Nakagami-Yamaguchi et al. Safety in Health (2016) 2:3
DOI 10.1186/s40886-016-0014-9

Safety in Health

RESEARCH ARTICLE Open Access

The effect of an animation movie for inpatient fall prevention: a pilot study in an acute hospital

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Abstract

Background: In this study, we developed an animated movie as a novel educational tool for fall prevention, and intended for patients and caregivers. We evaluated this new animation, comparing its effectiveness both before and after intervention, and have discussed its potential in the context of inpatient fall prevention.

Methods: While including previously implemented multidisciplinary fall prevention measures, we started to introduce the use of animation in August 2013. Pre-and post-intervention questionnaire surveys were conducted for patients and nurses in June and August 2013, respectively, for 2 weeks.

Results: We obtained 304 and 269 paired data in the pre-and post- intervention survey periods. On examining the difference between nurses' instructions and patients' understanding, in the pre-intervention period, only 70.0 % of patients instructed to call the nurses at any time and 33.3 % of those instructed to call at the time of need, correctly understood the instructions. The frequency of patients' falls significantly decreased from 15.6 to 8.6 % (p <0.05) between the pre- and post- intervention survey periods, respectively. In 65-year-old patients, the ratio of frequency significantly decreased from 19.0 to 7.6 % (p <0.01); however, it did not change in patients aged <65 years.

Conclusions: Our study indicated that animation could be an effective educational tool for inpatient fall prevention, even in older patients. In order to develop a multimedia tool with optimal educational impact, several aspects should be explored, including the addition of previous multidisciplinary approaches, increased variety of story and character design, improved hospital culture for better staff compliance and enhanced effectiveness, and interactive digital media content for an effective teaching feedback loop.

Keywords: Patient safety, Patient education, Risk management, Inpatient fall prevention

Background

Inpatient falls potentially resulting in severe patient injury are some of the most common incidents in an acute hospital setting. Falls not only cause events such as bone fractures and head injuries, but also involve extended hospital stays, increased cost, and reduced mobility led by fear of falling [1–6]. It is reported that falls tend to occur as a result of the interactions between patient factors and environment [7]. Such factors for fall risk include age, physical and cognitive impairment, recent fall history, toileting factors, certain medications, and postural hypotension [7, 8]. Environmental hazards include inadequacies of the floor surface, light, height of the bed or chair, and availability of staff [7]. According to the analysis of fall incident reports, patients often fall during unassisted tasks such as toileting, ambulating, getting out of bed, and getting into or out of the bath [9–11].

To prevent inpatient falls, multidisciplinary interventions are necessary, including assessment, environment improvement, establishment of a care plan dependent on individual patient needs, use of adequate alarm devices for high-risk patients, and communication and information

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support for patients and caregivers [3, 12–17]. For these interventions, educational efforts can be important, as can effective measures of informing patients and caregivers of fall risk and preventive strategies [15, 17–20]. In our hospital, we had also implemented similar long-term multidisciplinary measures including use of the modified fall risk assessment scale originally generated by the Japanese Nursing Association [21], environment improvement, use of alarm devices, and an explanatory leaflet for patients and families regarding fall risk and adequate preventive measures; however, both fall and injury rates remained unchanged. We found that many patients could not follow the instruction of the nurses because of low consciousness of fall risk or hesitation with regard to nurses. We speculate that our strategy to provide information regarding fall risk and adequate preventive measures to patients and families by using the explanatory leaflet was not sufficient. Hence, we planned to add a new explanatory movie as another educational tool.

Specifically, the introduction of multimedia strategies such as using video material in addition to paper-based educational tools (like leaflets) is considered to be more advantageous for enhancing the effect of fall prevention education, including causation, identification of problematic areas, and development of preventive strategies and behaviors [17, 19]. Therefore, based on the aforementioned reports, we implemented "Japanimation" (Japanese animation) techniques to develop a new educational multimedia tool for fall prevention, intended for patients and caregivers. Furthermore, we evaluated its effectiveness, comparing pre-and post-intervention groups of patients and nurses. Finally, we discussed the potential of digital media content such as animation in the context of inpatient fall prevention.

Methods

Outline of surveyed hospital

Our hospital is a general medical center in an acute setting attached to a school of medicine with over 2000 staff and which holds 994 beds, encompassing 31 clinical divisions including both surgical and internal medicine. Intensive care units (ICU) for emergency (ER) care, neonatal (NICU) care, cardiovascular medicine (CCU), and postoperative care are also in place. We provided medical care for over 2000 outpatients daily in 2013, with an average of 286040.2 (282452–292749, 2009–2013) inpatients per year, 783.2 (773.8–802.1, 2009–2013) inpatients per day and 15.0 days in hospital.

