

Issues Related to the Use of Healthcare Communication Robots in Healthcare Settings

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Abstract

Introduction: Healthcare communication robots are being introduced in hospitals and nursing homes in Japan. To facilitate their implementation in such settings, it is essential to explore healthcare communication robots-related issues. **Objective:** This study aimed to evaluate the utilization of healthcare communication robots and identify issues related to their use immediately after introduction and 2 years later. **Methods:** In August 2022, focus group interviews were conducted with 11 healthcare providers (seven nurses, two occupational therapists and two care workers) at a cooperating facility for 1 h to discuss concerns related to the use of healthcare communication robots immediately after their introduction and 2 years later. The interviews were recorded using an IC recorder, transcribed, and analyzed. **Results:** Immediately after the introduction of Pepper a humanoid robot that supports users' daily lives by providing recreation and conversation medical staff, particularly those responsible for managing Pepper, reported finding it "difficult to operate Pepper" and feeling "confused by the unfamiliar tasks." Two years later, the medical staff recognized the benefits of Pepper's use in recreational activities. Furthermore, patients at the facility looked forward to these activities. **Conclusion:** Although positive outcomes were observed, several challenges remained, including "Pepper's inadequate interactive communication," "hesitancy to handle the expensive and heavy Pepper," "safety concerns," and "periodic updates and malfunctions."

Keywords:

Aging Population, Healthcare Communication, Robot



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INTRODUCTION

According to the medium-fertility variant of population projections for Japan, the total population

of Japan is expected to decrease to 87 million by 2070, with 45.35 million individuals aged between 15 and 64 years and 33.67 million individuals aged over 65 years (38.7% of the population) (National Institute of Population and Social Security Research, 2023). In

Japan, the super-aging society and shortage of medical personnel have raised significant concerns, leading to an increased demand for robots in the healthcare industry to address labor shortages, particularly in nursing and welfare (Ministry of Health, Labour and Welfare, 2019).

Therefore, in 2014, the Japanese government, facing a rapidly aging population and declining birthrate, unveiled the Japan Robot Strategy, which aimed to develop robots for use in nursing and medical fields. The Ministry of Health, Labour and Welfare and the Ministry of Economy, Trade and Industry formulated the "Important Development Field" (The Headquarters for Japan's Economic Revitalization: New robot strategy – Vision, strategy, action plan) for healthcare robots, identifying key areas of care where robotic technologies could address nursing challenges, such as caring for patients with dementia, and providing support for transfer, excretion, and bathing. In June 2024, to further promote the development and dissemination of innovative care devices, the "Important Development Field" was renamed as "Priority Fields for the Use of Care Technology," encompassing information, communication technology, and care robots (Ministry of Health, Labour and Welfare). Healthcare communication robots (HCRs), which can replace certain aspects of nursing care, may be rapidly introduced into healthcare settings.

Engaging in conversations with others helps maintain sociability and cognitive function, particularly in older adults. To support this, many humanoid communication robots (CRs) have been developed (Fuji soft: PALRO, n.d.; Aldebaran, a part of United Robotics Group: Nao, n.d.; SoftBank). However, CRs specifically designed for older adults or patients have not yet been developed (Tanioka et al., 2021).

Pepper (SoftBank Robotics, Tokyo, Japan), a humanoid robot resembling a childlike human, was designed to support users' daily lives by providing recreation and conversation (SoftBank). The research team has been studying the Care Prevention Gymnastics Exercises program for Pepper (Pepper-CPGE), developed by XING Company (Japan) (Xing). In addition, they have been conducting clinical research using a conversation application for older adults that the team independently developed and installed on Pepper.

The development of CRs for use in the medical field offers hope for Japan and other countries facing similar challenges (World Health Organization, 2021). However, concerns associated with using robots must be addressed as a prerequisite. Particularly, the introduction of HCRs has been reported to have drawbacks, such as the high implementation cost, the need for training medical staff, and the need for environmental improvements (Care Work Foundation). These issues have hindered the implementation of HCRs in many healthcare facilities. As a result, only 0.3% of facilities in Japan use CRs daily (Care Work Foundation).

