

# Effectiveness of Telenursing for Postoperative Complications in Patients with Prostate Cancer

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## ABSTRACT

**Objective:** This study is addressing the question of whether a telenursing system using information and communication technology is effective for improving postoperative complications and quality of life (QOL) in patients with prostate cancer. **Methods:** Using a tablet computer, the participants were asked to provide information on various items, including urinary frequency, number of incontinence pads used, and presence of sexual desire and erections. Both the participants and researchers monitored automatically graphed time-dependent changes in symptoms, and the researchers could propose concrete measures to reduce patients' complications. The primary endpoint was an improved score on the expanded prostate cancer index composite (EPIC) and improved urinary incontinence based on a positive stress test. The secondary endpoint was an evaluation of self-care responses to the Functional Assessment of Cancer Therapy-General (FACT-G) instrument. **Results:** This study asked

33 patients who met all inclusion criteria to participate in the study, 30 of whom agreed. We compared the scores of EPIC, FACT-G, and stress test for prostate cancer patients 1 month and 3 months after surgery. The scores of urinary incontinence and urinary bother for both groups were significantly higher in 3 months after surgery than in 1 month after surgery, showing improvement in symptoms. The amount of urine left in the bladder after stress test increased showing the improvement in urinary incontinence ( $P = 0.001$ ). **Conclusions:** The relationship between prostate cancer patients' complications after surgery and QOL showed that their physical well-being improved as they found relief from their symptoms. Telenursing was shown to be effective for symptom management of patients with chronic diseases including cancer.

**Key words:** Postoperative complications, prostate cancer, quality of life, telenursing

## Introduction

In telenursing in Europe and the United States, the use of the Internet in the provision of nursing services has been increasing in popularity since the 1990s.<sup>[1]</sup> Telenursing was conducted for patients who chemotherapy, diabetes, heart failure, and respiratory failure in the 2000s.<sup>[2-5]</sup> In the case of Japan, outpatients who visit hospitals on remote islands<sup>[6]</sup> and patients with chronic obstructive pulmonary

disease (COPD) who receive home oxygen therapy for the prevention of acute exacerbation of COPD<sup>[7]</sup> have utilized telenursing support; however, there have been no reports on the use of telenursing by cancer patients. The performance of information and communication technology (ICT) such as personal computers, cell phones, and other communication equipment has dramatically improved,

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and the use of such devices no longer requires extensive technical knowledge. In addition, further developments are expected in telenursing for supporting home care, as the age of cancer survivors is rapidly increasing.

In Japan, the incidence of prostate cancer is rising due to the growing elderly population and the widespread use of the prostate-specific antigen (PSA) test. Over 90% of patients undergoing prostate cancer surgery, which is an orthodox treatment option for prostate cancer, report symptoms of urinary incontinence and sexual dysfunction,<sup>[8,9]</sup> and about 10%–20% of these patients do not show improvement in these symptoms at 1 year after surgery.<sup>[10]</sup> Complications after surgery impair physical function in such patients, leading to a lower quality of life (QOL) and sense of overall well-being.<sup>[11–13]</sup> To reduce these complications, such patients are therefore required to continue performing pelvic floor muscle exercises and reduce their alcohol consumption.

However, some patients are discharged from hospital soon after receiving general discharge instructions from medical staff, so the problem of support taking each patient's background and specific needs into consideration has become a critical issue.<sup>[14]</sup> In addition, in Japan, where over 90% of nurses are female, it is difficult to assess complications related to a prostate cancer patient's sense of well-being after surgery. Many patients do not seek support from nurses because they feel hesitant to tell nurses about postoperative conditions such as sexual dysfunction.<sup>[15,16]</sup> In Western countries, there have been a number of practical reports about nursing support for sexual dysfunction after surgery,<sup>[17]</sup> in-person counseling between a patient and a partner,<sup>[18]</sup> and periodic telephone counseling for urinary incontinence. However, none of these studies has provided significant evidence that such treatment is beneficial. It is important for nurses to grasp the physical symptoms of patients who are recuperating at home in real time while maintaining face to face with the patient and pay attention to shame. If the nurse can grasp the patient's physical symptoms and problems in real time, he can respond to the patient's condition from an early stage and prevent the symptoms from worsening.