Rate of inpatient fall

Over the past five years, the total number of reported falls, excluding near-miss cases, was 538 (495–579) annually. The daily fall rate per 1000 beds across all incidents was 1.9 on average. Since, at least a third of those aged 65 years or more reportedly experience one or more falls in the community [22, 23], our hospital routinely checks this age factor during fall risk assessment. Cases involving patients over 65 years of age accounted for 64.8 % of falls on average. The ratio of falls in female patients compared to male patients was 0.78 on average. Number of injuries including fracture, dislocation, and head injury accounted for 6.8 of annual fall incidents on average. In addition, cases classified as level 2 and 3 according to the fall assessment score, and patients who experienced a fall before admission, accounted for 86.3 and 40.1 % of cases, respectively (Table 1).

Daily fall prevention strategy

The following multicomponent fall prevention strategies have been already implemented: performing an original risk assessment, explaining fall risks and fall prevention to patients and caregivers, improving the environment to reduce risk, using appropriate alarm devices, and implementing appropriate observation and surveillance to reassess the status of the patient's fall risk. To inform patients and caregivers, a short explanatory article regarding fall risk and safe footwear preparation in a hospital setting was described in a guidebook for new admissions. In hospital rooms, patients could find an explanatory leaflet regarding fall risk and prevention on the bedside table. In addition, on the first day of admission, nurses explained the appropriate method and context for calling nursing staff for assistance.

Development of animated movie

To develop the animation, authors including physicians, nurses, clerical workers, animators, and affiliates of the media art college discussed story content aimed at providing an educational message to patients about fall risk and realistic strategies for fall prevention based on patients' comments retrieved by nursing chiefs (as described later in "Questionnaire survey"). The main scenes are displayed as still images in Fig. 1.

Animation technology has an advantage over live action films in its effectiveness in emphasizing important points [24]. First, we wrote scenes about major fall risk situations including toileting, bedside hypotension caused by getting out of bed after a meal, undressing in the bathroom, and walking with slippers [9]. In our scenario, we took into consideration a patient-based audience, and diffused the potential for creating a fear of falls by finishing the story with a comical and friendly tone. It was well known that patients often hesitated to ring for help due to nursing staff appearing busy and unavailable [25]. Therefore, as a secondary focus of the movie, we emphasized the importance of feeling comfortable about calling nurses. Utilizing the advantages of

Table 1 Falls per year* and related characteristics

	Year	2009	2010	2011	2012	2013
Total number of falls		524	495	517	574	579
Fall rate per 1000 beds per day		1.85	1.75	1.81	1.96	2.02
Age	0–64 yrs	200	166	194	207	179
	(%)	38.1	33.6	37.5	36.1	30.9
	over 65 yrs	324	329	323	367	400
	(%)	61.9	66.4	62.5	63.9	69.1
Sex ratio (Female/Male)		0.69	0.69	1.00	0.84	0.68
Number of injuries		8	5	6	7	8
Fall risk assessment levelof 2 and 3† (%)		85.3	87.4	86.5	86.1	–‡
Experience of fall before admission (%)		42.6	39.7	41.8	39.7	–‡

*The Japanese business year is defined from April to March

†In our assessment score system, level 2 indicates a moderately high risk of falling, and level 3 indicates extremely high-risk patients. Patients at level 1 have a low risk

