

The Usability and Feasibility of Augmented Reality for Home Hospital

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With minimal training, older adults with no prior augmented reality (AR) experience were able to use an AR headset and complete healthcare-related tasks at home, experiencing a low task load and a positive user experience.

Background

The home hospital (HH) model faces challenges with scalability and resource intensive in-home personnel demands.

Augmented reality (AR), which superimposes computer-generated graphics onto the user’s visual field, has potential to facilitate superior remote care and heighten collaboration among patients, clinicians, and caregivers.

Although studied in medical education and surgery, the application of AR in the home and in HH remains largely unexplored.

Study Aims:

- Usability**
Examine the use of AR hardware and software among older adults.
- Feasibility**
Assess patient performance during basic healthcare simulations.
- Acceptability**
Evaluate patient experience associated with home AR simulations.

Methods

We recruited local older adults with recent hospitalizations or significant medical comorbidities. AR tasks were developed using the Microsoft HoloLens®2 headset. Study visits were completed at home using the headset linked to a 4G hotspot. Data collection included electronic health records and the eHEALS, EQ-VAS, and PRISMA-7 questionnaires. The feasibility and usability of AR were evaluated using participant feedback and the HEALTH-ITUES, NASA-TLX, UX Evaluation Usability questionnaires.

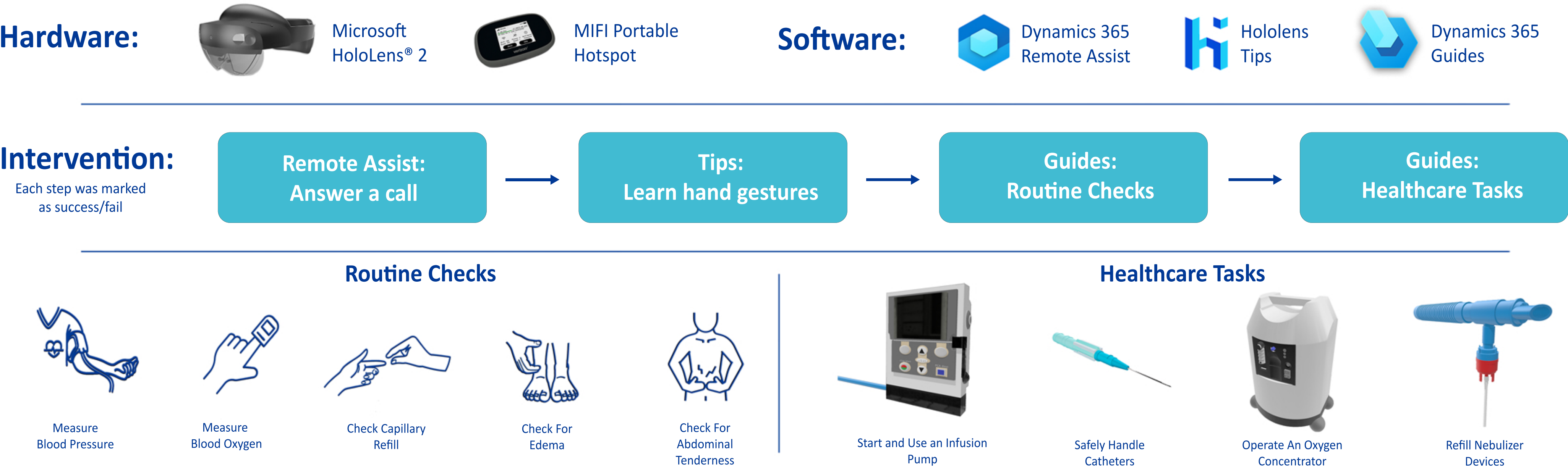


FIGURE 1. Participant answering a call using Remote Assist.

