



# Development of a home health care service platform for ostomy patient management

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**Purpose:** The use of an ostomy for urination and defecation leads to reduced quality of life. Although many ostomy management strategies are needed, such strategies are often implemented by patients. Thus, there is a need for a home health care service platform that can be used in ostomy patient management.

**Methods:** We developed an ostomy patient management platform by identifying the needs of patients and medical staff through the Chronic Care Ostomy Self-Management Training Program in the United States and from studies conducted in Korea.

**Results:** The platform encompassed physical management, psychological management, maintenance of social function, spiritual stability, and home medical care. These components were implemented through monitoring, self-care guidance, and a community platform. For the monitoring function, patients entered their health status in a mobile application (app); the medical staff at the affiliated hospital then monitored the stoma status through a web interface.

**Conclusion:** Our platform allows medical staff to monitor ostomy patients through a web interface and help such patients to fully manage their ostomy at home using an app. We expect that the continued development of patient-oriented functions in our app will allow ostomy patients to experience quality-of-life improvements.

**Keywords:** Ostomy; Home care services; Telehealth; Digital health platform; Telemedicine

## INTRODUCTION

An ostomy or artificial anus refers to a passage through which urine or feces is artificially discharged from the abdominal wall as

a result of disease (e.g., congenital anomaly, inflammatory bowel disease, or cancer); it may be permanent or temporary [1]. The numbers of cases of inflammatory bowel disease and colorectal cancer—both of which inevitably require a stoma—are increasing

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in Korea [2, 3]. Accordingly, the number of ostomy patients registered as disabled in Korea increased from 13,072 in 2010 to 15,427 in 2020 [4].

When an ostomy is established after surgical treatment of a life-threatening disease, the patient's life expectancy is generally prolonged. However, the use of an ostomy for urination and defecation requires many changes that reduce the patient's overall quality of life. Patients complain of sexual problems, depression, difficulty managing the artificial stoma, constipation, dissatisfaction with appearance, difficulty changing clothes, difficulty traveling, and fatigue [5]. Therefore, continuous management is crucial after stoma establishment. However, many problems must be solved by patients themselves after discharge from the hospital. Thus, we developed a mobile application (app) and a web-based digital health platform that can facilitate stoma management by ostomy patients.

## METHODS

### Ethics statement

This study was prepared based on the existing literatures, and no individual patient information was included. Therefore, it was not subject to approval from the Institutional Review Board.

### Development of services for at-home-based ostomy care

In the late 1990s, the Chronic Care Model was developed in the United States for organizational support of human and medical systems, with the aim of helping patients to manage their chronic diseases [6]. Among diverse types of programs based on this model, the Chronic Care Ostomy Self-Management Training Program (CCOSMTP) was developed for ostomy care; it laid the foundation for the development of a program that could facilitate stoma management by ostomy patients and improve daily life for those patients [7].

The CCOSMTP model was developed through surveys using the City of Hope-Quality of Life-Ostomy questionnaire, a focus group, and reviews of various studies (concerning social factors, patient symptoms, and comorbidities) to understand the needs of ostomy patients [7]. This model consisted of four components that required separate physical, psychological, social, and spiritual programming. Clinical trials to facilitate programs for each component have been conducted; the programs have allowed medical staff to provide regular education to patients via telemedicine [8, 9].

In Korea, many related studies have been performed (particularly in the nursing field) concerning the type of discomfort experienced by an ostomy patient and the degree of effort needed to

manage that discomfort. Upon discharge from the hospital, ostomy patients have nursing needs for treatment and prognosis; such needs include psychological support, complication management, and dietary management [10]. Ostomy patients also experience difficulties in the implementation of treatment instructions, use of treatment instruments and equipment, and interaction with treatment professionals [11]. Furthermore, patients with a permanent or temporary stoma require detailed information regarding the stoma, rapid access to medical staff, management of fear related to the stoma, and explanations of examination and treatment information [12]. They also complain of difficulties eating, managing their stool, and engaging in social activities [13]. Therefore, the four components (physical, psychological, social, and spiritual programming) included in the CCOSMTP model can be similarly applied to ostomy patients in Korea.

