

# COACH Prompting System

## An Efficiency Study

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The global number of people diagnosed with dementia, particularly Alzheimer's disease, will increase from 24.3 million in 2006 to 81.1 million by 2040. People who have dementia may require constant assistance from a caregiver when trying to complete activities of daily living (ADL).

Many older adults prefer to age-in-place, which is a term used to mean that they remain in their own homes or communities compared to other forms of care such as nursing homes. However, this type of care means that family members or caregivers are being depended upon to attend to the long-term health-care needs of the older adults with dementia. To support aging-in-place, older adults and their caregivers rely heavily on the use of computerized Cognitive Assistive Technologies (CATs) to complete ADL. CATs are often paired with a form of artificial intelligence that tries to support cognitive disorders; in doing so it enhances the patient's independence and reduces the caregiver's assistance.

There have been multiple studies done to assist people with dementia while reducing the constant assistance from a caregiver. This study examines the efficiency of a computerized device called COACH (Cognitive Orthosis for Assisting aCtivities in the Home). This device uses artificial intelligence to autonomously help dementia patients through ADL using verbal and/or visual prompts. Hand washing was chosen as the target ADL because it's a safe activity that older adults with dementia have difficulties completing due to required planning and initiation skills.

Hand washing was determined to have five essential steps to be accomplished in order to be considered successful. The COACH system is set up using four integrated components: the tracking system, belief monitoring system, policy, and prompting system. It works by taking the images captured by the camera, translated by the tracking system, and then the hand and towel positions are passed to the belief monitoring system. A probabilistic estimation of the current state of the user is called the belief state which is formed by the belief monitoring system. Then, the belief state is translated by the policy into an action for COACH to take. There are different levels of prompting

assistance which give COACH the ability to select the best support for each individual. This level of detail played for the patient is based on error committed, cognitive and sensory status of the patient, and past responsiveness to the earlier prompts.

The study was conducted in a controlled washroom that was fitted with a wall-mounted 21-inch LCD screen and desktop speakers, a ceiling-mounted IEEE-1394 digital video camera (Point Grey Research DragonFly2, a Dell Latitude laptop computer, and a camcorder positioned above the patient to capture video for post-trial evaluation. Trials consisted of one trial per day per patient, for 8 weeks, occurring Mondays through Fridays, for a total of 40 trials each. Older adults with moderate to severe dementia participated in this study. Patients were required to sit in a wheelchair and were taken to the test washroom by a caregiver. The caregiver then positioned the patient in front of the sink and asked the patient to wash their hands. The COACH system then prompted the patient to wash their hands.

The data was collected and analyzed to examine the impact of COACH on the participants' independence and the COACH's overall performance for the activity of hand washing. Patients were able to independently complete an average of 11% more hand washing steps and require 60% fewer interactions with the caregiver when using the COACH prompting system. Four of the patients achieved complete or very close to complete independence. About 78% of COACH's actions were considered clinically correct. In conclusion, the COACH prompting systems showed promise as a tool to help older adults with moderate to severe cases of dementia. Overall, these results showed the need for personalization in devices designed to assist older patients with dementia.

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[1] Mihailidis *et al* "The COACH prompting system to assist older adults with dementia through hand washing: An efficacy study." *BMC Geriatrics*. 2008 November 7; 8(28).