Brigham and Women's Hospital
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HARVARD MEDICAL SCHOOL

The Usability and Feasibility of Augmented Reality for Home Hospital: A Preliminary Analysis

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Background

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

Augmented Reality (AR), which superimposes computer-generated graphics onto the real world, has potential to facilitate superior remote care and heighten collaboration among patients, clinicians, and caregivers.

Outside of medical education, the application of AR in healthcare, including home hospital settings, 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

With minimal training, older adults with no prior 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.

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. Both qualitative and quantitative measures evaluated the intervention.

Hardware: Microsoft Hololens 2; MIFI Portable Hotspot

Software: Dynamics 365 Remote Assist; Hololens Tips; Dynamics 365 Guides

Intervention:
Each step was marked as success/fail

Remote Assist: Answer a call → Tips: Learn hand gestures → Guides: Routine Checks → Guides: Healthcare Tasks

Routine Checks

Healthcare Tasks

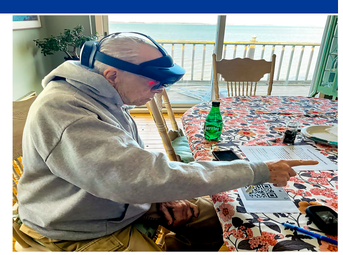

FIGURE 1. Participant answering a call

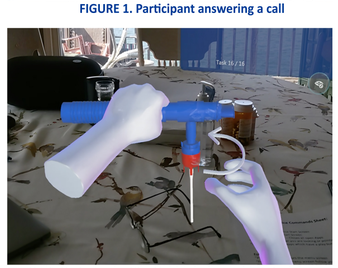

FIGURE 2. Dynamics 365 Guides holographic tutorial on refilling the nebulizer device

Results

Table 1: Demographics and Characteristics of Participants	Total n = 23
Age - Median (IQR)	77 (15)
Female, n (%)	15 (65.22)
Race	
White, n (%)	16 (69.56)
Black, n (%)	2 (8.70)
Latin@, n (%)	5 (21.74)
Spanish Speaking, n (%)	4 (17.39)
Education	
Highschool or Lower, n (%)	7 (30.43)
Less than 4 years College, n (%)	3 (13.04)
4 years College or more, n (%)	13 (56.52)
Uses a Mobile Device, n (%)	22 (95.65)
Able to Download and Use Apps on Mobile Device, n (%)	12 (52.17)
Uses the Internet, n (%)	18 (78.26)
eHealth Literacy - eHEALS[1] Median Score (IQR), n = 18	29.5 (8.50)
Number of Comorbid Conditions - Median (IQR)	12 (9.50)
Perceived Health Status - EQ-VAS[2] Median Score (IQR)	85 (10)

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.

Table 2. Health-ITUES[1] Adapted for AR	Total n = 23
Scale	Median (IQR)
Impact	4 (1)
Perceived Usefulness	4 (1)
Perceived Ease of Use	4 (2)
User Control	4 (2)
Overall Health-iTUES Score	4 (1)

1 The Health IT Usability Evaluation Scale (ITUES) is a 20-questionnaire 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.

Acceptability of AR for Healthcare Applications:

83% (19) of participants would be "very" to "extremely comfortable" with healthcare providers using Microsoft Hololens 2 and 87% (20) would maintain the same level of trust in a doctor using it.

83% (19) believed AR "very" to "extremely useful" in problem-solving and 87% (20) found it "very" to "extremely useful" for learning healthcare tasks.

96% (22) desired AR's frequent or constant use by healthcare providers if it improved care outcomes.

FIGURE 3. Self-Reported Usability of Augmented Reality on a 5-point Likert scale (1=Poor; 5=Excellent).

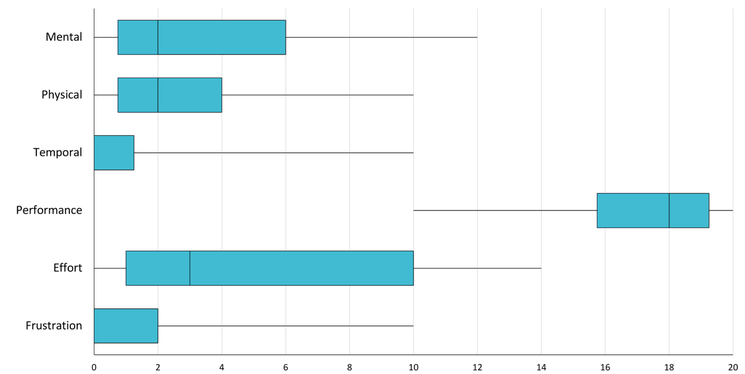

FIGURE 4. Box Plot of NASA-Task Load Index scores for AR healthcare tasks, consisting of six subscales (y-axis) each out of 20 (0 = low workload). The solid bar within each box marks median values (temporal and frustration medians = 0). Box edges show IQR and whiskers indicate range.

Discussion

Our preliminary findings demonstrate the feasibility and usability of AR in the home for healthcare. If further works affirm AR's role, it may facilitate significant upscaling of home hospital operations. Next steps include gathering AR insights from physicians through realistic clinician-patient simulations.