## RESULTS

### Development of a non-face-to-face service platform for at-home ostomy care

Based on a literature review, we developed a non-face-to-face service platform for at-home management of ostomy patients, with consideration of the following essential components: physical management, psychological management, maintenance of social function, spiritual stability, and home medical care. These components were implemented through three functions: monitoring, self-care guidance, and a community for ostomy patients. These functions were configured within a platform that was developed as an app and a website. The app and website establish a connection between ostomy patients and medical staff who specialize in stoma management and self-care for ostomy patients (Fig. 1).

### Monitoring

The monitoring function for discharged ostomy patients enables systematic patient management through a smartphone app; this is more robust than traditional patient management through a conventional telephone. A patient can be asked to upload several stoma pictures for assessment through their smartphone; guidance markers are displayed on the smartphone screen to ensure that the correct area is photographed. Stoma complications (e.g., bleeding, prolapse, hernia, necrosis, ischemia, stenosis, depression, intestinal obstruction, fistula formation, or mucosal skin boundary separation), skin complications (e.g., irritant contact dermatitis, allergic dermatitis, folliculitis, candidiasis, pyoderma gangrenosum, periosteal varices, softening/infiltration, epidermal hypertrophy, or physical damage), and information concerning the stoma bag cycle, weight, and other side effects were collected

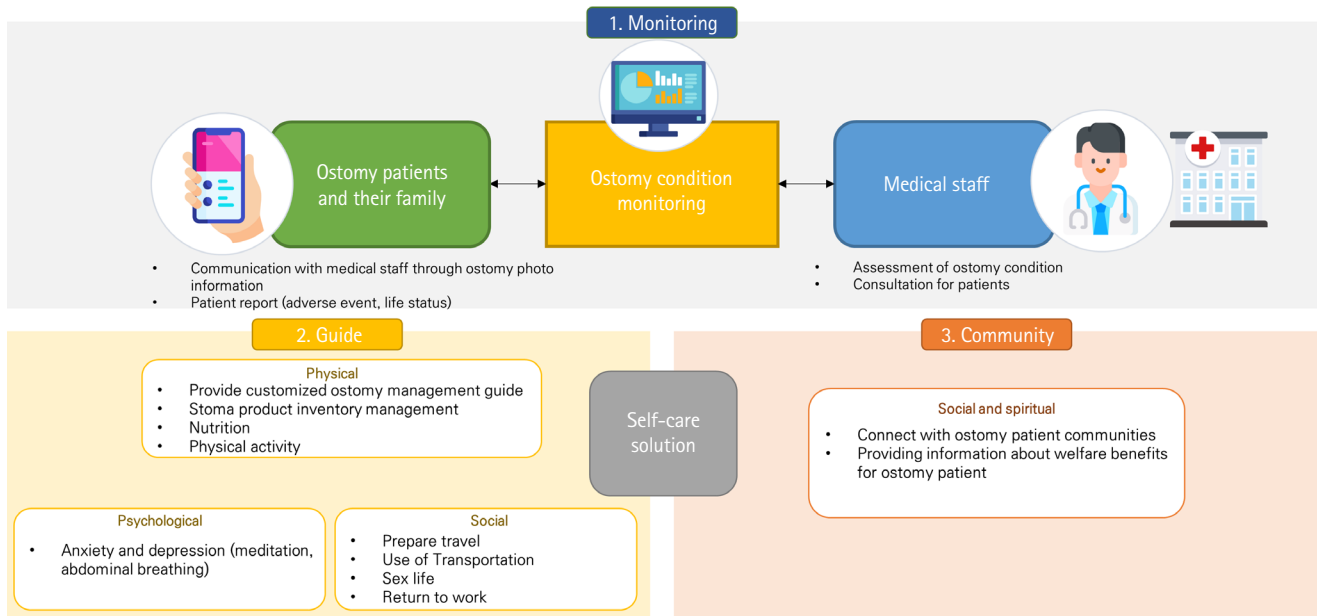


Fig. 1. Service platform for ostomy patient management.