‡This data was not retrieved for this business year

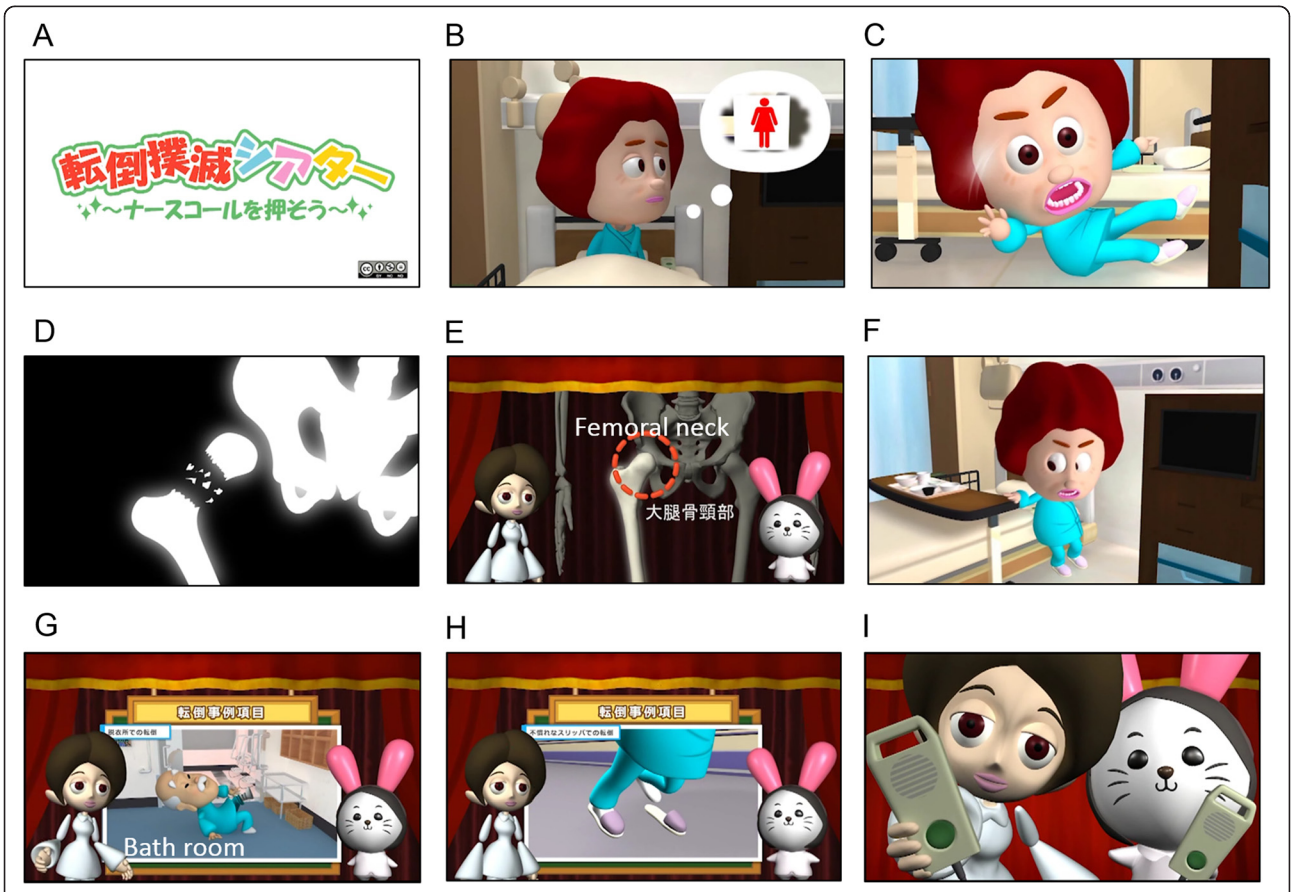

Fig. 1 Stills of 3D animation movie (**a**) Opening title "Fall Prevention Theater: Let's ring for nurses!" (**b**) A lady is thinking in her bed, "I feel like going to the bathroom…" (**c**) A lady falls when she gets out of bed. (**d**) Bone fracture. (**e**) Main characters, Ichiko Nurse (left side) and Koo-pyon (right side) as presenters explain femoral neck fracture. (**f**) When a lady places her hand on a table, suddenly it moves. (**g**) Explanation about the risk of falling in the bathroom. (**h**) Explanation about the risk of falling while wearing slippers. (**i**) Message from Ichiko and Koo-pyon, "Don't hesitate to ring for nurses!" (You can see the animation movie at https://youtu.be/Txa1YpPaFmk)

animation, we also showcased a bone fracture incident. After the animators and affiliates of the media art college drew the storyboard, set the character illustrations, and created computer graphics with background music and scenario-specific sound effects, all authors discussed the animation again and released it in August 2013.

After introducing the intervention to use the animation, on the day of admission, nurses instructed patients and families regarding the risk of a fall. A clerical worker from each ward then taught the patient how to view the movie on the television, either in the day room or at their bedside (See the movie at https://youtu.be/Txa1YpPaFmk).

Questionnaire survey

Before developing the animation, we asked nursing chiefs of all the wards to interview the patients who had fallen regarding how they had felt and what they had thought before falling. In these reports, we found that patients overestimated their physical ability. Reportedly, overestimation of physical ability is a possible fall risk [26], and inadequate self-estimation resulted from unawareness of decreased physical status and fall risks [27]. Then, we asked patients how they estimated their own physical ability normally and in hospital. Moreover, we speculated that if patients have less anxiety regarding hospital life, it might lead to overestimation of mobility, so we also asked them whether they were afraid of falling and worried about the difference between living at home and in the hospital.

Each category in the questionnaire had two or three items, which were rated on a 5-point Likert Scale (1 = 'never' to 5 = 'always' or 'strongly'). We also added others designed as closed questions for both nurses and patients, which included items regarding assistance instructions for nursing staff and patients' understanding, and falls experienced by patients and detected by nurses. Questions about basic patient information including age and sex were only for nurses, and questions about the impression of the animations were included only for patients in the post-intervention survey.