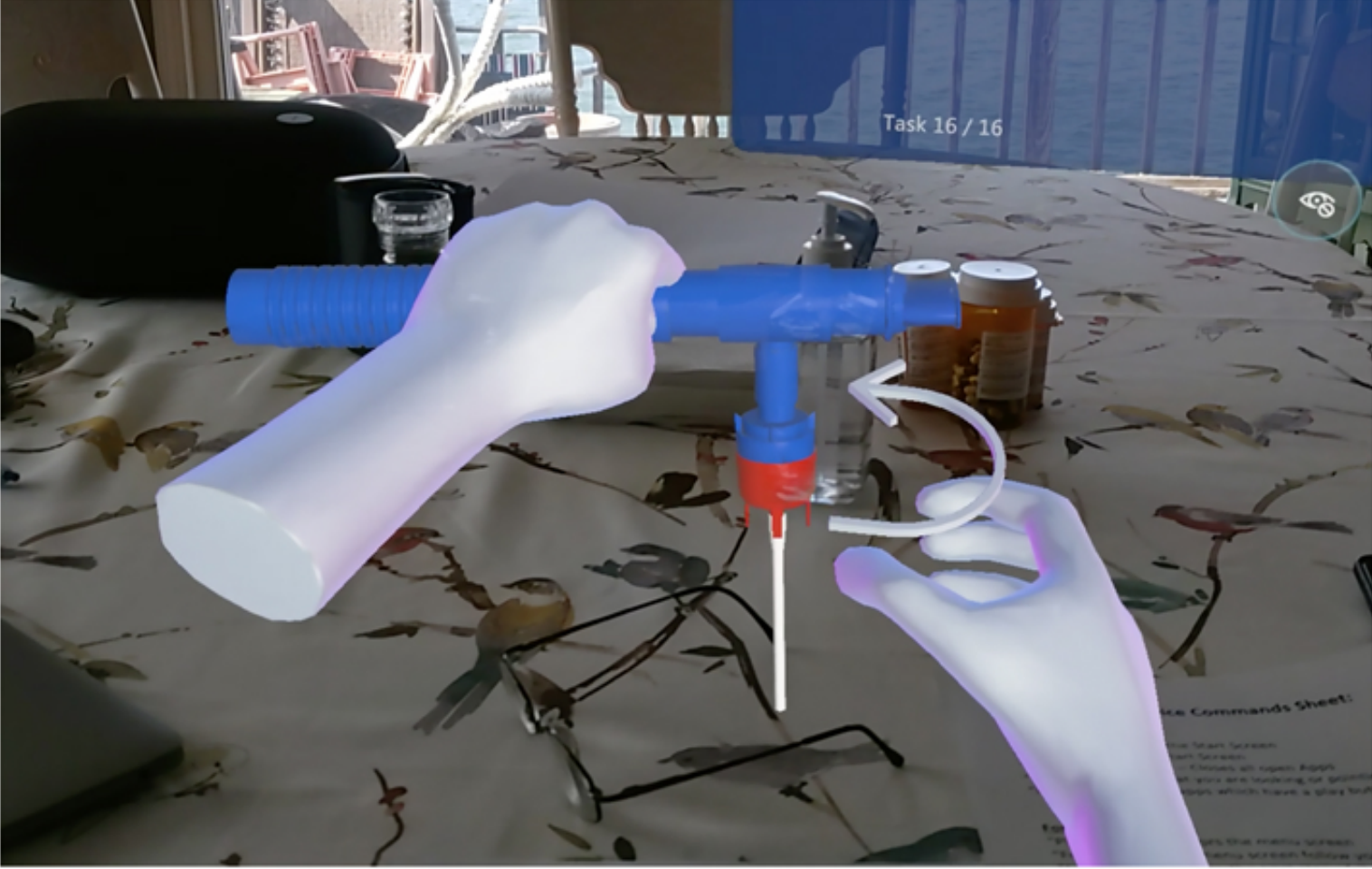


FIGURE 2. Dynamics 365 Guides holographic tutorial on refilling a nebulizer.

Results

Table 1. Demographics and Characteristics of Participants	Total n = 50
Age - Median (IQR)	72.5 (11.75)
Female, n (%)	34 (68)
Race	
White, n (%)	29 (58)
Black, n (%)	6 (12)
Latin@, n (%)	9 (18)
Asian, n (%)	1 (2)
Multi/Other, n (%)	5 (10)
Spanish Speaking, n (%)	12 (24)
Education	
Highschool or Lower, n (%)	22 (44)
Less than 4 years College, n (%)	8 (16)
4 years College or more, n (%)	20 (40)
Uses the Internet, n (%)	34 (68)
Uses a mobile device, n (%)	47 (94)
Able to download and use apps on mobile device, n (%)	22 (47)
EHealth Literacy - eHEALS ¹ Median Score (IQR), n = 34	30 (8)
Number of Comorbid Conditions - Median (IQR)	15.5 (12.5)
Perceived Health Status - EQ-VAS ² Median Score (IQR)	82.5 (15)
Fragility - Prisma-7 ³ Median Score (IQR), n = 49	3 (2)

1 The eHealth Literacy Scale (eHEALS) is a self-report instrument composed of 8 subscales, summarized out of 40, where 40 indicates the highest literacy.