Table 1. Functions included in the self-care solutions

| Function  | Domain                          | Subject                | Topic   |
|-----------|---------------------------------|------------------------|---|
| Guidance  | Physical well-being             | Ostomy management      | <ul style="list-style-type: none"> <li>• Customized ostomy management guide</li> <li>• Stoma-care checklist</li> <li>• Stoma supply management</li> </ul>   |
|           |                                 | Diet                   | <ul style="list-style-type: none"> <li>• Dietary considerations after surgery</li> <li>• Information about food that can and cannot be eaten</li> </ul>   |
|           |                                 | Physical activity      | <ul style="list-style-type: none"> <li>• Appropriate activities for ostomy patients</li> <li>• Warnings about specific activities</li> </ul>  |
|           | Psychological well-being        | Psychological symptoms | <ul style="list-style-type: none"> <li>• Management of fatigue, anxiety, and depression</li> <li>• Guidance for deep breathing and meditation</li> </ul>  |
|           | Social and spiritual well-being | Self-management        | <ul style="list-style-type: none"> <li>• Guidance to promote self-management</li> </ul>   |
|           |                                 | Daily life guidance    | <ul style="list-style-type: none"> <li>• Travel tips for ostomy patients</li> <li>• Transportation guidance</li> <li>• Intimacy guidance</li> <li>• Returning to the workplace</li> </ul>   |
| Community | Social and spiritual well-being | Support group          | <ul style="list-style-type: none"> <li>• Bulletins for sharing information about stoma care and communication</li> <li>• Explanations of benefits for disabled people through the Korean Ostomy Association (<a href="http://www.ostomy.or.kr/">http://www.ostomy.or.kr/</a>)</li> <li>• Connection to related communities</li> </ul> |
|           |                                 | Spiritual community    | <ul style="list-style-type: none"> <li>• Bulletins for sharing religious or spiritual values among ostomy patients</li> </ul>   |

and used for education and counseling.

**Guidance**

Patients living with a stoma can experience difficulty maintaining a healthy life because they lack knowledge and are recovering

from physical damage. Therefore, it is important to reduce these burdens and support a rapid return to daily life through the use of an appropriate lifestyle guide. Some guides have been proposed for physical, psychological, and social well-being (Table 1). The main guides referenced in the app are the patient guide published

by the United Ostomy Associations of America Inc (UOAA), the travel and exercise guide published by the Ileostomy and Internal Pouch Association (IA), and the symptom coping guide for cancer patients published by the Korean Oncology Nursing Society and the Korean Cancer Study Group [1, 14–18]. Each well-being category includes guidance concerning difficulties with replacing the stoma bag, difficulties with daily life and social activity, difficulties with diet and nutrition, the management of frequent stool leakage, and psychological problems. The app is configured to provide relevant guidance for specific patient questions.

Guidance for physical well-being includes the provision of customized stoma management, provision of checklists for stoma management, management of stoma product inventories, and considerations regarding nutrition and physical activity. Patients discharged from the hospital may not be accustomed to replacing the stoma bag; the suggested guide in the app may help them to manage this task. Additionally, ostomy patients may experience difficulty preparing a stoma-compatible diet; the nutritional management guide can provide helpful information [17]. This management guide contains stoma-specific recommendations concerning water intake and dietary habits. Moreover, the importance of physical activity may be underestimated by ostomy patients; their recovery may be delayed because of insufficient physical activity. Thus, the suggested physical activity guide in the app can help patients to quickly improve their health. The app provides pictures and videos to help patients follow the recommended physical activities [14], warnings about specific activities, and explanations of stoma-specific exercise modifications [16]. In addition, psychological problems can develop in ostomy patients. Because most of these patients have impaired body image recognition, self-esteem, depression, sexual problems, and low psychosocial adaptation [19], the app provides guidance to alleviate stoma-related psychological symptoms and to stabilize mood through meditation and abdominal respiration; it also assists with self-management [18]. Ostomy patients may experience difficulties controlling stool, which limits their ability to engage in social activities [13]. A guide for maintaining social function; engaging in travel, transportation, and sex; and returning to daily work will assist ostomy patients in their daily social activities is also provided (Table 2) [1, 15].