The questionnaire survey was conducted before and after the intervention. Within both periods, the survey was conducted for patients and their charge nurses in every ward and all clinical divisions excluding the ER, ICU, NICU, CCU, pediatric, and psychiatric wards. Clerical workers in each ward distributed the answer sheets to patients and nurses. They checked the answer sheet approximately on the 7th day after patient admission. Patient could also post the answer sheet to the clerical worker. Answer sheets of the patients and their nurses had the same serial number and were matched in the office of Quality and Patient Safety after independent retrieval by clerical workers.

Data analysis

Paired data of patients and their nurses were selected from the total questionnaire data. After excluding respondents aged <20 years, the frequency of patients' fall experiences and nurses' detection of fall incidents was assessed by the chi-squared (X^2) test. Patients were categorized into two subgroups with clustering not only by age (<65 and aged 65 or over), but also by their attitudes at admission toward self-estimation of physical ability in daily and hospital life, and their anxiety in hospital life. For clustering, we used Ward's method of hierarchical cluster analysis. The between-cluster comparison was performed using one-way analysis of variance (ANOVA), while the X^2 test was used for proportions. All statistical analyses were performed using IBM SPSS Statistics version 22.0.

Results

Characteristics of respondents

We conducted the questionnaire survey both pre-and post-intervention; two weeks in June and two weeks in August 2013 were the pre-and post-intervention survey periods, respectively. In the pre-and post-intervention survey periods, 304 and 269 sets of paired data, respectively, were obtained from nurses and patients aged >20 years, while the patients' sex ratios were 0.73 (129 female and 175 male) and 0.93 (129 female, 139 male and unknown 1), respectively. The response rates of patients aged >65 years were 55.6 % ($n = 169$) and 45.0 % ($n = 121$) in the pre- and post-intervention survey periods, respectively (Table 2).

Difference between nurses' instructions and patients' understanding

We examined how patients perceived and understood nurses' instructions about their own assistance requirements according to assessed fall risk (Fig. 2). In the pre-intervention survey group, 70.0 % of patients who were instructed to "call nurses at any time", 33.3 % of those instructed to "call us at the time of need", and 75.3 % of those instructed "no need to help", understood the nurses' directions. Notably, 66.7 % of patients instructed to call nurses only at the time of need interpreted the instructions as "call at any time" or "no need to help" (Fig. 2a). This tendency did not change in the post-intervention survey group (Fig. 2b). There were also no differences between the subgroups with regard to age, sex, and fall risk assessment levels (data not shown).

Fall experiences of patients and incidents detected by nurses

We analyzed how many times the patients experienced a fall or were likely to fall, and how many fall incidents

Table 2 Characteristics of respondents

	Pre-intervention (%)				Post-intervention (%)			
Cases matched	304				269			
Patients' sex	*male*	*female*	*unknown*	*total*	*male*	*female*	*unknown*	*total*
	175	129	0	304	139	129	1	269
(%)	(57.6)	(42.4)	(0)	(100.0)	(51.7)	(48.0)	(0.4)	(100.0)
Patients' age								
20–64 years	77	58	0	135	70	78	0	148
(%)	(25.3)	(19.1)	–	(44.4)	(26.0)	(29.0)	–	(55.0)
over 65 years	98	71	0	169	69	51	1	121
(%)	(32.2)	(23.4)	–	(55.6)	(25.6)	(19.0)	(0.4)	(45.0)