Therefore, we need to develop a system that allows patients to consult with nurses at any time using ICT.

We conducted study to address the question of whether a telenursing system using ICT is effective for improving postoperative complications and QOL in patients with prostate cancer.

### Conceptual framework

The theoretical framework of the study was provided to the Tele-Nurse Practice Model (TNPM).<sup>[19]</sup> The TNPM is a theoretical framework nurses can use to define and guide the complex process of care in a telephone encounter.

Telenursing provide comprehensive care and information on self-management to patients, and provide resources for health promotion and changes in health behavior in cooperation with other professionals. In the study, nurses use ICT to grasp the state of side effects after surgery of cancer patients. Nurses can grasp side effects symptoms accompanied prostate cancer patients in real time and provide nursing support at an early stage. At the same time, telenursing using ICT can easily share patient information with a doctor, and can prepare an environment where patients can receive treatment early.

## Methods

### Study design

This study was conducted to examine whether telenursing could help prevent the acute exacerbation of postoperative adverse symptoms in patients with prostate cancer.

### Participants

The study participants were prostate cancer outpatients who visited the Urology Department at Miyagi Cancer Center, underwent radical prostatectomy without receiving neoadjuvant therapy, had urinary and sexual dysfunction after surgery, and met the following eligibility criteria: (1) informed of their cancer diagnosis, (2) under 70 years of age, (3) had a Gleason score lower than 10 and were classified into a low, intermediate, or high risk group according to the D'Amico classification, and (4) agreed to participate in the study. The exclusion criteria are as follows: (1) 70 years of age or over, (2) had a Gleason score of 10 or higher and were classified into a very high risk group according to the D'Amico classification, (3) had distant metastasis, and (4) had a mental disorder. Gleason score is a pathological classification that represents the malignancy of prostate cancer. A Gleason score of 6 or less is a low-risk cancer of malignancy, 7 is a cancer of medium risk, and 8–10 are cancer of high risk. D'Amico classification comprehensively evaluates Gleason score, PSA, tumor-node-metastasis classification, and determines the malignancy of prostate cancer.

We asked the doctors in-charge at hospital to distribute a study manual to prostate cancer patients hospitalized for surgery, and explained the study in detail to these patients. The researcher again explained the contents of the study to the subjects who gave consent and obtained consent. Those who agreed to participate were asked to submit consent forms.

### Intervention programs

The telenursing support system aiming to prevent postsurgical complications and improve QOL among

patients with prostate cancer is shown in Figure 1. First, the participants received explanations from the doctor and nurse about pelvic floor muscle exercise methods, including the number of repetitions, the recommended amounts of drinking water, and the effects of sildenafil citrate [Figure 1: 1]. The participants then received a brief outline of telenursing from a researcher, as well as a tablet computer [Figure 1: 2]. Using the tablet computer, the participants were then asked to log into a patient website and enter information regarding postoperative symptoms and complications, including urinary frequency, the severity of urinary incontinence, the number of incontinence pads used, stool frequency, the presence of sexual desire, the presence of erections, hours of sleep, and presence of a sound sleep [Figure 1: 3, 3.1]. In addition, if you have any questions or problems in living, you can use E-mail and chat functions to contact researchers [Figure 1: 3.2]. All information was stored in cloud storage. Their symptoms were automatically graphed as progress notes that could be monitored by both participants and researchers [Figure 1: 4, 5]. The data transmitted from the researchers were also kept in cloud storage and automatically transmitted to the participants, who were expected to

review their home care by monitoring their own graphed data [Figure 1: 6].

