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Case Report

Exploring the Impact of Smibi, A Baby Robot, on Emotion in Older Individuals Needing Care - A Preliminary Study

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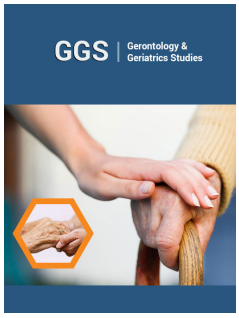
ISSN: 2578-0093



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Submission: October 20, 2023
Published: November 01, 2023

Volume 8 - Issue 4

How to cite this article: Eiko Takano, Kei Ito, Kenji Sato, Shota Suzumura, Rie Narukawa, et al. Exploring the Impact of Smibi, A Baby Robot, on Emotion in Older Individuals Needing Care - A Preliminary Study. Geron & Geriat Stud. 8(4). GGS. 000693. 2023.
DOI: 10.31031/GGS.2023.08.000693

Abstract

Unlike general social robots, Smibi, a baby robot, is not designed to assist users with tasks, but rather, to respond as a human baby, ceasing to cry, smile, or sleep in response to the quality and quantity of care provided by the user. This study investigated whether engaging with Smibi could reduce depressive symptoms in older individuals who require care or assistance. The study participants were 30 community-dwelling older individuals (15 men, 15 women; mean age±standard deviation, 81.7±6.6 years). All participants interacted with Smibi for 4 weeks. The Self-Rating Depression Scale (SDS) and the functional independent measure were then used to assess the participants before and after the 4-week interaction. The results revealed a significant difference in mean SDS scores (38.3±8.5 before the intervention vs. 34.4 ±8.2 after the intervention; p=0.031). These findings suggest that interacting with baby robots such as Smibi might reduce depressive symptoms in older individuals.

Keywords: Baby robot; Depressive symptoms; Emotion; Older individuals; Social robot

Abbreviations: FIM: Functional Independent Measure; MMSE: Mini-Mental State Examination; NCGG: National Center for Geriatrics and Gerontology; SDS: Self-Rating Depression Scale; WHO: World Health Organization

Introduction

Depressive symptoms are prevalent among older individuals dealing with chronic conditions, social isolation, or age-related declines in physical function [1-4]. To enhance the psychological well-being of older individuals, the World Health Organization (WHO) recommends implementing emotion regulation strategies such as up-regulation (boosting positive emotions) and down-regulation (mitigating negative emotions). Togo Seisakusyo (Aichi-gun, Japan) developed an engaging baby robot, Smibi, as an alternative. Smibi is similar in size to a 3-month-old baby and replicates the reactions of a human baby to the quality of user care. We hypothesized that engagement with Smibi could lead to a reduction in depressive symptoms among older individuals. Given this background, the present exploratory study aimed to investigate the impact of Smibi on depressive symptoms among older individuals who require care.

Case Presentation

Participants

This study was approved by the National Center for Geriatrics and Gerontology (NCGG) Medical Ethics Committee (no. 1082) and conformed to the provisions of the Declaration

of Helsinki (as revised in Brazil, 2013). The study participants were 30 community-dwelling older individuals (15 men and 15 women; mean age±Standard Deviation [SD], 81.7±6.6 years). All participants had undergone home-visit rehabilitation at NCGG, with sessions occurring two or three times per week to address various issues related to aging, physical disabilities, stroke recovery, or neurological disorders. Written informed consent was obtained from all participants.

Instrument

Smibi imitates a human baby's reactions to the quality and quantity of user care. It was designed to engage users in a caregiving role by simulating parent-child interactions. Its dimensions are as follows: 440mm in height, 200mm in width, 190mm in depth, and 1.2kg in weight (Figure 1). It emits baby-like sounds and incorporates an accelerometer to detect posture and movement, which trigger expressions such joy or sadness through motorized actions and light-emitting diodes. It has a soft, human-like, silicone resin face that enhances the tactile experience, and a full charge provides approximately 10 hours of operation. Smibi therefore offers a unique and interactive approach to caregiving and companionship.

Figure 1: Smibi, the baby robot used in the present study, replicates the reactions of a human baby and is similar in size to a 3-month-old (440mm in height, 200mm in width, 190mm in depth, and 1.2kg in weight).

Interaction with smibi and outcome measures

The study participants used Smibi individually or with a family member for a minimum of 30 minutes each day over a period of 4 weeks. Therapists monitored Smibi usage and the presence of life events that might cause depressive symptoms during two to three home-visit rehabilitation sessions per week. Therapists assessed the following measures on the first day of interaction with Smibi (pre-intervention) and on the final day of interaction with Smibi (post-intervention): the Self-Rating Depression Scale (SDS) [5], the Functional Independent Measure (FIM) [6], and the Mini-Mental State Examination (MMSE) (administered only at the pre-intervention) [7].

Statistical analysis

Normality tests were conducted using the Shapiro-Wilk test. Outcomes between pre- and post-intervention were compared using a paired t-test or the Wilcoxon signed-rank test, with the significance level set at $p<0.05$.

Results

The mean±SD MMSE score at pre-intervention was 24.1±5.7 points (range, 12-30 points). A significant difference was observed for SDS scores (pre: 38.3±8.5 points vs. post: 34.4±8.2 points; $p=0.031$) as determined by a paired t-test. However, no significant difference was found for FIM scores (pre: 104.4±19.0 points vs.

post: 104.6±18.6 points; p=0.317) based on the Wilcoxon signed-rank test. Importantly, over the 4-week interaction period, no life events were reported that could potentially trigger depressive symptoms, such as the bereavement of a spouse.

Discussion

Interacting with Smibi for 4 weeks resulted in a significant decrease in SDS scores among older individuals compared with before the interaction, which indicates that interacting with Smibi may reduce depressive symptoms in older individuals. Ito et al. reported that an 80-year-old woman without cognitive impairment interacted with Smibi for 30 minutes per day for one month, and her SDS score decreased from 37 to 26 points after using Smibi [8]. Our findings supported this case research study. Smibi was designed to engage older people in caregiving roles akin to that of a parent. Dosso et al. reported that with regard to the social uses of robots, users desired some form of companionship, conversation or interaction with the robot. One of the users expressed that having a non-verbal reaction from a robot to indicate its attention was appropriate [9]. The interactive nature of Smibi, which responds to the quality and quantity and expresses emotions of care provided, has the potential to address emotional needs and reduce depressive symptoms in older people. This concept aligns with WHO's recommendation for emotion regulation strategies, such as up-regulation and down-regulation, to enhance psychological well-being. However, it is important to note that the clinical significance of the decrease in SDS scores from 38.3 to 34.4 points is unclear, particularly because the cutoff for clinical depression is around 40 points. Future research should aim to establish clinically meaningful benchmarks and examine whether the observed changes in depressive symptoms translate to improved overall well-being.

Acknowledgments

The authors are grateful to the older individuals and their families in the present study. This study was supported by Research Funding for Longevity Sciences (grant No. 28-14 and grand No. 21-21) from NCGG, Japan.

Conflict of Interest

The authors declare no conflict of interest.

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