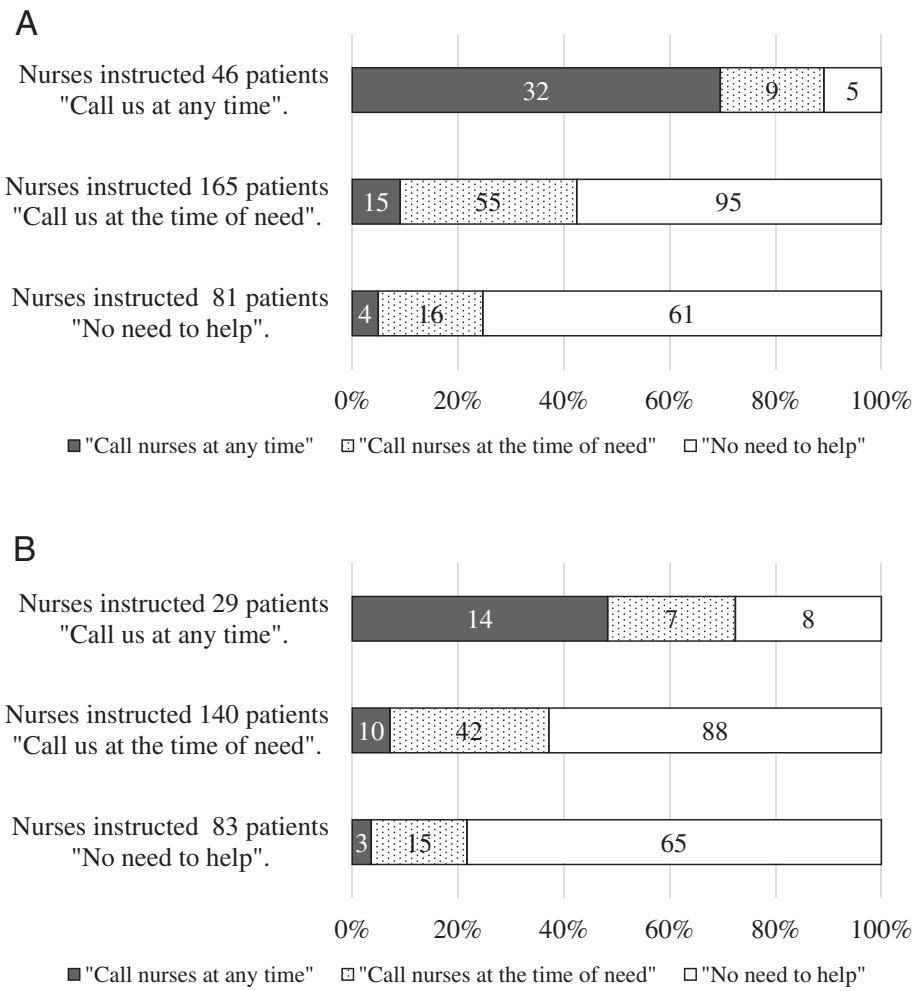

Fig. 2 Difference between nurses' instructions and their understanding by patients. **a** In the pre-intervention survey period group, 70.0 % of patients ($n = 32$) instructed to "Call nurses at any time," 33.3 % ($n = 55$) of patients instructed to "Call us at the time of need," 75.3 % ($n = 61$) of patients instructed "No need to help," understood nurses' directions. Nurses had instructed 46, 165, and 81 patients, respectively. Some patients (30.4 %; $n = 14$) instructed to call nurses at any time understood the phrases "at the time of need" or "no need to help" differently; 66.7 % ($n = 110$) of patients instructed to call nurses at the time of need understood it as "at any time" ($n = 15$) or "no need to help" ($n = 95$), and 24.7 % ($n = 20$) of patients instructed "no need to help" understood it as "at any time" ($n = 4$) or "at the time of need" ($n = 16$). (**b**) In the post-intervention survey period group, similar tendencies were observed

the nurses detected from admission until the date of survey (Fig. 3). Compared to the pre-intervention survey period, the frequency and likelihood of patient falls significantly decreased post-intervention (p <0.05). There was a significant decrease in those over the age of 65 (p <0.01) as well; however, there was no significant difference in patients under the age of 65 (Fig. 3a). Similarly, the frequency of nurse-detected falls decreased post-intervention in both the total and over 65 patient groups, but without statistical significance (Fig. 3b).

Additionally, patients were divided into two subgroups using cluster analysis according to potential risk factors, "self-estimation of physical ability in daily and hospital life" and "anxiety feeling in hospital during admission". In each case of clustering, the frequency of fall experiences significantly decreased in patients who had attitudes toward adequate estimation or underestimation of physical ability or high anxiety in the post-intervention rather than the pre-intervention survey period (Fig. 3c). The frequency of fall incidents as detected by nurses in each subgroup in the post-survey period also decreased, but not significantly (data not shown).

Patient and family comments regarding the animation

Most of the comments from patients and families who watched the animation were favorable. They mentioned: "I could understand the risk of a fall very well"; "I didn't know about professional, and technical issues, but I felt it was easy to understand the message of this animation"; "I was very interested in this movie because I have two mothers-in-law over 80 years old"; "I will be more careful about falling"; and "I think this is a better way to watch the movie than to be to be given a verbal caution".

Fall and injury after intervention

Table 3 showed that the number of fall incidents, the daily fall rate per 1000 beds, and the number of injuries due to falls one year after intervention (from August 2013 to July 2014) did not change compared to the year just prior to the intervention.

Discussion

Education is recommended as an important and effective measure for fall prevention [17, 18, 28]. Recently, it has been reported that using multimedia such as video material is an effective educational tool for reducing inpatient falls [17, 19, 29, 30]. Particularly, animation is becoming widely used in healthcare contexts such as training, education, and communication for both patients and staff [24, 31–36]. Based on these reports, we developed a "Japanimation" movie as a new educational tool for inpatient fall prevention, and introduced it in addition to common ward-based fall prevention measures. Animations perform better than live action videos in accentuating important details and actions, depicting hypothetical situations, and helping users develop accurate mental models of complex concepts [24, 34]. In our results, the group of patients who experienced the animation intervention had fewer fall experiences, especially in patients aged >65 years. This result indicated that the introduction of animation has the potential to promote a careful attitude toward fall prevention in patients, even in older populations, when well-known situations associated with fall risk are highlighted, such as at the bedside and in the bathroom, and when it is illustrated by a virtual bone fracture incident scene.