Even when HCRs are implemented on a trial basis, some facilities have discontinued their use (Mibu et al., 2022). In social welfare facilities with a shortage of medical staff, continuous research on HCR-related issues is necessary to support their introduction and ensure continued use. No research has analyzed the narratives of medical staff who use CRs, although research on HCR-related issues aimed at facility managers exist (Mibu et al., 2022). This study aimed to evaluate the utilization of HCRs and identify issues related to their use, both immediately and 2 years after implementation in healthcare facilities.

METHOD

1. Design

This descriptive study, based on a qualitative descriptive design, aimed to describe the participants' experiences as derived from their narratives

2. Participants

Participants who met the following inclusion criteria were enrolled: 1) users of Pepper-CPGE in their work, 2) individuals able to share their experience of using Pepper-CPGE, and 3) those who agreed to participate in the study. The exclusion criteria were: 1) non-medical staff, 2) those on a leave of absence while using HCR. The criteria did not include the number of years of experience as a medical professional. The study included 11 healthcare providers (seven nurses, two occupational therapists and two care workers from Hospital A, a long-term healthcare facility in Shikoku, Japan (Table 1). The average age of participants was 56.46 years.

3. Data Collection

Data were collected from Hospital A in August 2022. The interview was conducted once and lasted approximately 1 h. Hospital A had 328-bed with psychiatry, internal medicine, dentistry, and oral surgery departments, and related long term healthcare facility had 80 beds and 20 day-care patients per day. Since 2019, Hospital A had used the Pepper-CPGE for the rehabilitation and recreation of older adults receiving day service and patients with mild dementia. The first interview for the focus group began with the question, "Please tell me about the used of HCRs and the problems associated with their used immediately after their implementation in healthcare settings." In the subsequent interviews, participants were asked, "How was the used of HCRs progressing and what ongoing problems were associated with their used 2 years after implementation in healthcare settings?"

During the focus group interviews, the participants were informed that their words and narratives would be examined in detail. With their consent, their stories were recorded using IC recorders and transcribed. The participants' facial

expressions and tone of voice, which were challenging to capture through interviews alone, were documented in observation notes. These notes served as supplementary data for a detailed interpretation of the results. Additionally, a separate 1-h interview was conducted with a key participant who frequently used Pepper-CPGE to confirm these issues.

4. Data Analysis

First, the recorded interviews were transcribed verbatim. The transcripts were then reread, and segments of the narratives related to HCR issues were extracted. These narratives were coded based on their semantic content. NVivo (NVivo Windows Release 1.5, QSR International Pty Ltd., Australia), a qualitative data analysis software, was used to code similar data extracted from the responses to each question. Subsequently, a qualitative inductive analysis was conducted to classify and organize the data.

5. Research Ethics

The study was approved by the Ethics Committees of Tokushima University Hospital (No. 2039) and Hospital "A" (20220608), Japan. The following points were carefully explained verbally and in writing: the purpose and content of the research,

the voluntary nature of participation and that refusal to participate would not result in any disadvantage, the freedom to agree or disagree with the used of results in the presentation of the research, and the right to anonymity and security of confidentiality. Participants received a 2,000 Japanese yen Quo-card as an honorarium after completing the focus group interviews, as approved by the ethics review board. This research was conducted in accordance with the Japanese version of the Standards for Reporting Qualitative Research (SRQR) (The Qualitative Research Implementation Network of Nursing, n.d.). The authors declare that they had no competing interests related to this manuscript.

RESULT

Table 1 presents the demographic characteristics of participants from the focus group interview. The participants consisted of occupational therapists, care workers, and nurses, with the majority being female nurses. Their ages ranged from the early 40s to the late 60s, with most participants in their late 50s to early 60s. Professional experience varied from 17 to 46 years, indicating that the group was composed of highly experienced healthcare professionals, many of whom had more than three decades of service in their respective fields.

