Background: Epidemiology of bathing disability

The ADL item “Bathing” includes the use of a bath tub or a shower as well as taking a complete sponge bath. Bathing disability is defined as need of help from another person (Katz et al. 1963). For persons aged 70 years and older 12.7% (Lazaridis et al. 1994), for persons aged 85+ living at home 21% (Dawson et al. 1987), in institutionalized persons 90% receive help with bathing (Wiener et al. 1990). Bathing represents a most complex ADL, and thus is among the first to be lost within the ageing process (e.g. Katz et al. 1963; Siu et al. 1997). The total incidence of bathing disability is 29.9% in women and 25.0% in men in an aged population. Only incidence rates of walking disabilities are higher (Dunlop et al. 1997).

I-Support: Main objectives

- Developing an ICT-supported service robotics system assisting people with bathing disability to safely enter and exit the shower environment and most importantly to safely, effectively and independently perform the complete sequence of bathing activities (i.e. rinsing, soaping, scrubbing, drying) of all body regions respecting their functional capacity, privacy and dignity.
- Validation of system functionalities with a focus on the application and human-robot-interaction in a geriatric setting.

Clinical Model of User Requirements

<table>
<thead>
<tr>
<th>Age</th>
<th>Disease</th>
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Impairments

- Mental Functions
  - Orientation (b114)
  - Memory (b140)
  - Attention (b144)
  - Language (b152)
- Neuro-musculoskeletal Functions
  - Mobility of bone functions (b720)
  - Mobility of joint functions (b210)
  - Proprioceptive functions (b260)
- Sensory Functions
  - Visual functions (b520)
  - Hearing functions (b570)
  - Temperature and other stimuli (b620)
  - Pain (b670)

Limitations

- User requirements
  - Cognitive assistance
  - Shower assistance
  - Motion control of the soft arm
  - Transfer assistance
  - Processor assistance

User requirements

- Motorized chair
  - with three degrees of freedom
  - as modification of the Pressalt chair
- Robotic shower
  - with two identical soft-arms
  - and different magnetic end effectors
- Kinect V2 sensors
  - Human and robot pose estimation
  - Gesture recognition
- Audio sensors (microphones)
  - Vocal human-robot interaction
- ATI force sensors (Nano 17)
  - Forces human-robot-interaction
- Cube sensor
  - Context awareness
- Amphi
  - Context awareness (water flow)
- Smart watch
  - Context awareness (user)

Summary

- The ICF is an international well-established and comprehensive model to define user requirements and assistive functionalities for ambient assisted living tools based on the recent functional capacity and needs of users.
- This clinical model will be enhanced by specific ethical and/or cultural user attitudes and user behaviors.

References


Technical configuration of the I-Support bath robot

- Motorized chair
  - with three degrees of freedom
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