One possible reason for the patients' attitude and behavior change toward fall prevention after our intervention is the effect of entertainment education, which is reported to be an effective method for delivering educational messages in an "entertainment format" such as a radio or TV drama, and for changing behavior by serving as a positive or negative model [37–39]. According to the definition of entertainment education materials, animation is considered one of the suggested methods. In addition, entertainment education material increases interpersonal communication between friends and families [38]. In our case, we also found the families' comments increased, improving the discussion regarding risk of inpatient fall. From the perspective of entertainment education, the strategy to introduce animation into a community setting as a fall prevention measure has the potential to affect both patients and families or care givers who viewed the movie together not only in a home but also in a hospital.

For fall risk and prevention education, we used two tools before this intervention: a small article in the admission guidebook and a bedside explanatory leaflet. In the pre-and post-intervention survey periods, 77 and 76 % (guidebook article), and 51 and 69 % (bedside leaflet) of patients, respectively, had read these text-based materials. Among those who had read the text-based materials, 96.5 and 99.2 % in the pre- and post-intervention survey period, respectively, felt that they would be more vigilant regarding fall prevention. We found that there was similar gap between patients' understanding and nurses' instructions in both the pre- and post-intervention survey periods, whereas fall experiences of patients and incidents detected by nurses in the post-intervention survey period significantly decreased compared to those in the pre-intervention survey period. This finding may lead one to speculate that visual, nonverbal communication tools like animated movies can complement the limitations of textual and verbal communication such as guidebooks, leaflets, and oral explanations by staff in helping patients and caregivers change their behavior and attitudes toward fall prevention.