Table 1. Demographic characteristics of participants

Profession	Gender	Age	Years of professional experience
Occupational Therapist	Female	Late 50s	34
Occupational Therapist	Male	Early 40s	17
Care worker	Male	Late 50s	32
Care worker	Female	Early 40s	22
Nurse	Female	Late 50s	38
Nurse	Female	Late 60s	46
Nurse	Female	Early 50s	33
Nurse	Female	Early 60s	38
Nurse	Female	Early 60s	38
Nurse	Female	Early 60s	43
Nurse	Female	Late 50s	36

Table 2. Issues arising immediately after the initial use of Pepper-CPGE

Categories	Sub-category
Burden on medical staff and insufficient support system	Difficulty in operating Pepper-CPGE, including system issues
	Confusion about tasks that are different from normal work
	Extra time to prepare HCR
	Hesitancy to handle the expensive and heavy Pepper-CPGE
	Irregular updates and malfunctions of Pepper-CPGE
Inadequate communication function	Stop and freeze the conversation of Pepper-CPGE

Categories	Sub-category
Safety function concerns regarding Pepper-CPGE	Necessity of intermediary participation of healthcare practitioners
	Inability to hold a conversation with patients
	Unfamiliarity with the technique of monitoring the distance between patients and Pepper-CPGE
	Concerns regarding the safety of the large and heavy Pepper
Pepper-CPGE, care prevention gymnastics exercises for Pepper	

Table 3. Issues arising 2 years after the introduction of Pepper-CPGE

Categories	Sub-category
Burden on specific medical staff	Specific staff who use Pepper are limited
	Extra time required to prepare Pepper-CPGE
Inadequate communication function for patients	Necessity of intermediary participation of healthcare practitioners
	Conversations do not continue with only Pepper-CPGE
Safety function concerns regarding Pepper-CPGE	Concerns regarding the safety of the large and heavy Pepper
Pepper-CPGE, care prevention gymnastics exercises for Pepper	

Tables 2 and 3 present the issues identified immediately after the initial use of Pepper-CPGE and two years following its introduction. In the early stage (Table 2), concerns centered on the additional burden for medical staff, including difficulties in system operation, extra preparation time, and hesitancy in handling an expensive and heavy robot. Issues related to inadequate communication functions, such as conversation interruptions and the need for intermediary healthcare staff, were also reported. Furthermore, safety concerns emerged, particularly regarding the monitoring of patient distance and the physical risks of handling Pepper-CPGE. After two years (Table 3), some of these challenges persisted, notably the burden on specific medical staff and ongoing safety concerns. Communication issues also remained, as patients' interactions did not continue with Pepper alone, requiring continued support from healthcare providers. Notably, no concerns were raised regarding personal information leakage or violations of privacy linked to Pepper's cloud-based servers. Despite these limitations, staff emphasized that Pepper-CPGE offered benefits in recreational contexts, particularly by encouraging patients to engage in conversations with one another rather than relying solely on the robot.

DISCUSSION

In this focus group interview, from immediately to 2 years after their implementation in healthcare facilities, the ongoing issues with using HCRs were

that Pepper-CPGE was large, heavy, and expensive and that its conversation feature was inadequate.

The major issues immediately after the start of the robot use included the Burden on medical staff and the insufficient support system associated with Pepper-CPGE, such as "difficulty operating Pepper-CPGE, including the system," "confusion about tasks different from normal work," and "irregular updates and malfunctions of Pepper-CPGE."

The implementation of HCRs in clinical settings requires additional effort from the medical staff. Medical staff must continue providing equal care to all patients, including those who do not use HCRs (International Council of Nurses; Japanese Nursing Association). Immediately after implementation, the quality of other work and care may decrease owing to HCRs preparation and operation, and it is necessary to minimize this impact.

When introducing HCRs, measures such as providing training to medical staff in advance and creating manuals are essential to prevent an excessive burden on the staff. Additionally, it was suggested that for long-term use, robots must be designed to be easy for anyone to use.

In addition, Pepper is heavy and expensive, and the medical staff are confused about its operation. Pepper weighs approximately 30 kg (66 lbs.), stands 120 cm (approximately 47 inches) tall, and requires extra staff to prepare it for use and clean it (Softbank robotics, n.d.).

The costs, including insurance and the basic package, amount to approximately \$2,400 per year for renting Pepper. There are many other CRs on the market, but if they possess communication functionality, they are expensive, costing \$2,600–

3,900 (Aldebaran, a part of United Robotics Group: Nao, n.d.; Fuji soft: PALRO, n.d). Therefore, only 0.3% of facilities in Japan use CRs daily (Care Work Foundation). High costs were cited as a reason for suspending the use of Pepper. As smaller humanoid robots are being developed, price and size will continue to be factors influencing the use of HCR in nursing care settings.