Researchers could then learn how the participants understood pelvic floor muscle exercise methods after surgery, as well as the number of repetitions, the amount of drinking water consumed, and the effects of sildenafil citrate. They use the system's E-mail and chat capabilities to check the participant's postoperative complications and home care situation, such as daily activities, including job and household activities, and the amount of drinking water consumed. This information was collected via E-mail and chat when more personalized nursing support was provided [Figure 1: 5]. An achievable goal was set based on the acquired data, and consultation and educational support was implemented. The period of intervention was set at 3 months. Participants were then asked to answer closed-ended questions that appeared on an Internet terminal at a specific time once a day and transmit their responses to a server using a tablet computer. This task was expected to take about 10 min. Trigger points were set for each question item beforehand. Researchers continued monitoring transmitted data, offering necessary information on concrete self-care activities if a trigger point became active. In this way, educational guidance was

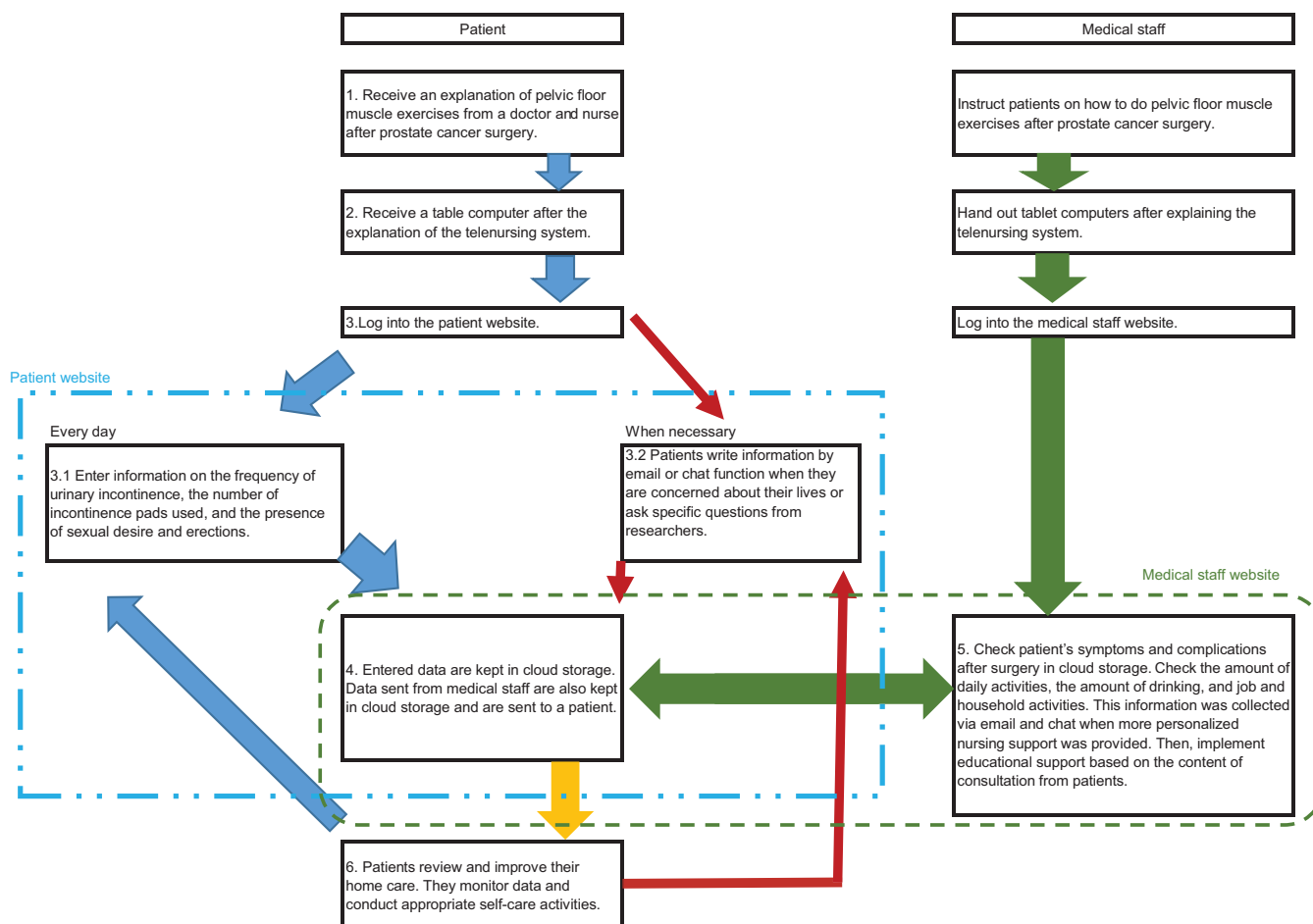


Figure 1: Telenursing system aiming to prevent postsurgical complications and improve quality of life among patients with prostate cancer

conducted on the ICT screen to advise each patient in terms of his/her activities of daily living. Researchers also sent E-mails to participants every 2 weeks asking whether they were troubled by complications and other problems in daily activities. Participants underwent outpatient examinations at the first and third postoperative months. Participants then received an evaluation of their postoperative complications from the attending physician in accordance with their symptoms and therapeutic drug prescriptions. During all 3 months of the intervention period, we set up an environment in which we could contact the hospital if there were any concerns about patients.

### Content of evaluation

The primary endpoint was an improved score on the expanded prostate cancer index composite (EPIC) and improved urinary incontinence based on a positive stress test. EPIC measures the severity of complications and sense of burden in prostate cancer patients. It is composed of fifty items and four subscales (urinary, bowel, sexual, hormonal). The reliability and validity of the Japanese version of EPIC.