

An example of mail display

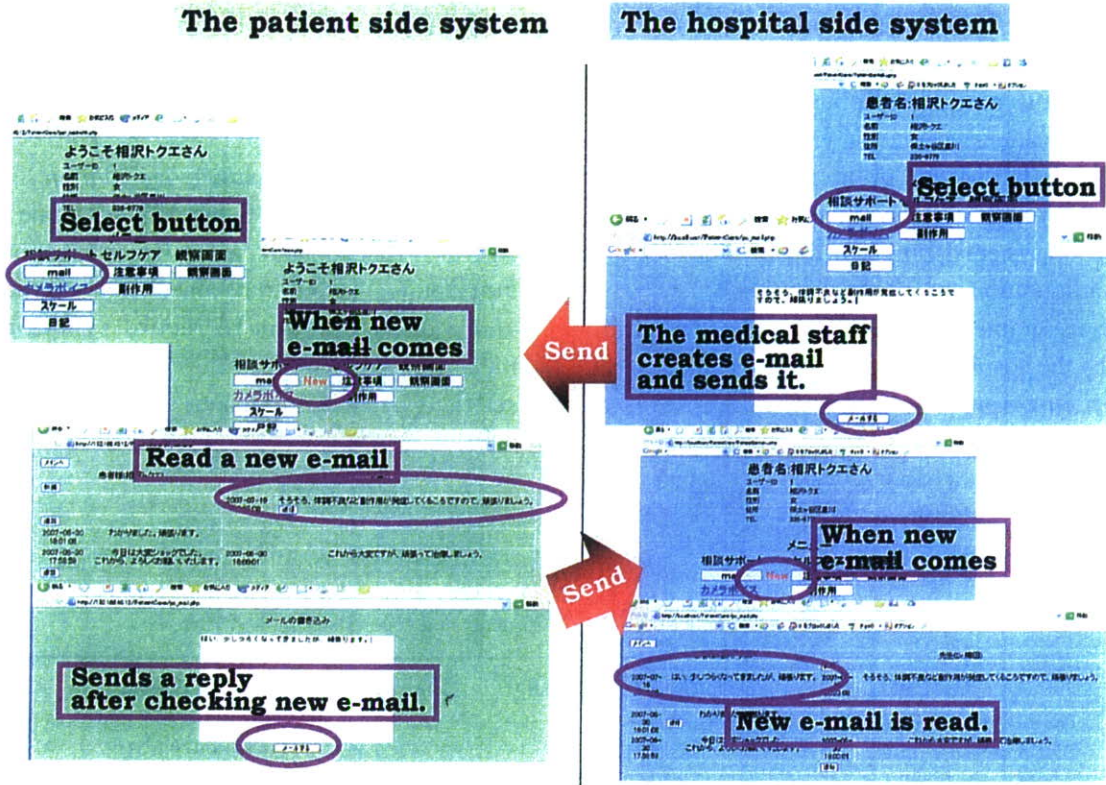


Figure 4. The e-mail operation screen

An example of camera/voice display

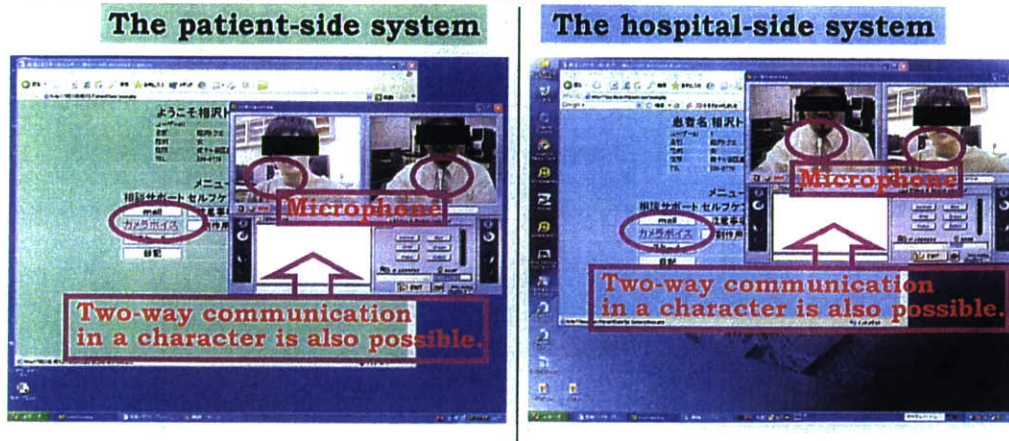


Figure 5. The camera/voice operation screen

An example of SDS scale test display

The patient side system

The hospital side system

Answer to a person's authentication

To input screen

The answer to each item is chosen with a button.