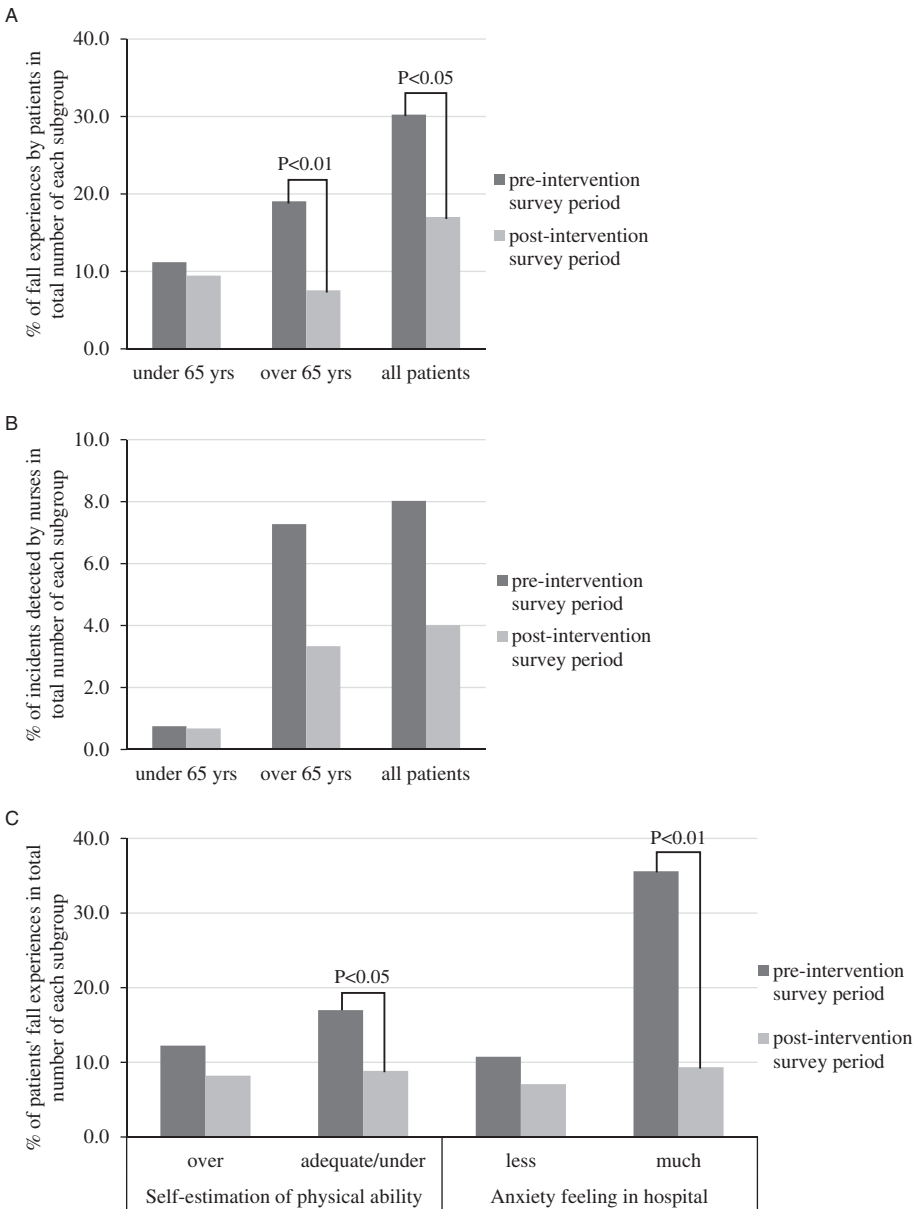

Fig. 3 Comparison of the frequency of patients' fall experiences and fall incidents detected by nurses between pre- and post-intervention survey periods. **a** The number of total patient respondents was 302 pre-intervention and 267 post-intervention. The percentage of patients' fall experiences or fall likelihood significantly decreased from 15.6 ($n = 47$) to 8.6 % ($n = 23$) on comparing the pre- and post-intervention survey periods, respectively ($p < 0.05$). In the group of patients aged >65 years (pre; $n = 168$ and post; $n = 119$), fall experiences or fall likelihood also significantly decreased from 19.0 ($n = 32$) to 7.6 % ($n = 9$) ($p < 0.01$); however, it did not change in the group of patients under the age of 65. (**b**) The number of patients who responded was 298 and 267 in the pre- and post-intervention surveys, respectively. The percentage of fall incidents detected by nurses decreased from 4.4 ($n = 13$) to 1.9 % ($n = 5$). In those aged >65 years (pre; $n = 165$ and post; $n = 120$), it decreased from 7.3 ($n = 12$) to 1.9 % ($n = 4$) with no statistical significance, whereas it did not change in those aged >65 years. (**c**) Percentage of patients' fall experiences in each subclass clustered by attitude toward "self-estimation of physical ability" and "anxiety feeling in hospital". In the group of patients with attitude toward "adequate/under-estimation", it decreased from 17.0 % ($n = 34$) in the pre-intervention survey period to 8.9 % ($n = 17$) post-intervention ($p < 0.05$); the total number of patients in this subclass was 200 in the pre-intervention survey, and 192 post-intervention. Similarly, in the group of patients with attitudes toward "much anxiety feeling", it was reduced from 35.6 ($n = 21$) to 9.4 % ($n = 13$) in the post-intervention survey period ($p < 0.01$), while the total number in each clustered subclass was 59 in the pre-intervention survey and 139 post-intervention

Table 3 Number of fall incidents one year before the intervention and one year after the intervention

	Aug 2012–July 2013	Aug 2013–July 2014
Number of fall reports*	579	547
Per 1000 beds per day	1.97	1.95
Number of injuries†	10	12

*The number of fall and crash incident reports excluding near-misses
†Injuries include fracture, dislocation, and head injury

Reviewing our results, some considerations remain. First, falls experienced by those aged <65 years did not decrease, even after watching the animation. One reason considered was the impression of the main character (heroine), who had been designed as a lady of just >50 years old. This character design may have caused younger patients not to feel a strong connection to their own reality. Thus, character design should be one of the most considered factors when making educational animations.

Next, there is a danger of causing an excessive fear of falls in patients. As described above, overestimation of physical ability [26] is considered a potential fall risk. Therefore, we expected that the frequency of fall experiences in patients who overestimated their ability and had less anxiety in hospital would decrease after watching the animation movie. In our study, the frequency of patients' fall experiences in two subgroups of patients with attitudes toward "adequate estimation or underestimation of physical ability" and "high anxiety" decreased significantly in the post-intervention survey period. That is to say, watching the animation might have led to more fear of falling [31] in those who have a more careful attitude toward hospital life, which could possibly lead to them restricting their mobility, even though fear of falling and lack of mobility are reported to trigger repetition of falls and associated injury [2, 6]. When developing the animation content, this point should be examined carefully. Furthermore, some patients who had not watched the animation commented that their reasons for not being able to watch it were severe disease status or visual impairment. For these patients, it will be necessary for audio content to be developed using text- or speech-based entertainment, such as radio or CD drama. For Japanese patients, Rakugo (Japanese traditional comic storytelling) or Senryu (Japanese traditional humorous short poem) could be effective media for patient education.

