities using the Jaco robotic arm found a reduction of 72% in time needed to perform activities, along with improvements of 2.3 and 2.9 on a seven-point Likert scale for perceived ease of use and usability, respectively. Authors conclude that Jaco could produce significant improvements in performing activities of daily living (LeBrasseur, 2021).

A study (n = 7) found that upper extremity performance to accomplish certain life habits improved after long-term use with Jaco. Authors determined satisfaction among users was high, psychosocial impacts were positive, and impacts on family caregivers were slight (Beaudoin, 2019). The same research team had assessed 36 studies of robotic arms (Kinova Jaco and others) in terms of self-care, productivity, and leisure, finding mostly positive impacts (mean quality score 8.8 of 15) (Beaudoin, 2018).

A survey found 31% (n = 29) of 93 occupational therapists had recommended wheelchair-mounted robotic arms; of these, 26 of 29 were the Jaco robotic arm. Barriers to recommendations commonly cited include limited funding, lack of training and knowledge, and resource constraints (Bourassa, 2023).

Interviews with Kinova Jaco users identified use of the joystick to be a key problem in terms of time and cognitive load. Mode switching was a particular problem, consuming 17.4% of execution time for able-bodied users controlling the Jaco (Herlant, 2016).

Laser pointer interactions, allowing wheelchair-bound patients with upper body disabilities to point out objects and pick them up, were the subject of experiments using a Kinova Jaco robotic arm. Average time consumption of the pose generation was reduced from 5.36 to 4.43 seconds, and synchronously, the pose estimation error was reduced from 21.31% to 3.91% (Zhong, 2019). A review showed the rate that a laser pointer correctly selected the desired object ranged from 92% to 99% (Liu, 2023).

In 2024, we found no newly published relevant literature to add to the policy. No policy changes are warranted.

References

On August 6, 2024, we searched PubMed and the databases of the Cochrane Library, the U.K. National Health Services Centre for Reviews and Dissemination, the Agency for Healthcare Research and Quality, and the Centers for Medicare & Medicaid Services. Search terms were “Kinova Jaco2” and “robotic arm.” We included the best available evidence according to established evidence hierarchies (typically systematic reviews, meta-analyses, and full economic analyses, where available) and professional guidelines based on such evidence and clinical expertise.

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Policy updates

8/2022: initial review date and clinical policy effective date: 9/2022

8/2023: Policy references updated.

8/2024: Policy references updated.