A send button is pushed after answering all the items.

苦痛症状尺度

No.	月日	合計	distress 65-23	distress 32-25	serious 24-11
15-36-203	2005/4/1	25	0	1	0
15-50-179	2005/4/2	43	1	0	0
15-45-130	2005/4/8	30	0	1	0
15-48-383	2005/4/11	28	0	1	0
15-32-64	2005/4/14	23	0	0	1
15-78-178	2005/4/18	35	1	0	0
15-53-98	2005/4/21	20	0	0	1
15-78-79	2005/4/22	37	1	0	0
15-44-154	2005/4/26	50	1	0	0
15-45-124	2005/4/29	44	1	0	0
15-33-189	2005/5/2	19	0	0	1
15-33-111	2005/5/5	23	0	0	1
15-45-132	2005/5/8	47	1	0	0
15-45-945	2005/5/12	45	1	0	0
15-78-233	2005/5/15	39	1	0	0
15-43-24	2005/5/17	28	0	1	0
15-43-158	2005/5/22	27	0	1	0
15-44-263	2005/5/29	49	1	0	0
15-50-320	2005/5/4	22	0	0	1
15-23-182	2005/5/13	18	0	0	1
15-45-22	2005/5/20	52	1	0	0
15-47-298	2005/5/26	36	1	0	0
15-43-281	2005/5/30	38	1	0	0
15-48-188	2005/7/13	48	1	0	0
15-32-273	2005/7/20	20	0	0	1

The send answer results are classified after an automatic total and is displayed.

Figure 6. The Symptom Distress Scale operation screen

An example of self-care operation display

The patient-side system

The hospital-side system

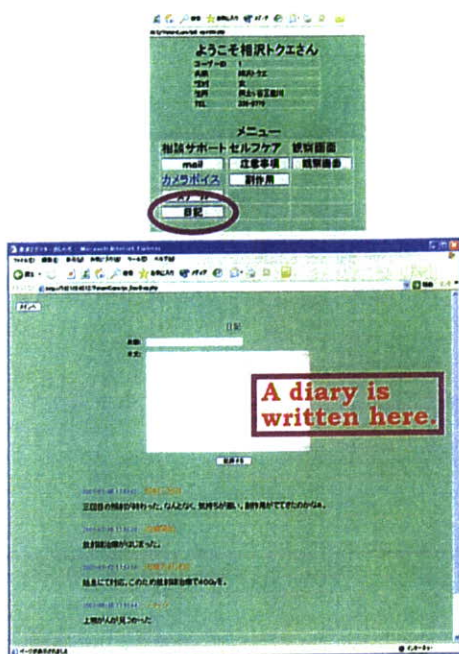
Notes

Announce of side effects

Figure 7. The screen for areas requiring extra caution in everyday life and how to handle adverse effects