<sup>[20]</sup> A self-administered questionnaire survey was conducted at 1 and 3 months after surgery. A stress test was conducted by asking patients to cough when they felt bladder fullness and by checking the level of urinary incontinence. According to the method proposed by the International Continence Society, a participant puts on an absorbent pad and drinks 500 ml of water before performing the following activities: Stand from sitting (ten times), cough vigorously (ten times), and wash hands in running water for 1 min. Changes in weight are recorded, with an increase of 2 g classified as positive. In the present study, all participants had urinary incontinence; therefore, the weight of pads was not measured. Instead, a bladder ultrasound device (BladderScan BVI 6100 Japan) was used to evaluate the level of urinary incontinence by twice measuring the amount of urine left in the bladder: Before and after the stress test (at 1 and 3 months after surgery).

For secondary endpoint, QOL was evaluated using the Functional Assessment of Cancer Therapy-General (FACT-G) 19. The FACT-G is a self-administered questionnaire survey that measures health-related QOL. It is composed of 27 items and four subscales: Physical well-being (PWB), social/family well-being, emotional well-being (EWB), and functional well-being (FWB). Its reliability and validity has been confirmed. The FACT-G was conducted at 1 and 3 months after surgery.

Information on the participants' ages, content of treatment, PSA test results, Gleason scores, prescription drugs, and neurovascular bundle (NVB) preservation was collected from their medical records.

### Statistical analysis

Descriptive statistics for EPIC were calculated. The Wilcoxon test was used to examine time-dependent changes in EPIC and FACT-G. The volume of urine in the bladder before the test was rated as 100%, and the percentage after the test was measured. The Mann–Whitney U test was used for statistical analysis ( $P < 0.05$ ). All statistical analyses were performed using SPSS version 21 (SPSS Inc., Chicago, IL, USA).

### Ethical approval

This study was approved by the Ethics Committees of the research department at Tohoku University Graduate School of Medicine (Approved No. 2013-1-615) and Miyagi Cancer Center (Approved No. 26-4). The purpose and methods of study were explained to participants both verbally and in written form. The acquired data were managed safely and appropriately by collecting, storing, and discarding the information according in a company server with the privacy mark certification.

