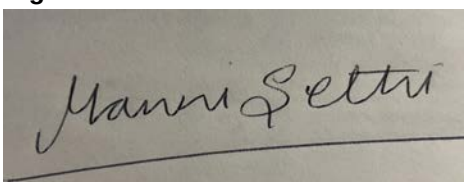
Prior Authorization Review Panel
MCO Policy Submission

A separate copy of this form must accompany each policy submitted for review.
Policies submitted without this form will not be considered for review.

Plan: AmeriHealth Caritas Pennsylvania Community Health Choices	**Submission Date**: 9/1/2023
Policy Number: CCP.1520	**Effective Date:** 9/2022 **Revision Date:** August 1, 2023
Policy Name: Wheelchair mounted robotic arm – Kinova Jaco2	
Type of Submission – Check all that apply: **New Policy** **X Revised Policy*** **Annual Review – No Revisions** **Statewide PDL**	
***All revisions to the policy must be highlighted using track changes throughout the document.** **Please provide any clarifying information for the policy below:** See tracked changes below.	
Name of Authorized Individual (Please type or print): Manni Sethi, MD, MBA, CHCQM	**Signature of Authorized Individual:** 

Wheelchair mounted robotic arm – Kinova Jaco2

Clinical Policy ID: CCP.1520

Recent review date: 8/2023

Next review date: 12/2024

Policy contains: Kinova Jaco2, robotic arm.

AmeriHealth Caritas Pennsylvania Community HealthChoices has developed clinical policies to assist with making coverage determinations. AmeriHealth Caritas Pennsylvania Community HealthChoices' clinical policies are based on guidelines from established industry sources, such as the Centers for Medicare & Medicaid Services (CMS), state regulatory agencies, the American Medical Association (AMA), medical specialty professional societies, and peer-reviewed professional literature. These clinical policies along with other sources, such as plan benefits and state and federal laws and regulatory requirements, including any state- or plan-specific definition of "medically necessary," and the specific facts of the particular situation are considered by AmeriHealth Caritas Pennsylvania Community HealthChoices when making coverage determinations. In the event of conflict between this clinical policy and plan benefits and/or state or federal laws and/or regulatory requirements, the plan benefits and/or state and federal laws and/or regulatory requirements shall control. AmeriHealth Caritas Pennsylvania Community HealthChoices' clinical policies are for informational purposes only and not intended as medical advice or to direct treatment. Physicians and other health care providers are solely responsible for the treatment decisions for their patients. AmeriHealth Caritas Pennsylvania Community HealthChoices' clinical policies are reflective of evidence-based medicine at the time of review. As medical science evolves, AmeriHealth Caritas Pennsylvania Community HealthChoices will update its clinical policies as necessary. AmeriHealth Caritas Pennsylvania Community HealthChoices' clinical policies are not guarantees of payment.

Coverage policy

The wheelchair-mounted Kinova Jaco2 robotic device 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

Beginning in 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, over 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 can be used for conditions including:

- Amputation.
- Amyotrophic lateral sclerosis.
- Cerebral palsy.
- Muscular dystrophy.
- Quadriplegia.
- Spinal cord injury.
- Spinal muscular atrophy.
- Stroke (Kinova Robotics, 2023).

Findings

No guidelines from professional medical societies specifically mention the Kinova Jaco2 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, 2021).

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).

A clinical trial (n = 20) comparing joystick with vocal control in users of the Kinova Jaco2 with muscular dystrophy was conducted in 2019 - 2020, but the trial is not randomized, and no results are published (National Institutes of Health, 2020).

References

On May 22, 2023, 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.

Arif Z, Fu Y. Mix frame visual servo control framework for autonomous assistive robotic arms. *Sensors (Basel)*. 2022;22(2):642. Doi: 10.3390/s22020642.

Beaudoin M, Lettre J, Routhier F, Archambault PS, Lemay M, Gélinas I. Impacts of robotic arm use on individuals with upper extremity disabilities: A scoping review. *Can J Occup Ther*. 2018;85(5):397-407. Doi:10.1177/0008417418820878.

Beaudoin M, Lettre J, Routhier F, Archambault PS, Lemay M, Gélinas I. Long-term use of the JACO robotic arm: A case series. *Disabil Rehabil Assist Technol*. 2019;14(3):267-275. Doi:10.1080/17483107.2018.1428692.

Bourassa J, Faieta J, Bouffard J, Routhier F. Wheelchair-mounted robotic arms: A survey of occupational therapists’ practices and perspectives. *Disabil Rehabil Assist Technol*. 2021 Dec 22;1-10. Doi: 10.1080/17483107.2021.2017030.

Campeau-Lecours A, Maheu V, Lepage S, Lamontagne H, Latour S, Paquet L, Hardie N. JACO assistive robotic device: Empowering people with disabilities through innovative algorithms. https://www.resna.org/sites/default/files/conference/2016/other/campeau_lecours.html. Published 2016.

Herlant LV, Holladay RM, Srinivasa SS. Assistive teleoperation of robot arms via automatic time-optimal mode switching. *Proc ACM SIGCHI*. 2016;35-42. Doi: 10.1109/HRI.2016.7451731.

Kinova Robotics. Robotic arm: Enabling new possibilities. https://assistive.kinovarobotics.com/product/jaco-robotic-arm. Published 2023.

Lebrasseur A, Lettre J, Routhier F, Archambault PS, Campeau-Lecours A. Assistive robotic arm: Evaluation of the performance of intelligent algorithms. *Assist Technol*. 2021;33(2):95-104. Doi:10.1080/10400435.2019.1601649.

Liu Y, Liu Y, Yao Y, Zhong M. Object affordance-based implicit interaction for wheelchair-mounted robotic arm using a laser pointer. *Sensors (Basel)*. 2023;23(9):4477. Doi: 10.3390/s23094477.

Maheu V, Frappier J, Archambault PS, Routhier F. Evaluation of the JACO robotic arm: Clinico-economic study for powered wheelchair users with upper-extremity disabilities. *IEEE Int Conf Rehabil Robot*. 2011;2011:5975397. Doi:10.1109/ICORR.2011.5975397.

National Institutes of Health. LARA: Use of JACO2 controlled by joystick or by voice control system, in muscular dystrophy. Clinical Trial Number NCT04313049. https://clinicaltrials.gov/ct2/show/study/NCT04313049. Last updated published March 2020.

Routhier F, Archambault P, Cyr M-C, Maheu V, Lemay M, Gélinas I. Benefits of JACO robotic arm on independent living and social participation: An exploratory study. Rehabilitation Engineering and Assistive Technology Society of North America. https://www.resna.org/sites/default/files/conference/2014/PDF%20Versions/Robotics/Routhier.pdf. Published 2014.

Sauzin D, Vigouroux N, Vella F. Usability of JACO arm interfaces designed with a user-centred design method. *Stud Health Technol Inform*. 2017;242:573-582. https://pubmed.ncbi.nlm.nih.gov/28873855/.

Zhong M, Zhang Y, Yang X, et al. Assistive grasping based on laser-point detection with application to wheelchair-mounted robotic arms. *Sensors (Basel)*. 2019;19(2):303. Doi: 10.3390/s19020303.

Policy updates

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

8/2023: Policy references updated.