An example of the diary display

The patient-side system



The hospital-side system

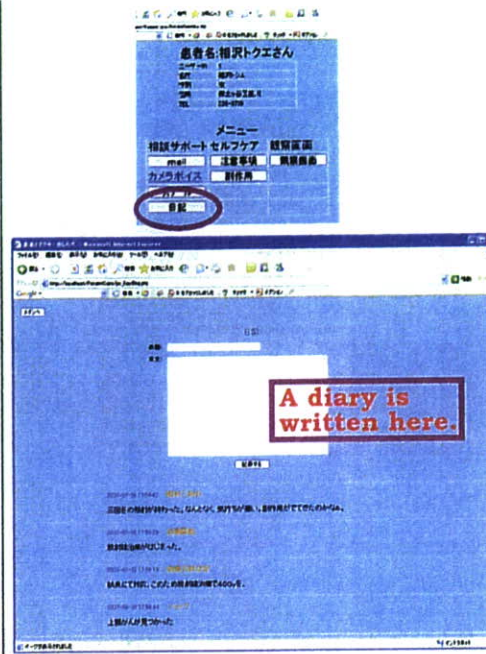


Figure 8. The diary screen

Consulting support system

An emotional support system was created to allow patients to consult their medical staffs, such as physicians and nurses in the medical facility by e-mail. New e-mails are clearly visible on the screen (Figure 4). Patients can directly consult their medical staffs in virtual interviews using the camera/voice system and discuss any worries they may have (Figure 5). With the camera/voice system, the medical staff can monitor the patient's tone of voice and their facial expressions, along with skin tone and color. The camera/voice system also has a chat function so that patients with impaired language and/or auditory function can also make use of the system.

Symptom Distress Scale input system

Based on the factors determined by Katagiri and colleagues,¹ such as "disease and future prospects," "treatments," and "limitations in everyday lives," this system encourages patients to express their feelings regarding their disease. We created an emotional support system for questions and consultations regarding the treatments and a self-care system for somatic symptoms. Chemotherapy has strong adverse effects, which may affect patients' everyday lives, and result in a large degree of physical distress. The Symptom Distress Scale (SDS)² is used to objectively understand the degree of distress.

However, because the SDS was designed for American subjects, we modified it for Japanese patients.³ The SDS has 11 factors and 13 items including: nausea, appetite, difficulty in sleeping, pain, fatigue, defecation pattern, concentration, appearance, respiration, future prospects, and coughing. It measures the degree of distress accompanying the cancer treatment. The answers are evaluated on a scale of 1 to 5, with 5 indicating the highest level of symptom distress. As shown in Figure 6, the SDS was created on the screen, so the questions can be answered by pointing and clicking with the mouse. When the patient places a mark at the appropriate place for each item on the SDS, and then clicks the Submit button, the answer is sent to the system at the facility side, the score is automatically calculated, and the final score is immediately displayed. The score is classified into 3 levels so that the patients can easily see their levels of distress. Observations of symptoms, such as cutaneous symptoms, can be saved as image data.

Self-care system concerning somatic symptoms

In the self-care system concerning somatic symptoms, areas requiring extra caution in everyday life, and ways to handle adverse effects can be explained (Figure 7). The diary system was also created to record the patients' daily understanding of their condition (Figure 8).

The signs and symptoms observation system

In the signs and symptoms observation system, shown in Figure 7, a picture of a patients' cutaneous signs and symptoms taken with a digital camera can be uploaded into the system and sent so that detailed observations of a patients' cutaneous signs and symptoms are possible.

Results

Emotional Support Operation

For outpatients, e-mail is a means to convey their concern about problems at any time. For healthcare providers, e-mail has become a means of communication with the outpatients, allowing them to understand each patient's emotional state. The nature of e-mail makes it difficult for the patients to receive an immediate response, however, the system was designed to display a mark when a new e-mail is received.

The camera/voice system requires both parties to coordinate the timing and to be on the system at the same time, but it allows them to speak with each other directly in real-time. Another advantage of this feature is that the healthcare providers can make observations on the color of the home-care patient's face and facial expression through the camera. In addition, this feature increases the patient's sense of relief because it represents virtual in-person counseling. Since the simulated patient using this support function performed virtual interviews with various medical staffs, he expressed the opinion that there was an increased sense of relief.

Input operation of the SDS

Objective information on patients' distress levels can now be obtained using the SDS. In addition, as the data history is accumulated in the medical facility, the patient's current state can be compared with their past condition. A nurse trying this system was of the opinion that it was easy to find out from a patient when the patient was experiencing pain.

Self-care operation regarding somatic symptoms

Healthcare providers can now explain areas requiring extra caution in everyday life through text messages or images. This allows patients to view the information at their own convenience, whenever they want. As a result of patients keeping diaries, the medical staffs could more easily know the patients' conditions.

Observation of signs and symptoms

It is sometimes necessary for the medical professionals to look at the signs and symptoms directly to make a

judgment. Patients can send photographic images through their home system to the medical facility, thus allowing the medical staffs to make more accurate observations. Previous data are saved, allowing the current and past conditions to be compared. As a result of these observations becoming easier, this system has also been used for consultations between doctors and medical staffs. Thus, the staffs' sense of relief is increased as well.