## Results

### Outline of the participants

An outline of the study participants before surgery is shown in Table 1. We asked 33 patients who met all inclusion criteria to participate in the study, 30 of whom agreed. The characteristics of the participants were 21 (70.0%) in their 60 s and 12 (40.0%) working. Seventy percent of participants have spouses, but 20 (66.6%) have both resection of NVB that affects sexual dysfunction. Three of the participants (10.0%) had been taking PDE5 inhibitors before surgery. Participants were at high risk for postoperative sexual dysfunction. The login status of the telenursing system was “everyday” for 23 (76.6%). Approximately 90% of respondents, including those “more than five times a week,” use the system regularly.

### Comparison between one and 3 months after surgery

Table 2 shows the two-group comparison of EPIC, FACT-G, and stress test one and three months after prostate cancer surgery. The scores of urinary incontinence and urinary bother for both groups were significantly higher in 3 months after surgery than in 1 month after surgery, showing improvement in symptoms. The amount of urine left in the bladder after stress test increased showing the improvement in urinary incontinence ( $P = 0.001$ ). There was no significant difference in sexual function between the 1 and 3 months after surgery, and there was no change in symptoms ( $P = 0.125$ ).

The total scores of FACT-G in 3 months after surgery were significantly high showing the improvement

Table 1: Overview of the study participants ( $n=30$ )

Item	$n$ (%)
Age, mean $\pm$ SD	62.7 $\pm$ 4.1
50 s	9 (30.0)
60 s	21 (70.0)
Occupation	12 (40.0)
Educational background	
Junior high school	5 (16.6)
High school	18 (60.0)
University	6 (20.0)
Other	1 (3.4)
Family structure	
Single	4 (13.3)
Couple	17 (56.6)
Couple and children	4 (13.3)
Three generations	5 (16.8)
Anamnesis	19 (63.3)
PSA (presurgery), mean $\pm$ SD	6.5 $\pm$ 1.0
Gleason score (presurgery), mean $\pm$ SD	6.9 $\pm$ 0.6
<7	7 (23.3)
7	18 (60.0)
>7	5 (16.7)
NVB	
Both resection	20 (66.6)
One resection	10 (33.4)
PDE5 inhibitors	3 (10.0)
Anticholinergic drug	6 (20.0)
The login status of the telenursing system	
Every day (7 times a week)	23 (76.6)
5-6 times a week	4 (13.3)
2-4 times a week	2 (6.7)
Once a week	1 (3.4)

PSA: Prostate-specific antigen; NVB: Neurovascular bundle; PDE5 inhibitors: Phosphodiesterase Type 5 inhibitors; SD: Standard deviation

of QOL ( $P = 0.027$ ). On the subscales, the scores of PWB ( $P = 0.000$ ), EWB ( $P = 0.032$ ) and FWB ( $P = 0.019$ ) were significantly higher. Overall, the QOL improved 3 months after surgery compared to 1 month after surgery.

### Example of nursing support using telenursing system

Patients whose urinary function was good were asked to adjust the use of sanitary napkins and incontinence pads in accordance with the change in their conditions. Those who did not see improvements in their urinary function were asked to reevaluate how they performed pelvic floor muscle exercises and to set new achievable goals. Next, both patients and nurses evaluated urinary function every week. Nurses proposed an achievable goal based on the patients' daily activities, the number of arousals during sleep at night, the amount of drinking after sleep onset, and the repetitions of pelvic floor muscle exercises. Some patients failed to see improvements in urinary function even after they had done pelvic floor muscle exercises for a long time. An anticholinergic agent, beta-receptor stimulant, and alpha-receptor stimulant were prescribed for patients

