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Assessing the impact of an emotion-intelligent robot on stress in long-term dementia care: Insights from a case-series study

Introduction

- Stress is common in nursing home residents with dementia and may escalate into challenging behavior.
- Emotion-Intelligent (EI) robots may offer support.
- In this first prototype – on our way to developing an autonomous EI robot for long-term care (LTC), the HUME stress detection system was coupled with the social assistive robot SARA for automatic activation when stress is detected.

Objective To explore the effect of an EI-robot prototype on perceived and physiological stress in nursing home residents with dementia.

Methods

Design: Case series; 2-week intervention per resident;
Participants: 4 residents with moderate-severe dementia;
Intervention: Continuous HUME monitoring + automatic SARA activation;
Outcomes: Physiological stress (measured by HUME), structured observations assessing behavioral indicators of stress, agitation and comfort (using VAS, DS-DAT, fieldnotes).

Workflow HUME-SARA combination

Resident wears HUME sensor

↓

Realtime measurement of skin conductance via sensor

↓

HUME makes stress prediction and sends status to SARA robot.

Stress detected?

yes → Healthcare professional receives notification and can remotely start a robot intervention.

no → No robot intervention is started.

Results

Case 1 92 yr
Goal: Provide distraction when feeling anxious.
Observed effect: due to connectivity issues and errors in data logging, no usable data was collected.

Case 2 91 yr
Goal: Keep resident engaged when alone.
Observed effect: 👍
"She loves the music and sees SARA as her friend."

Case 3 86 yr
Goal: Prevent restlessness and wandering.
Observed effect: 👍👎
"SARA has calming effect when her husband leaves."

Case 4 90 yr
Goal: Provide companionship when alone.
Observed effect: 👎
"She has no interest in SARA at all."

Physiological stress measures showed a decrease in stress after intervention, but no clear trend across cases was found.

Preliminary conclusions

- Large inter-individual variability on both perceived and physiological stress;
- No consistent pattern of stress reduction observed;
- Outcomes strongly influenced by context, technology performance, and resident characteristics.

Challenges	Recommendations future research
Limited staff availability	Only include units with sufficient staffing capacity; check organization readiness
Low resident alertness or mobility; residents fall asleep or walk away	Stricter inclusion criteria; no intervention when residents are sleepy
Sensor and technical reliability issues	Regular technical and clinical check-ins; Mixed-methods process evaluation

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