Discussion

System operation

We developed a telesupport system to provide mental and physical support to outpatients receiving treatment. With regard to the emotional support function, the patients can consult the healthcare providers about their diseases, their future prospects, and their emotions and feelings regarding changes in the state of their diseases. Patients can express and clarify their feelings by writing them in e-mails directly to their doctors and/or medical staff. The medical staffs can instruct the individual patients how to handle possible adverse effects, or how to manage oral medication through virtual face-to-face counseling. Regarding the physical aspect of the support function, the patients can be instructed on restrictions in their everyday lives or on possible adverse effects. In addition, this system is useful in self-care, allowing outpatients to perform self-monitoring as their SDS and image data can be saved. There have been many studies of telesupport systems, such as weight-loss programs, exercise instruction, and nutritional guidance, used for lifestyle-related diseases,⁴ and they have been shown to be effective. Current issues in outpatient treatment include the doctors' difficulties in understanding the patients' awareness of their diseases and their needs, as well as difficulties in understanding the patients' home lifestyles or any other aspects they may wish to report due to the short duration of face-to-face medical examinations.⁵ Medical staffs are fighting for quality of patient care within the restricted environment of outpatient treatment. This system is not only beneficial to the patients but also to the medical staffs in that the accumulated subjective and objective information from the past can be compared to the present data to better understand and analyze the patients' conditions. This becomes a richer source of information to help prescribe treatment and/or for follow-up treatment. The communications between outpatients in their homes and the healthcare institutions will provide the patients a heightened sense of emotional relief. Moreover, this allows the provision of timely instructions

to the patients and their family members, improving the self-care ability as well as their QOL (quality of life) during treatment. However, a previous study⁵ indicated that nurses' work, such as the allocation of outpatient nurses, becomes even more complicated with this system. Healthcare providers feel the demand, but under current conditions, they feel physically and financially restricted in setting up the infrastructure necessary for such systems. To operate such a system, it is necessary to set up a hardware facility as well as to increase the number of nurses.

In the USA, 65% of cancer patients receive radiation therapy.⁶ During the course of their treatment, oncology nurses specializing in the different types of cancer work with the patients from before starting treatment to after the completion of treatment for follow-up. This new system of treatment environment allows patients and their families to consult a healthcare professional whenever they want to, thus providing more of a sense of relief, and leading to patients receiving better treatment and continuing their treatment for as long as needed. It is necessary to focus on follow-up systems for cancer outpatient treatment, a necessity that will only continue to increase in the future.

Prevention of leaks of transmitted information and recorded contents, securing safety, and measures to prevent tampering

As indicated in the overview regarding data transport in this system shown in Figure 3, the patients' information is input and then viewed at another location via the Internet. This allows the viewing of existing information and input of new information from both the patient's home and at the facility, increasing the ease, functionality and usability of the system. However, using the Internet carries the risk of leaks of private information, unauthorized access, and tampering. This necessitates securing confidentiality of the information, securing the safety, and implementation of measures to prevent tampering.

This system handles patients' personal information and medical records. To prevent leaks of personalized data and unauthorized access, the users are restricted through user authorizations of user name and password when a healthcare professional logs into the system on the hospital side.

Contrarily, in the system in the patient's home, a menu-selection screen is displayed when the patient's ID and password are entered in the login screen. Patient ID and password are provided to individual patients by the

medical facility. To use the system at the patient's home, the authorization is classified according to 3 levels: outpatients and their family members, home healthcare providers and nurses, and attending physicians. The rights to view and input medical information are restricted according to the level of authorization. System software is managed at the medical facility side in case the software used is changed in the future to facilitate uniform management.

Conclusions

This telesupport system for outpatients receiving treatment provides mental and physical support to patients and their families. As the users can use both e-mail and virtual interviews allowing direct conversations in real-time, this system allows them to consult with healthcare staffs about the hospital, schedules, treatments, and the patients' diseases. Moreover, this system helps patients, and their families, understand areas requiring extra caution in everyday life, as well as their physical condition, leading to improved self-care. This telesupport system allows physicians and medical staffs to provide more personalized follow-up care during and even after the outpatient treatment period.

References

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