A Real-World Experience of Integrating Patient-Reported Outcomes into Electronic Hospital Records Using a Mobile Messaging App in Patients Undergoing Radiation Treatment for Breast Cancer: A Cross-Sectional Retrospective Study

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Abstract

Background: Integrating electronic patient-reported outcomes (ePRO) into electronic health records (EHR) can enhance cancer care. However, effective integration remains challenging, especially in real-world settings.

Objective: This study aims to evaluate the effectiveness of integrating ePRO into EHR using a mobile messaging app for patients with breast cancer.

Methods: We conducted a retrospective analysis of prospectively collected ePRO data using the Breast-Q questionnaire from breast cancer patients who received adjuvant radiotherapy (RT) at our institution between May 2023 and April 2024. During the study period, each patient encountered ePRO requests one to three times according to their scheduled hospital visits before and after RT. Our ePRO system delivered questionnaires through the app, with responses automatically integrated into the EHR. Response rate was calculated as the percentage of patients whose responses were successfully recorded in the EHR among those asked to respond. Complete response (CR) was defined

Results: A total of 1,488 patients' data were analyzed, including 2,431 encounters (median of one encounter per patient). The CR rate across the first to the third ePRO encounter was 89.9%, 98.3%, and 97.3%, respectively. Younger patients had a significantly higher CR rate (90.9% in patients < 60 years vs. 87.0% in patients ? 60 years, p = 0.03). The timing of questionnaire dispatch also influenced CR, with higher rates observed when questionnaires were sent more than one hour before the visit (93.3%) or in the afternoon of the previous day (92.7%) compared to other timings, which were approximately 80% (p < 0.01). Both factors of age and the timing remained significant in multivariate analysis (both, p < 0.01).

Conclusions: This study demonstrates that integrating ePRO into EHR through the app is feasible and shows high patient adherence. Factors including age and timing of questionnaire requests influence ePRO response rates. These findings provide insights for optimizing ePRO systems in clinical oncology practice.

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Disclosure: none

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Running head: ePRO implementation using a mobile messaging app

Abstract

Background: Integrating electronic patient-reported outcomes (ePRO) into electronic health records (EHR) can enhance cancer care. However, effective integration remains challenging, especially in real-world settings.

Objective: This study aims to evaluate the effectiveness of integrating ePRO into EHR using a mobile messaging app for patients with breast cancer.

METHODS: We conducted a retrospective analysis of prospectively collected ePRO data using the Breast-Q questionnaire from breast cancer patients who received adjuvant radiotherapy (RT) at our institution between May 2023 and April 2024. During the study period, each patient encountered ePRO requests one to three times according to their scheduled hospital visits before and after RT. Our ePRO system delivered questionnaires through the app, with responses automatically integrated into the EHR. Response rate was calculated as the percentage of patients whose responses were successfully recorded in the EHR among those asked to respond. Complete response (CR) was defined as all questions were being answered and recorded in the EHR. Factors influencing CR were analyzed.

RESULTS: A total of 1,488 patients' data were analyzed, including 2,431 encounters (median of one encounter per patient). The CR rate across the first to the third ePRO encounter was 89.9%, 98.3%, and 97.3%, respectively. Younger patients had a significantly higher CR rate (90.9% in patients < 60 years vs. 87.0% in patients ≥ 60 years, $p = 0.03$). The timing of questionnaire dispatch also influenced CR, with higher rates observed when questionnaires were sent more than one hour before the visit (93.3%) or in the afternoon of the previous day (92.7%) compared to other timings, which were approximately 80% ($p < 0.01$). Both factors of age and the timing remained significant in multivariate analysis (both, $p < 0.01$).

CONCLUSION: This study demonstrates that integrating ePRO into EHR through the app is feasible and shows high patient adherence. Factors including age and timing of questionnaire requests influence ePRO response rates. These findings provide insights for optimizing ePRO systems in clinical oncology practice.