2 The EuroQol Visual Analog Scale (EQ-VAS) is used by patients to rate their overall health, scaled from 0 to 100, where 100 represents best possible health.

3 The PRISMA-7 questionnaire is a screening tool for frailty in older adults, consisting of seven yes/no questions, with a score of ≥3 indicating frailty.

Table 2. HEALTH-ITUES ¹ Adapted for AR	Total n = 50
Scale	Median (IQR)
Impact	5(1)
Perceived Usefulness	5(1)
Perceived Ease of Use	5(1)
User Control	5(1)
Overall Health-ITUES Score	5(1)

1 The Health IT Usability Evaluation Scale (ITUES) is a 20-question scale on a 5-point Likert scale designed to evaluate usability of health technology on 4 scales: impact, perceived usefulness, perceived ease of use, user control.

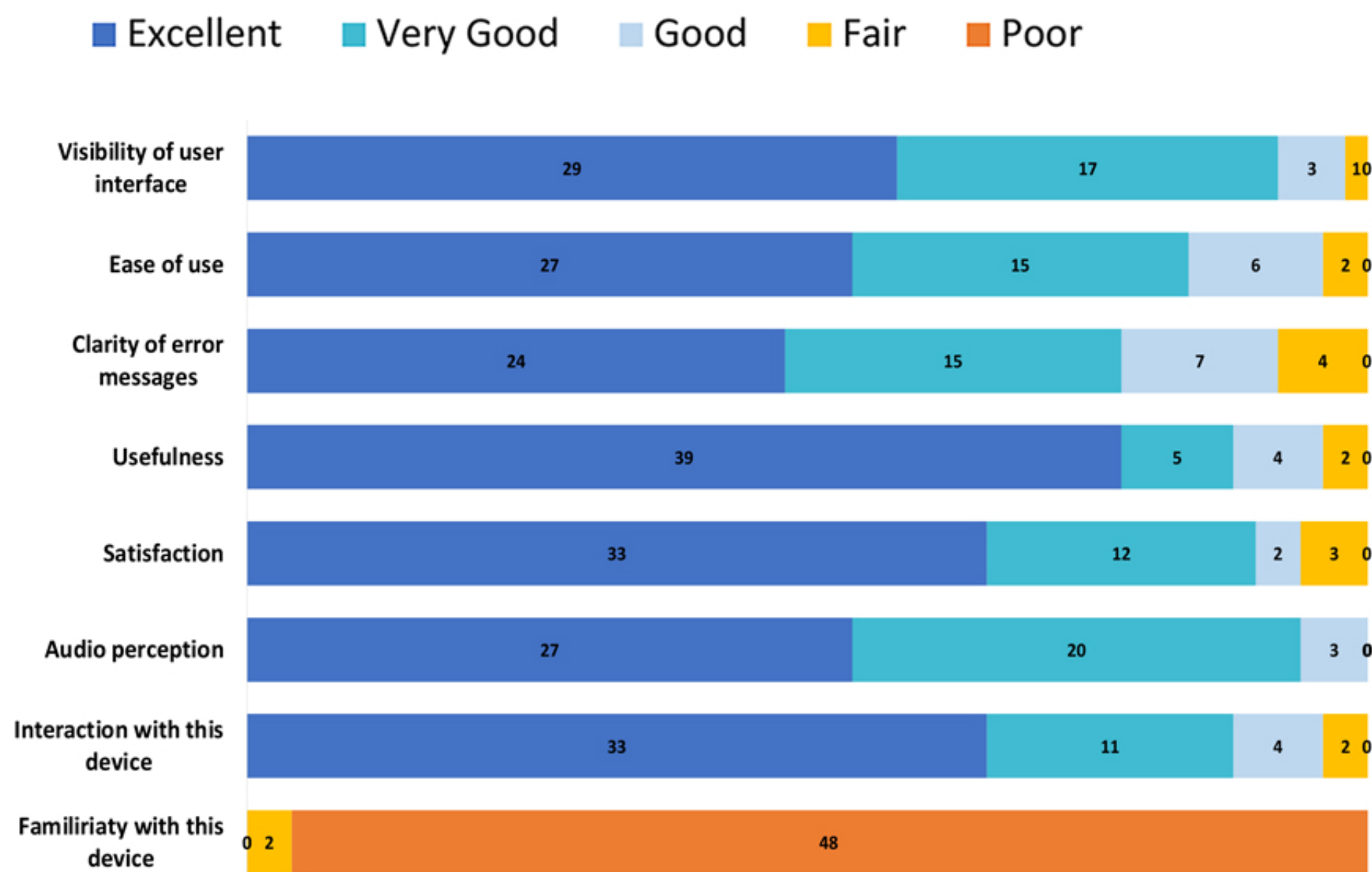


FIGURE 3. Self-Reported Usability of Augmented Reality on a 5-point Likert

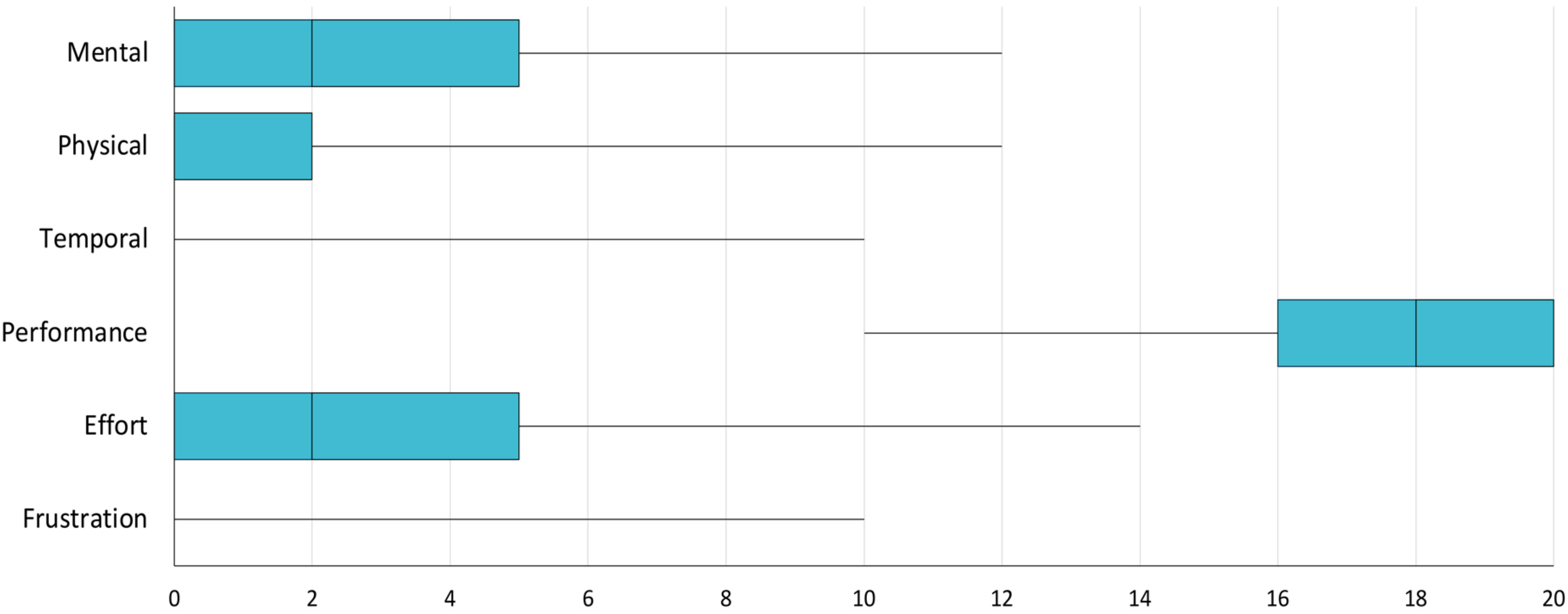


FIGURE 4. Box Plot of NASA-Task Load Index scores for AR healthcare tasks, consisting of six subscales (y-axis) each out of 20 (0 = low workload). The solid bar within each box marks median values (temporal and frustration medians = 0). Box edges show IQR and whiskers indicate range.

Acceptability of AR for Healthcare:

90% (n = 45) of participants would be "very" to "extremely comfortable" with healthcare providers using Microsoft HoloLens®2 and 92% (n = 46) would maintain the same level of trust in a doctor using it.

88% (n = 44) believed AR was "very" to "extremely useful" in problem-solving and 88% (n = 44) found it "very" to "extremely useful" for learning healthcare tasks.

96% (n = 48) desired AR's frequent or constant use by healthcare providers if it improved care outcomes.

Discussion

Our findings demonstrate the feasibility and usability of AR for HH. If further works affirm AR's role, it may facilitate significant upscaling of home hospital operations. Next steps include simulations with in-home clinician + remote clinician and in-home family caregiver + remote clinician.