### *Community*

According to a report published by the Korea Disabled People's Development Institute, most ostomy patients are discharged from the hospital without adequate education; they gain useful tips through trial and error, which is a painful process [20]. In addition, patients will likely find it difficult to attend external educa-

tion because of the psychological burden. Accordingly, there might be a demand for community support at the time of discharge. The community function for the social and spiritual well-being of ostomy patients consists of functions that connect people outside the home, such as ostomy patient gatherings, bulletin board communities, and the provision of a space for sharing welfare benefits with ostomy patients. In addition, a bulletin board related to a specific religion or belief in the community may be used to share spiritual beliefs.

## **Structure of the mobile app and web-based administration platform**

### *Mobile application*

Patients discharged from the hospital after surgery are registered as outpatients; they receive a registration number and temporary app password from the app administrator. They access the home screen after logging in using the given information; available sections are “all about ostomy” (containing stoma information) and “health records.” The ostomy information section provides information necessary for daily life, such as an introduction to the digestive system, methods to manage the ostomy, types of ostomy complications, replacement of the ostomy bag, diet management, and a checklist for emergency management. Such information supplements the patient's physical, psychological, and social well-being. In the “health records” section, patients enter their ostomy status and receive feedback from the medical staff through regular checkups twice monthly on a set date through the “check ostomy” function; this function directly addresses the patient's physical well-being. In addition, the “health diary” function enables patients to make daily entries regarding their weight, water intake, bowel movements, and meals consumed.

Ostomy inspections can be initiated by the patient or the patient's guardian; they begin by determining the patient's body weight and major problems requiring education (e.g., difficulty replacing the stoma or difficulties with diet and nutrition). The questionnaire about stoma and skin complications may differ depending on the type of ostomy (e.g., colostomy or ileostomy). Then, patients are asked to upload three photos of their stoma and skin condition for assessment by medical staff; a video guide is provided for an accurate collection of images containing the front, left, and right sides of the stoma. In addition, patients can ask questions in the app before they submit the questionnaire. Medical staff at the affiliated hospital will review the submitted documents within a few days to evaluate the patient's stoma status; they provide feedback to the patient in the app. The patient confirms receipt of the feedback and explains whether they understand the information provided by the medical staff. The com-

**Table 2.** Components of well-being addressed in ostomy patient guides

| Subject                          | Component  |
|----------------------------------|--|
| Diet                             | <p>Colostomy guidelines</p> <ul style="list-style-type: none"> <li>• Consume vegetables and whole grains to prevent constipation</li> <li>• Antibiotics or dairy products may cause diarrhea</li> <li>• Try lactose-free products</li> <li>• White rice, potatoes, or pasta can help thicken stools</li> <li>• Hydrate with a cup of water after emptying the pouch</li> <li>• Replenish electrolytes with sports drinks</li> <li>• Call your doctor if constipation or diarrhea persists, or if dietary modification is not helpful</li> </ul> <p>Ileostomy guidelines</p> <ul style="list-style-type: none"> <li>• Start with low-fiber foods and try solid foods one at a time</li> <li>• Stop eating these foods if they cause any symptoms, then try them again within 2–3 weeks</li> <li>• Drink 8–10 glasses of fluid every day unless your doctor tells you otherwise</li> <li>• Sugary beverages, such as fruit juice and soda, should be limited</li> <li>• Because your pouch may fill more quickly than normal, you will need to empty it more often</li> <li>• Call your doctor if you show signs of dehydration or have three or more consecutive loose stools</li> </ul> <p>Avoiding blockages</p> <ul style="list-style-type: none"> <li>• Large food particles can more easily become obstructed in ileostomy patients</li> <li>• A food blockage can cause abdominal cramps, pain, and watery stools with a bad odor</li> <li>• Avoid high-fiber foods that absorb water (e.g., oats, citrus fruits, apples, and beans) for the first 6–8 weeks after surgery</li> <li>• Avoid food suspected to cause a blockage, and slowly add this food back into your diet</li> <li>• Nuts, popcorn, coconut, dried fruits, celery, mushrooms, foods with fibrous peels, and raw and crunchy vegetables may cause blockages</li> <li>• Eat slowly, chew food thoroughly, and drink fluids with meals</li> </ul> |
| Physical activity                | <ul style="list-style-type: none"> <li>• Empty ostomy bag before starting exercise</li> <li>• Start with low resistance and progress slowly under the guidance of trained exercise professionals</li> <li>• Ostomy patients may be at an increased risk of parastomal hernia</li> <li>• Correct lifting technique and good form are important to regulate intraabdominal pressure</li> <li>• Avoid the Valsalva maneuver</li> <li>• Modify any core exercises that cause excess intra-abdominal pressure</li> <li>• Get medical advice to ensure that you maintain optimal hydration before, during, and after exercise</li> <li>• When participating in contact sports or when there is a risk of a blow to the ostomy, consider wearing an ostomy protector/shield</li> </ul>  |
| Physical symptom management      | <ul style="list-style-type: none"> <li>• How to handle damage from feces</li> <li>• How to manage allergic reactions</li> <li>• Emergency calls and frequently asked questions</li> </ul>  |
| Psychological symptom management | <p>Fatigue</p> <ul style="list-style-type: none"> <li>• Energy-consuming tasks in the morning</li> <li>• Regular activities with sufficient break</li> <li>• Set balanced diet plans</li> <li>• Improve sleep quality</li> <li>• Spend time doing what you like with people you love</li> </ul>  |