Keywords: Patient Reported Outcomes; Mobile Applications; Electronic Health Records; Radiotherapy; Breast Neoplasms

Introduction

Breast radiotherapy is an essential element in the management of breast cancer, as it enables breast conservation by eliminating microscopic tumor foci following tumor resection and prevents locoregional recurrence, leading to improved survivals [1, 2]. With advancements in breast cancer treatments, patient survival has improved over several decades [3, 4]. Given these trends, regimens for breast radiotherapy have evolved to minimize toxicities while maintaining tumor control [5]. Analyzing toxicity profiles following breast irradiation is important in optimizing radiotherapeutic regimens. To adequately capture treatment-related toxicities and patient satisfaction, it is crucial to incorporate patient-reported outcomes (PRO) into daily practice, including patient counseling and decision-making [6].

However, it is challenging to collect individual longitudinal PRO data over the course of treatment and post-treatment surveillance. In particular, patients with breast cancer require follow-up for more than a decade, as the risk of cancer recurrence and treatment-related toxicities persists long after the completion of primary treatment [7, 8]. Therefore, it is necessary to adopt automated systems for collecting large amounts of data on PRO. Moreover, the data needs to be integrated into hospital records to enable physicians to incorporate PRO into their clinical practice. In this regard, there have been efforts to minimize the burden of data collection by using specific systems that utilize electronic PRO (ePRO) [9]. Even though various systems for ePRO acquisition exist, they typically operate as standalone systems, without incorporating the data into electronic health records (EHR) [10]. To streamline the process of collecting ePRO data and integrating it into the EHR, an online-based system was developed at our institution using KaKaoTalk, a widely used mobile messaging application in South Korea. The system is designed to send a web-link connected to ePRO questionnaires to individuals' KaKaoTalk app, and the responses are automatically imported into our hospital's EHR immediately after the individual completes them.

We have been using the system to evaluate acute and chronic toxicities following breast radiotherapy by incorporating individual patients' PRO data. In the current study, we conducted a retrospective analysis of prospectively collected ePRO data to assess the system's effectiveness in collecting ePRO and to identify significant factors influencing response rates to the ePRO questionnaires among breast cancer patients who received radiotherapy and post-radiotherapy surveillance at our institution.

Methods

Participants and study design

Between May 2023 and April 2024, ePRO questionnaires were sent to patients visiting our department for postoperative adjuvant radiation treatment for breast cancer. These visits included both pre-radiotherapy evaluations and post-radiotherapy follow-ups for surveillance. A web link connected to the ePRO questionnaires was sent to each individual's KaKaoTalk mobile messaging app before their appointment with the attending physician, and patients were asked to respond to the questionnaires through the app. The dispatch of the questionnaires was managed by nurses or physicians through a system deployed in the EHR prior to each patient's visit. The timing of the questionnaire sending varied depending on the sender's preference, ranging from days to minutes before the visit, with no predefined time points. On the day of the visit, an outpatient receptionist or nurse checked whether the questionnaires had been completed. If the questionnaires were incomplete, the receptionist or nurse briefly asked the patient to complete them before the physician's session.

After an outpatient visiting for pre-radiotherapy evaluation, patients received radiation treatment according to our institutional protocol. Radiotherapy was administered once daily for five consecutive days, with three to 19 fractionations over a period of one to four weeks. Fractionation schedules were determined based on tumor stage, surgery types, the inclusion of regional nodal irradiation, and other risk factors. After completing the treatment, patients were followed up two to three weeks post-treatment, and subsequently every six months. ePRO data were collected at the pre-radiotherapy visit, the immediate post-radiotherapy visit at two to three weeks after treatment, and every six months thereafter. As each patient was required to respond to a questionnaire at each hospital visit, one or more questionnaires were requested to be completed by each patient during the period of this study.

Each participant's responses to the questionnaires were transferred to the EHR and our hospital's data warehouse in real-time immediately after the patient submitted each answer through their mobile messaging app. The ePRO data stored in the data warehouse were retrospectively downloaded and analyzed for this study. The current study was conducted with a retrospective cross-sectional design using data collected up to August 30, 2024, following approval from the institutional review board of our hospital (SMC 2024-07-147-001).