Table 2: Comparison between 1 month and 3 months after surgery

	Intervention ( $n=30$ ), median (IQR)		$P^a$
	1 month	3 months	
EPIC			
Summary score			
Urinary	57.9 (43.7-70.1)	84.7 (73.7-97.8)	0.000
Bowel	95.6 (82.1-95.2)	100.0 (92.3-97.5)	0.043
Sexual	27.9 (23.1-32.7)	28.9 (19.2-32.7)	0.125
Hormonal	87.4 (77.3-92.7)	93.2 (79.1-94.6)	0.022
Subscale			
Urinary function	46.0 (35.0-60.0)	76.8 (53.2-95.0)	0.000
Urinary bother	65.2 (46.4-82.1)	85.7 (75.0-92.7)	0.015
Urinary incontinence	13.5 (0.0-29.0)	66.7 (39.5-87.5)	0.000
Urinary irritative/obstructive	86.7 (67.8-94.6)	96.4 (78.5-92.1)	0.046
Bowel function	93.8 (85.7-91.8)	100.0 (89.3-96.1)	0.032
Bowel bother	97.4 (78.5-99.4)	100.0 (96.4-97.8)	0.048
Sexual function	0.0 (0.0-5.6)	2.8 (0.0-12.0)	0.089
Sexual bother	87.5 (75.0-100.0)	75.0 (50.0-93.8)	0.246
Hormonal function	76.0 (60.0-100.0)	85.0 (60.0-98.4)	0.004
Hormonal bother	95.8 (79.0-100.0)	100.0 (87.5-98.7)	0.248
Stress test <sup>b</sup>	70.2 (14.2)	93.9 (4.8)	0.001
FACT-G			
Summary score	63.0 (45.0-79.0)	69.0 (48.0-85.0)	0.027
Subscale			
Physical well-being	15.0 (6.0-22.0)	19.0 (9.0-26.0)	0.000
Social/family well-being	20.0 (11.0-25.0)	21.0 (10.0-26.0)	0.072
Emotional well-being	13.0 (8.0-24.0)	17.0 (10.0-25.0)	0.032
Functional well-being	15.0 (8.0-20.0)	18.0 (9.0-22.0)	0.019

<sup>a</sup>The Wilcoxon test was used for comparing the scores in one and three months after surgery, <sup>b</sup>The bladder urine volume (%) after the stress test (the bladder urine volume before the stress test as 100%) and average SD. IQR: Interquartile range; SD: Standard deviation; FACT-G: Functional Assessment of Cancer Therapy-General; EPIC: Expanded prostate cancer index composite

whose urinary dysfunction was serious. One patient in the intervention group requested that he wanted to take an anticholinergic drug at an early stage; therefore, a nurse reported the patient's condition to the doctor in-charge through telenursing.

## Discussion

The results of this study showed that there was a significant difference in EPIC and FACT-G scores, and symptoms and QOL improved 3 months later than 1 month later. It is thought that the telenursing system introduced in this study influenced these backgrounds. Telenursing help patients improve his/her disease condition by sharing goals with a nurse<sup>[21]</sup> and enhancing feelings of self-efficacy.<sup>[13]</sup> Urinary incontinence tends to be serious soon after surgery; therefore, many prostate cancer patients fluctuate between hope and despair over their ever-changing physical condition. The telenursing system implemented in this study collected information on living conditions and questions using not only physical symptoms but also E-mail and chat functions and provided individualized nursing support in

real time. In addition, the visualization of the physical symptoms input by the patient enabled the patient to look back on his life and was able to perform self-care by himself. I was able to improve patient self-efficacy by having the nurse evaluate patients' efforts with the telenursing system and being able to observe the patient's physical condition objectively.

### **Nursing support for urinary function**

The primary endpoint, EPIC results, contributed to improvements in urinary function in the intervention group. Symptoms related to excretion can cause patients to be ashamed and may not be able to properly communicate their symptoms to healthcare professionals. On the other hand, since the telenursing system uses ICT, there is no need to communicate face-to-face. Setting a specific target value and carrying out support indispensable for improving symptoms enhanced their self-efficacy and motivation to manage their own symptoms. From this background, it is presumed that urinary function improved 3 months after the operation. The EPIC scores did not differ much from those of the previous study.<sup>[22]</sup> Starting pelvic floor muscle exercises before surgery and continuing such exercises after surgery has been reported to accelerate the recovery of urinary function.<sup>[23,24]</sup> Participants were instructed by both physicians and nurses prior to prostate cancer surgery to explain the importance of pelvic floor muscle exercise methods and continuation. After discharge, the urinary function is thought to have been improved by receiving timely support by the telenursing system according to the individual's living situation.