**Table 2.** (Continued)

| Subject             | Component   |
|---------------------|---|
|                     | <p>Anxiety</p> <ul style="list-style-type: none"> <li>• Remove factors that enhance anxiety (e.g., caffeine or nicotine)</li> <li>• Discuss your feelings with family and friends</li> <li>• Try to talk spontaneously</li> <li>• Find a person for emotional support</li> <li>• Do not blame other people for your anxiety</li> <li>• Try to find the main reason for your anxiety</li> </ul> <p>Depression</p> <ul style="list-style-type: none"> <li>• Talk about feelings with medical staff and family</li> <li>• Regular activities with a sufficient break</li> <li>• Make a prescription list and share it with medical staff</li> <li>• Deep breathing and meditation</li> </ul>   |
| Daily life guidance | <p>Travel tips</p> <ul style="list-style-type: none"> <li>• Precut all pouches at home</li> <li>• Know your stoma size in both metric units and inches if you will be traveling out of the country</li> <li>• Pack supplies in carry-on and checked bags</li> <li>• Take extra supplies in case you become stranded</li> <li>• Expect to be screened without prior notice</li> </ul> <p>Transportation guides</p> <p>Road</p> <ul style="list-style-type: none"> <li>• In a car, you can stop when you want to</li> <li>• Many restaurants and carryout food stores have toilets and you can often use these</li> <li>• On a bus, you may find toilets on board or have sufficient space to empty a bag</li> <li>• Be aware of your ostomy equipment in the car trunk because this is the hottest part of the car in hot weather</li> </ul> <p>Rail or sea</p> <ul style="list-style-type: none"> <li>• There are usually adequate toilets or spaces to change your stoma bag on board</li> </ul> <p>Air</p> <ul style="list-style-type: none"> <li>• Remember to empty your bag in the departure lounge toilets while you are waiting to board your plane</li> </ul> <p>Intimacy</p> <ul style="list-style-type: none"> <li>• Allow some time to heal, both physically and emotionally</li> <li>• The usual discomfort, fatigue, and occasional depression can have a direct effect on your desire and libido</li> <li>• Doubt and anxiety prevent focusing on your partner</li> <li>• Accept yourself, feel comfortable and confident in your approach</li> <li>• Think about how you can approach sexual activity in a relaxed, non-pressured manner</li> <li>• Open, honest communication is essential, even if talking about the stoma is uncomfortable or embarrassing for you</li> </ul> <p>Back to work</p> <ul style="list-style-type: none"> <li>• Embracing a new normal in life after ostomy surgery is important for living an active life</li> <li>• The timing of your return depends on your recovery and the physical demands of your job</li> <li>• A few tips from UOAA's Facebook community and Advocacy Network:             <ol style="list-style-type: none"> <li>1. Be prepared</li> <li>2. Know your rights</li> <li>3. Dispose/empty your pouch properly</li> <li>4. Find the best clothing for your job</li> <li>5. Don't stress about stoma noise</li> <li>6. Hydrate</li> <li>7. Find support</li> </ol> </li> </ul> |

UOAA, United Ostomy Associations of America.  
Based on Settlemyre [1], a publication of UOAA.



community function within the app supports social well-being in ostomy patients; it allows information exchange between patients and the support system. Registered patients support each other by clicking the support button or writing comments for a new post on the community bulletin (Fig. 2).