A system for ePRO collection and storage in the EHR

A system for ePRO acquisition and integration with the EHR was developed as an in-house model at our institution. The system links our hospital's EHR with the individual's mobile messaging app for collecting and storing of ePRO data. Data entry is performed through the messaging app on the patient's mobile phone, while the data presentation and storage are conducted in our hospital's EHR. A section dedicated to ePRO is integrated into the EHR, allowing physicians and other medical staff to send new ePRO questionnaires on request and view each patient's responses at any time **(Supplementary Figure 1).** When medical staff select ePRO questionnaires and dispatch them through the EHR, a web link for the ePRO questionnaires is sent to the patient's messaging app. The patient can open the link by entering their date of birth and submit their response to the questionnaire, which is in the form of checkboxes **(Supplementary Figure 2).** The patient's responses are automatically transferred to the ePRO section of the EHR and stored in the hospital's data warehouse. This process of entering, transferring, and storing ePRO data occurs simultaneously in real-time, enabling physicians to view the content and timestamp of the data in the EHR.

For the PRO instrument used in this study, we employed the Korean version of Breast-Q version 2.0 postoperative scale, including modules for Breast-Conserving Therapy, Mastectomy, and Reconstruction. Among the domains of these modules, the following were used for our patients: satisfaction with breasts, satisfaction with implants, physical well-being of the chest or upper body, and adverse effects of radiation [11, 12]. Patients who visited for pre-radiotherapy evaluation were asked to complete a questionnaire without the domain of adverse effects of radiation, while those attending for post-radiotherapy surveillance received a questionnaire that included the domain.

Assessment of the response rate and influencing factors

Response rate was calculated as the percentage of patients whose responses were successfully recorded in the EHR among those who were requested to respond to the questionnaires. The response rate for each survey encounter was assessed and compared according to the number of encounters, from the first to the third. Since the current analysis was based on surveys conducted over one year, most of our patients encountered the questionnaires one to three times according to the scheduled follow-up interval. We classified response status into three categories: complete response (CR, all questions answered), partial response (PR, at least one question answered but not all), and no response (NR). Additionally, when analyzing significant factors

influencing CR, we divided our patients into two groups: complete responders and non-complete responders, by merging partial and non-responders into the non-complete responder group.

To determine the significant factors influencing CR, we compared the CR rate according to various factors, focusing only on patients who encountered the survey for the first time. Specifically, to assess the impact of questionnaires request timing before a visit appointment, the timing was categorized into five groups: within one hour of the appointment time (≤1 hour on the day), more than one hour before the appointment on the visit day (>1 hour on the day), in the afternoon of the day before the appointment (PM the day before), in the morning of the day before the appointment (AM the day before), and two or more days before the appointment day (≥ 2 days before). In addition, patients who had previous experiences responding to questionnaires requested from other departments in our hospital were categorized as previous other ePRO (+), while those without the experiences were categorized as previous other ePRO (-). Lastly, patients with any of the following disease were categorized as having comorbidity: diabetes, cardiovascular disease, chronic pulmonary disease, hepatic disease, renal disease, or other cancers.

Statistical Analysis

For the univariate analysis, Fisher's exact test was used to compare the CR rate to the questionnaires based on various factors. The multivariate analysis was conducted using logistic regression. Factors with p-values < 0.1 in univariate analyses were included in the multivariate model. All p-values were two-sided, with $p < 0.05$ considered statistically significant. All analyses were performed using the Statistical Package for the Social Sciences, version 27 (SPSS Inc., IBM, Armonk, NY).

Results

Patient's Characteristics

A total of 2,334 patients with breast cancer attended our department during the study period. Of these, 1,491 patients with non-metastatic breast cancer were asked to complete the Beast-Q questionnaires using our ePRO system at their scheduled visit for pre-PORT evaluation or post-PORT surveillance. Among these, three patients were excluded from the analysis due to missing time records of their questionnaire responses, resulting in 1,488 patients being included in this study. Among these patients, 740 encountered one survey, 563

encountered two surveys, 175 encountered three surveys, and 10 encountered four surveys, resulting in a total of 2,431 survey encounters.

The characteristics of the1,488 patients are summarized in Table 1. The median age was 51 years, with most of the patients were between the ages of 40 and 59 (65.1%), and 41 (2.8%) patients aged 75 or older. Most patients underwent breast-conserving surgery (79.7%) and had invasive carcinoma (90.2%). Comorbidities were found in 223 (14.9%) patients, including diabetes (n=98, 6.6%), cardiovascular disease (n=67, 4.5%), chronic disease of the liver, lung, or kidney (n=63, 4.2%), and other cancers (n=26, 1.7%).