Finally, we could not confirm the reduction of fall incidents and injuries one year after intervention, although we had been able to observe the reduction within two weeks just after intervention. One potential reason was poor compliance when instructing patients to watch the animations in addition to the pre-existing, basic multicomponent measures in our hospital. Actually, the compliance rate of nurses allowing patients to watch the animations decreased from around 100 % in post-intervention survey period to 73 % in September 2014, 13 months after intervention. According to previous reports, the complexity of the fall prevention interventions led to less timely compliance by staff and resulted in a loss of potential benefit from multidisciplinary methods in spite of staff efforts [16, 39–41]. To overcome this issue, changing the hospital culture surrounding fall prevention plays a key role [7], and leadership support and engagement of staff in the program will enhance the effectiveness of its implementation [16]. On the other hand, Haines et al. [42] reported that although they did not find a significant difference between the use of the usual fall prevention measures and that of additional education using multimedia (DVD), they found that fall incidents were less frequent in cognitively intact patients than in cognitively impaired ones. Additionally, this difference was more significant in patients with multimedia education and additional health professional follow-up. Unfortunately, we did not ask the patients about their cognitive function in our research, but Haines et al. suggested that in estimating the effect of interventions using animation and other multimedia education, patients' cognitive function should be investigated. As well as follow-ups by health professionals after watching the DVD, feedback from teaching is important to emphasize the effect of education in other studies [20]. Our method involved making the patients watch the animation but not assessing whether they understood or not. In the future, interactive tools such as quizzes and games on tablet technology could be developed.

Our study indicated that an animation would be an effective educational tool for inpatient fall prevention even in older patients. Our animation content included scenes of fall risk and adequate measures for fall prevention, which are also common in other countries. Furthermore, the main scene in our animation express without dialogue. Therefore, the contents of our animation could be used for other stories and media in other countries with a different culture. In order to achieve optimal effectiveness in the future, we should consider including previous multidisciplinary approaches, increasing the variety of story and character design, changing the hospital culture for better compliance among staff, and improving interactive digital media content for teaching feedback. However, the effect of multimedia including animations in reducing fall incidence and injuries is still limited. Hill et al. [43] compared the use of a DVD with that of a workbook adding usual fall prevention care, and found that the DVD group had better understanding of fall risks and a higher motivation to engage in self-protective strategies than the workbook group. This may also have led to reduced fall incidences only in

cognitively intact patients after education using DVDs or DVDs and health professional follow-up [42]. Therefore, further investigation of the appropriate approach for patients who have cognitive impairment and their families/caregivers is needed.

Conclusion

Our study indicated that animation could be an effective educational tool for inpatient fall prevention, even in older patients. In order to develop a multimedia tool with optimal educational impact, several aspects should be explored, including the addition of previous multidisciplinary approaches, increased variety of story and character design, improved hospital culture for better staff compliance and enhanced effectiveness, and interactive digital media content for an effective teaching feedback loop.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

KF, as a production adviser, carried out pre-interview for nursing chiefs, making scenario, planning questionnaire survey and its analysis. AB, as an assistant producer, carried out making scenario and directing animators. She was also a voice actress. NB, as a producer, carried out making scenario, directing animators and having charge of the issue of copyright of animation. KN, as an editorial supervisor, carried out making scenario, conducting questionnaire survey and its analysis KM, as an editorial supervisor, carried out making scenario, conducting questionnaire survey and its analysis. She was also a voice actress. MM, as an editorial supervisor, carried out pre-interview for nursing chiefs, making scenario, conducting questionnaire survey and its analysis. MS, as a supervisor directed animators to make computer graphics. TN, as an executive producer, directed the study and participated in its design and coordination. All authors read and approved the final manuscript.

Acknowledgment

We are grateful to the departmental safety managers and all ward staff. We especially thank Mr. Hiroshi Kato (chief of General Affairs Section, Osaka City University Hospital) and Dr. Yoko Taga of Takatsuki Hospital who cooperated in developing the animation. We also thank Mr. Takuya Tokuoka, Mr. Hiromichi Tokita, Ms. Nozomi Sugawara, Mr. Takuya Ito, Mr. Ryoichi Tamaru, and Mr. Shohei Inoue, who are animators who graduated from Digital Holy Wood Osaka School. Further, we thank Ms. Atsuko Sato (data entry operator, Department of Quality and Patient Safety, Osaka City University Hospital), Mr. Hironobu Nishino (subsection chief, General Affairs Section, Osaka City University Hospital), and Mr. Shingo Kitamura (senior staff, Medical Professions Division, Osaka City University Hospital) who contributed to data retrieval. Our study was supported by a grant from Terumo Corporation (Collaborative Research Project in Osaka City University Graduate School of Medicine and JSPS KAKENHI Grant Number 90189738 and 60369684). We reported some of the results at the 8th annual meeting of the Japanese Society of Quality and Safety in Healthcare in Tokyo.

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Received: 3 December 2015 Accepted: 23 February 2016
Published online: 15 March 2016

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