*Web-based administration platform*

The web-based administration platform is a system in which the medical staff of the affiliated hospital access and manage information entered through the app. After login, the staff can view information (e.g., the total number of patients to be managed, patient sex, distribution of stoma types, and number of recent stoma inspections) along with graphs on the dashboard. In terms of stoma inspection, stomas can be managed according to the date of each patient's regular ostomy check; the questionnaire is completed and feedback is provided by the medical staff. A separate patient list is created with the names of individuals who have not requested an ostomy check on the expected day; if a patient does not request the ostomy check service after 3 days of push notification reminders, medical staff will directly contact the patient and remind them to request the ostomy check service.

Each patient is evaluated on the ostomy check screen; medical staff review basic patient information, ostomy management records, health diary data, and any graphs or photos. The medical

staff checks the questionnaire and stoma photos entered through the app; they then enter the evaluation and consultation details. When all items have been entered, the full document is printed in the form of a report and exported from the web interface. In addition,

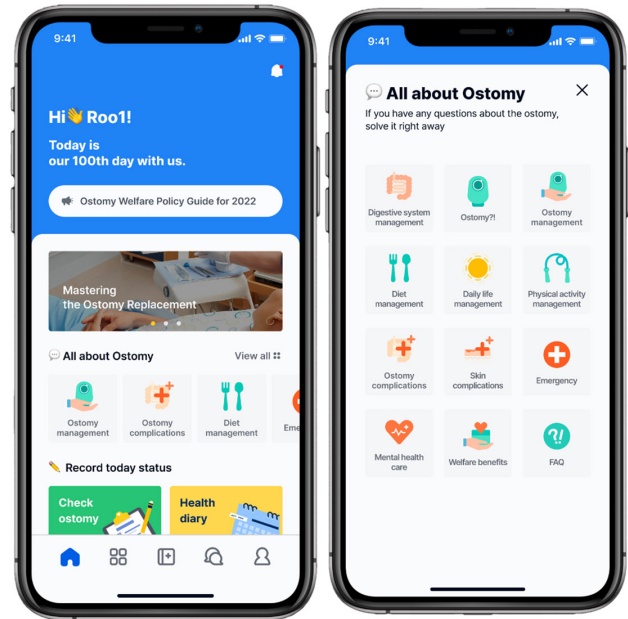


Fig. 2. Mobile application for ostomy care.