Table 1. Patients' characteristics

Characteristics		Number of patients (N=1488)
Age (years)	Median (range)	51 (24 – 85)
	≥20, <40	136 (9.1%)
	≥40, <60	968 (65.1%)
	≥60	384 (25.8%)
Gender	Female	1487 (99.9%)
	Male	1 (0.1%)
Type of surgery	Breast-conserving surgery	1186 (79.7%)
	Mastectomy without reconstruction	129 (8.7%)
	Mastectomy with reconstruction	173 (11.6%)
Histology	Ductal carcinoma in situ	146 (9.8%)
	Invasive carcinoma	1342 (90.2%)
Type of visit	Pre-radiotherapy evaluation visit	946 (63.6%)
	Post-radiotherapy follow-up visit	542 (36.4%)
Comorbidity	Yes	1265 (85.0%)
	No	223 (15.0%)
Experience of other ePRO	Yes	392 (26.3%)
	No	1096 (73.7%)
Timing of the questionnaires request*	≤ 1 hour on the day	115 (7.7%)
	> 1 hour on the day	586 (39.4%)
	PM the day before	545 (36.6%)
	AM the day before	112 (7.5%)
	≥ 2 days before	130 (8.7%)

Abbreviation: ePRO, electronic patient reported outcomes

* The timing of the questionnaires requests before a visit appointment was categorized as follows: within one hour of the appointment time (≤1 hour on the day), more than one hour before the appointment on the visit day (>1 hour on the day), in the afternoon of the day before the appointment (PM the day before), in the morning of the day before the appointment (AM the day before), and two or more days before the appointment day (≥ 2 days before).

Response rate and influencing factors

Of the 1,488 patients who encountered the questionnaires for the first time, 1,338 (89.9%) exhibited CR, 35 (2.4%) submitted PR, and 115 (7.7%) did not respond to the questionnaire. The response status and rates according to the number of survey encounters are shown in Figure 1.

In the univariate analysis of factors influencing CR, the following were statistically significant: patient's age, type of visit, and the timing of the questionnaires request before a visit appointment (Table 2). The rate of CR was significantly lower in patients aged 60 or older compared to those younger than 60 years (87.0% vs. 90.9%, $p = 0.03$). A significant lower CR rate was observed in patients encountering the questionnaire at pre-radiotherapy visit compared to those receiving the survey at post-radiotherapy visits (88.5% vs. 92.4%, $p = 0.02$). Notably, the timing of the questionnaires request before the visit appointment was significantly associated with the CR rate ($p<0.01$), and CR rates differed significantly across the five groups of request timing: patients who received the questionnaires more than two days before the appointment day had lowest CR rate (76.9%) and those who encountered the survey within one hour before the appointment time had the second lowest CR rate (81.7%). Meanwhile, patients who received the questionnaires more than one hour before the appointment time or encountered the survey in the afternoon of the day before the appointment showed favorable CR rates, exhibiting 93.3% and 92.7%, respectively. In the multivariate analysis, age and the timing of the questionnaires request remained significant influencing factors for CR. Old age (OR = 0.98, confidence interval; [CI] 0.96 – 0.99, $p < 0.01$) and questionnaires request timing of ≤ 1 hour on the day of the visit, AM the day before, or ≥ 2 days before the appointment (OR = 0.32, CI 0.22 – 0.45, $p< 0.01$) were significantly associated with a lower CR rate (Table 3).

Figure 1. Rates of complete response (CR), partial response (PR), and non-response (NR) for electronic patient-reported outcomes surveys across first, second, and third requests