### **Nursing support for sexual function**

There was no significant difference in sexual function between 1 month and 3 months, and no improvement in symptoms was observed. The cause is related to NVB preservation. This was a difficult group to restore sexual function because 20 of the subjects had both NVB resection. NVB preservation is associated with the recovery of sexual function after surgery, but also a risk of prostate cancer recurrence.<sup>[25,26]</sup> NVB resection can also lead to a decline in sexual function, so medical staff must monitor this in patients and provide support at an early stage after surgery if necessary. The problem of sexual function is content with shame. Similar to urinary incontinence. Therefore, it is difficult to consult nurse while looking at the face of nurse. Telenursing is useful because patients can talk indirectly to nurses about their own sexual function, as well as their feelings about it. It is important to confirm whether we want patients to take medication for sexual dysfunction and want opportunities to talk about sexual activity after surgery. Although avoidance attitude in

regard to sexual bother can be an appropriate coping mechanism for recovering mental health,<sup>[27,28]</sup> it is not a direct method to solve the problem. In cooperation with the doctor in-charge, telenursing was helpful for checking patients' views on sex and preventing his/her sexual bother from worsening. A standard consultation with urologist and nurse 3 months after treatment to discuss sexual and relational issues is considered as most preferable.<sup>[28]</sup> Patients felt relief because they could get necessary information in a timely fashion from a distant place. This sense of security helped enhance the patients' abilities to manage their own symptoms. In diabetes and other cancer patients, the ability to manage symptoms by distant nursing was improved.<sup>[29]</sup> In the cultural background of Japan, there is a culture that is abhorrent to tell others about information on sexuality. It is meaningful for patients and nurses that patients with prostate cancer in Japan can communicate information on sexuality without looking at the face of medical personnel by telenursing.

### **Quality of life after surgery and the future direction of telenursing**

QOL was evaluated using the FACT-G. The scores of FACT-G were not significantly different from those of the previous study.<sup>[30]</sup> The relationship between prostate cancer patients' complications after surgery and QOL showed that their PWB improved as they found relief from their symptoms. Educational support aiming for the improvement of complications after surgery and the sense of security brought about by communication with nurses through telenursing was thought to contribute to the improvement of emotional and FWB at 3 months after surgery. In this study, QOL was considered a secondary evaluation. However, when living at home, cancer survivors become more susceptible to slight changes in their physical condition and face various problems such as noncancer diseases, work, and family care. It is necessary to continue. This situation has a significant impact on the patient's QOL. The system in this study is dedicated to monitoring postoperative complications. In the future, we believe that it is necessary to develop a centralized system that includes not only medical care but also information on welfare and nursing care and a system that can be customized according to individual situations. While telenursing systems can help improve symptoms and improve QOL, they also create the burden of log into the system every day. For prostate cancer patients, many of whom are elderly, some people have an aversion to ICT. In the future, it will be necessary to build a system that can be used with patients' smartphones and to collect information using videophones. Nurses are required to be able to constantly create new nursing support regardless of existing methods. We believe that telenursing

utilizing ICT has the potential to be applied to patients with various diseases as a means of a new nursing support method.

### Limitations

This study was a verification of intervention effect in a short period of 3 months. The reason for setting the intervention period is generally considered to be a period during which the effect of remote nursing is easy to verify because the period up to 3 months after surgery is heavy symptom of postoperative complications and affects patient's QOL. However, recovery of postoperative complications of prostate cancer is a mid- to long-term problem generally requiring about 6 months to a year, so mid-to long-term verification is necessary in the future.

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### Conflicts of interest

There are no conflicts of interest.

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