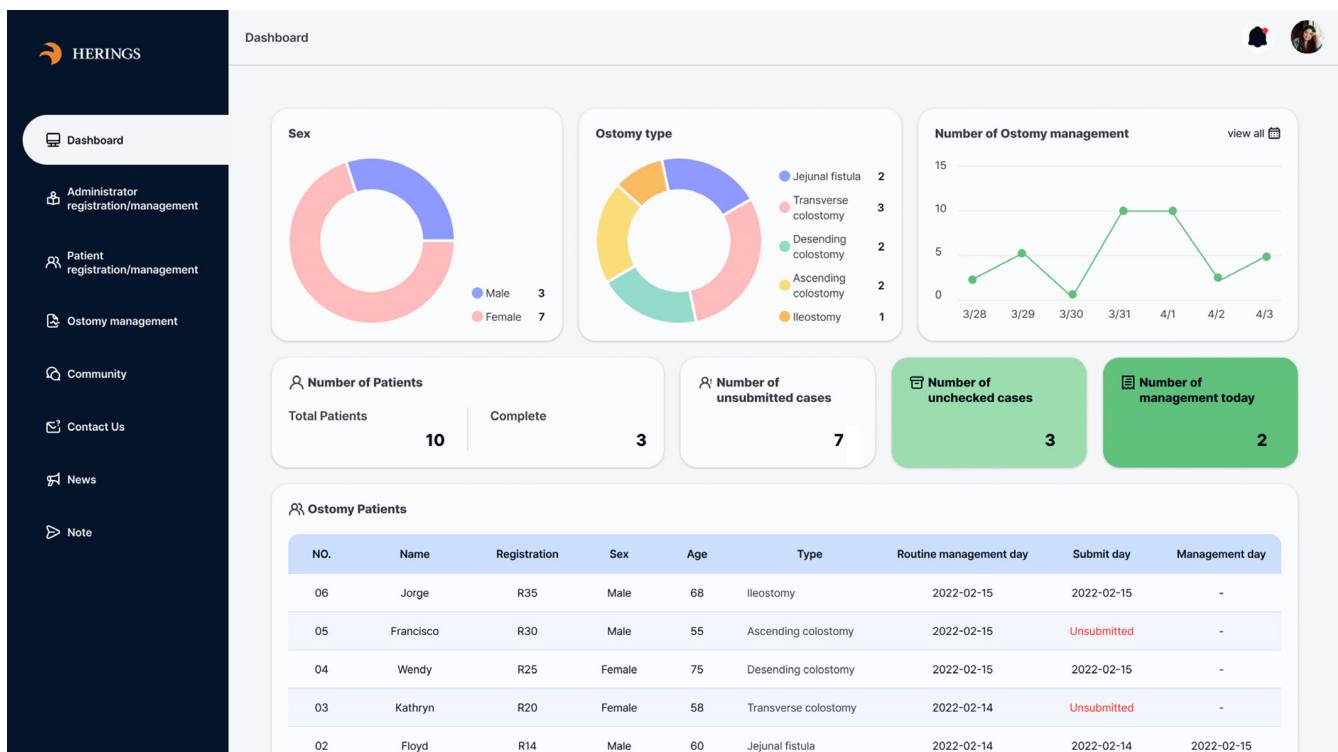


Fig. 3. Web-based administration platform for ostomy care.

tion, the health diary data and any graphs or photos allow medical staff to identify health problems that require more than a standard stoma inspection before the next outpatient visit (Fig. 3).

## DISCUSSION

To improve health status and quality of life in patients with a stoma, a mobile app has been developed as well as a web-based administration platform for medical staff who engage in ostomy care. As a previous review study suggests that mobile app use has become commonplace for a variety of health-promoting behaviors in addition to physical activity and weight control [21], ostomy care through the mobile app might become a part of daily life effectively. In addition, this mobile app can bring many advantages for medical staff in virtue of no time constraint and direct collection of abundant health data from each patient, which enables more thorough evaluation of patients' health status.

However, some limitations may exist for these digital platforms to settle down in the health care system. Among them, obstacles to licensing and regulation of mobile apps should be mainly considered. There are still few guidelines on the regulation of digital health software or apps, so it is hard for developers to expect the scope of regulation. Therefore, practical use of these apps will be possible only when specific guidelines for licensing and regulation are established.

Medical staff can access and manage information entered in the mobile app; thus, it is easy to understand the patient's condition remotely and reduce the burden of additional medical treatment. In addition, outcomes can be improved when patients continuously use these functions in the app to manage their stoma. Thus, ostomy patients learn how their stoma functions and whether they have correctly replaced the stoma bag. They can also check the stoma and skin condition, stoma-related complications, outpatient schedule, diet/nutrition/weight, and mental health. Even though the target users are the elderly who may not be accustomed to fully exploiting functions of smartphone apps, a high rate of smartphone penetration in Korea will gradually help overcome this limitation. We expect that the continued development of patient-oriented functions in our app will allow ostomy patients to experience the quality-of-life improvements.

## ARTICLE INFORMATION

### Conflict of interest

Seongwoo Yang and Kyoungsoon Park participated in the study as employees of HERINGS (Seoul, Korea).

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### Author contributions

Conceptualization: SY, KP, IYK; Data curation: SY, JWP, IYK; Formal analysis: SY, JWP, IYK; Investigation: SY, JP; Writing—original draft: all authors; Writing—review & editing: all authors. All authors read and approved the final manuscript.

### Additional information

This study was presented at the 55th Annual Meeting of the Korean Society of Coloproctology, held in Busan, Korea, on April 8–10, 2022.

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