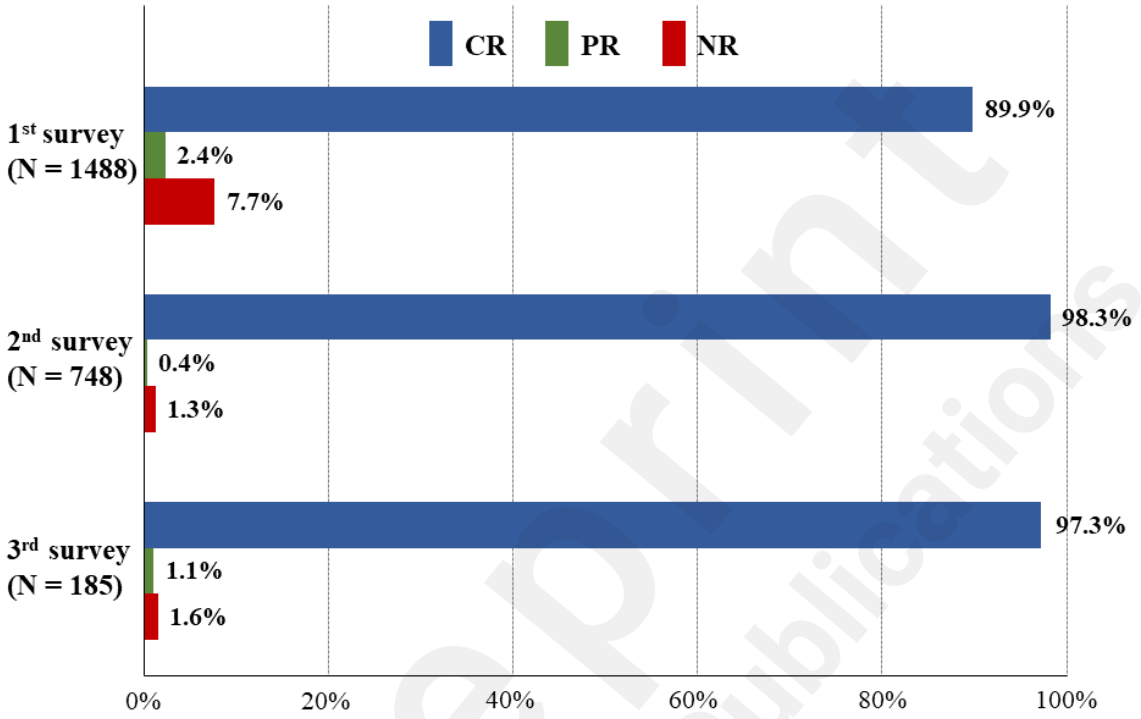

Table 2. Univariate analysis of factors affecting the complete response to ePRO questionnaire

Characteristics		CR (%)	Non-CR (%)	p-value
Age (years)	< 60	1004 (90.1%)	100 (9.1%)	0.03
	≥ 60	334 (87.0%)	50 (13.0%)	
Type of surgery	Breast-conserving surgery	1057 (89.1%)	129 (10.9%)	0.10
	Mastectomy without reconstruction	122 (94.6%)	7 (5.4%)	
	Mastectomy with reconstruction	159 (91.9%)	14 (8.1%)	
Histology	Ductal carcinoma in situ	133 (91.1%)	13 (8.9%)	0.77
	Invasive carcinoma	1205 (89.8%)	137 (10.2%)	
Type of Visit	Pre-radiotherapy evaluation visit	837 (88.5%)	109 (11.5%)	0.02
	Post-radiotherapy follow-up visit	501 (92.4%)	41 (7.6%)	
Comorbidity	Yes	198 (88.8%)	25 (11.2%)	0.55
	No	1140 (90.1%)	125 (9.9%)	
Experience of other ePRO	Yes	354 (90.3%)	38 (9.7%)	0.85
	No	984 (89.8%)	112 (10.2%)	
Timing of the questionnaires request*	≤ 1 hour on the day	94 (81.7%)	21 (18.3%)	<0.01
	> 1 hour on the day	547 (93.3%)	39 (6.7%)	
	PM the day before	505 (92.7%)	40 (7.3%)	
	AM the day before	92 (82.1%)	20 (17.9%)	
	≥ 2 days before	100 (76.9%)	30 (23.1%)	

Abbreviation: CR, complete response; ePRO, electronic patient reported outcomes

* The timing of the questionnaires requests before a visit appointment was categorized as follows: within one hour of the appointment time (≤1 hour on the day), more than one hour before the appointment on the visit day (>1 hour on the day), in the afternoon of the day before the appointment (PM the day before), in the morning of the day before the appointment (AM the day before), and two or more days before the appointment day (≥ 2 days before)