The medical staff have issues related to inadequate communication function, such as “stop and freeze the conversation of Pepper-CPGE” and the “necessity of intermediary participation of healthcare practitioners.” This issue was still ongoing 2 years later but may be resolved by using a CR other than Pepper.

At present, due to insufficient conversation function, it is difficult to have a conversation using only the conversation application. Thus, CRs have not yet reached a stage where they can provide application functions that allow conversations to continue in a way that is appropriate for older adults and patients with varying symptoms and medical histories.

Betrian et al., (2022) and Tanioka et al., (2021) reported that both healthy individuals and patients with schizophrenia enjoyed conversations with Pepper when Pepper controlled the conversation content from the operating room. Osaka et al., (2021) reported that it was necessary for medical staff to be involved as intermediaries. Further development is needed for applications where the robot and test subject can have conversations without the intervention of a medical professional.

About the <Safety function concerns regarding Pepper-CPGE>, such as “unfamiliarity with the technique of monitoring the distance between the patients and Pepper-CPGE” and “concerns regarding the safety of the large and heavy Pepper,” the medical staff were worried that the introduction of the large Pepper would cause the patients to fall or become injured. This issue persisted even after 2 years.

Medical professionals always consider patient safety as part of their normal duties. There have been concerns that the use of HCRs in the clinical field poses different types of risks to patients than those experienced previously (Miyagawa et al., 2020). The development of safe HCRs is desirable; therefore, identifying potential safety issues is essential.

As the capabilities of artificial intelligence continue to evolve, issues that must be considered during the CR development process, such as privacy protection, cloud-server management, and access rights, have been reported (Yasuhara, 2021). In this study, no narratives from the participants were presented regarding the leakage of personal information and violations of Pepper's right to privacy concerning cloud servers (Tanioka et al., 2018). Currently, the conversation function of Pepper-CPGE is inadequate and requires the presence of a medical professional as an intermediary to continue the conversation with the patient. As this research did not

involve a dialog application using multiple generative artificial intelligences, it was not possible to have in-depth conversations about personal information or privacy violations. Therefore, in the focus group interviews, there were no concerns raised about the leakage of personal information or privacy violations during conversations between Pepper-CPGE and the older adults.

In the future, it will be necessary to consider the personal information and privacy rights of conversation data accumulated during the development of CRs from a medical perspective. As the period of use increased, medical staff became more familiar with the operation of Pepper-CPGE and the distance between Pepper and the patients, recognizing the benefits of using Pepper-CPGE for recreation. Additionally, patients at the facility looked forward to recreation involving Pepper-CPGE. In terms of rehabilitation support, Pepper-CPGE was useful because it allowed medical staff to perform other tasks while acting as instructors. Therefore, expanding the use of not only Pepper but also other CRs could help with the shortage of medical personnel (Takahashi et al., 2025; Yoshikawa et al., 2021).

This study has some important limitations. First, it was conducted at a single facility, and the participants were in their 40s to 60s. Moreover, the results may have varied depending on the age of the participants operating the HCRs and the sizes of the HCRs. Additionally, as this study used focus group interviews, it may not have captured the perspectives of all participants. Therefore, future studies should consider the sizes of the HCRs, the characteristics of the participants, and the research method, such as individual interviews or fieldwork in the facilities.

CONCLUSION

After 2 years, the ongoing issues included the Burden on specific medical staff, such as the limited number of staff who use Pepper and the extra time required to prepare Pepper-CPGE, as well as safety function concerns regarding Pepper-CPGE, such as concerns regarding the safety of the large and heavy Pepper. To continue using the CRs, it is necessary to consider their size, price, and safety. Most importantly, the implementation of CRs should not place an undue burden on medical staff. Reducing the size of the HCR can help alleviate the burden on medical staff and increase the potential for safe use by the elderly. Additionally, increasing the frequency of use and the number of institutions that use it continuously can reduce costs and promote wider adoption. Therefore, it is essential to focus on HCR development from this perspective in the future.

Conflict of Interest

The authors declare no conflicts of interest.

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