Table 3. Multivariate analysis of factors affecting the complete response to ePRO questionnaire

Characteristics		OR (95% CI)	p-value
Age (years)	(continuous)	0.98 (0.96 – 0.99)	<0.01
Type of surgery	Breast conserving surgery	0.64 (0.39 – 1.05)	0.08
	vs. mastectomy or reconstruction		
Type of visit	Pre-radiotherapy evaluation visit	1.33 (0.90 – 1.97)	0.15
	vs. post-radiotherapy follow-up visit		
Timing of the questionnaires request*	≤ 1 hour on the day or AM the day before or ≥ 2 days before	0.32 (0.22 – 0.45)	<0.01
	vs. > 1 hour on the day or PM the day before		

Abbreviation: HR, hazard ratio; ePRO, electronic patient reported outcomes

* The timing of ePRO requests before a visit appointment was categorized as follows: within one hour of the appointment time (≤1 hour on the day), more than one hour before the appointment on the visit day (>1 hour on the day), in the afternoon of the day before the appointment (PM the day before), in the morning of the day before the appointment (AM the day before), and two or more days before the appointment day (≥ 2 days before)

Discussion

Interpretation of Results

Patients using our ePRO system, which links a commercial mobile messaging app with our hospital's EHR, showed an 89.9% of CR rate to the Breast-Q questionnaires, and their responses were successfully recorded in the EHR among those who visited our radiation oncology department for breast cancer management. The response rate to the questionnaires increased as the number of survey encounters increased. Age of 60 or older was associated with a lower rate of CR; however, 87.0% of this age group provided appropriate responses to the questionnaires delivered through their mobile messaging app, even if it was their first time encountering the questionnaires using the app. Notably, the timing of the questionnaire requests significantly influenced the CR rate, with a higher CR rate of over 92% observed when the questionnaires were requested more than one hour before the scheduled visit or in the afternoon of the day before the appointment. Given these findings, our ePRO system appears to be an efficient platform for collecting ePRO and integrating the data with hospital's EHR. Additionally, the factors identified as significantly affecting the CR rate to the questionnaires can be used to guide improvements in responses to ePRO questionnaires in daily practice.

The significance of PRO measurement in oncology care has been increasingly emphasized in recent years [13]. In this regard, the European Society for Medical Oncology released clinical practice guideline concerning the use of PRO in the continuum of cancer care, emphasizing the essential role of symptom monitoring via PRO measurements [14]. ePRO offers several advantages, such as greater patient preference and acceptability, lower human resource costs, and higher data quality [9, 15]. Various forms of ePRO collection platform, including web-based and app-based systems, have been developed and utilized [16-18]. In addition to the data collection system, integrating the data into the EHR is essential to facilitate the incorporation of ePRO into clinical practice [9, 10, 15, 19].

In this analysis, we found favorable patient adherence to our ePRO system, with over 89% CR rate for the ePRO questionnaires, even at the first encounter. This promising result is attributed to adopting a system that uses the KakaoTalk messaging app, which was familiar to our patients, as approximately 90% of the Korean population uses the app [20]. Patients were able to access the questionnaires using the existing app on their smartphone, without the need to install an additional app for ePRO. Since the message with the questionnaire link was sent under the hospital's name, our patients likely accepted it confidently, without concerns about

cybercrimes. Moreover, given that over 94% of Koreans own a smartphone, ePRO questionnaires delivered via the mobile app could effectively encourage responses from our patient population [21]. According to previous studies, ePRO adherence rate among patients with cancer has been reported to range between 27% and 95% [16, 17, 22-24]. In a study conducted in the US, ePRO adherence rates ranged from 27% to 70%, following administration either on-site via tablet or remotely via a patient portal. There were significant differences in response rates depending on patient age and race, with older patients over 65 years, and non-white individuals being negatively associated with adherence to ePRO [17]. Meanwhile, a Japanese study reported a 95% ePRO adherence rate via a mobile messaging app, LINE, from 40 participants, which was similar to our patients' adherence rate [24]. Considering that LINE is used by over 70% of the Japanese population, the familiarity with the ePRO acquisition tool likely contribute to the high ePRO adherence in their study [25]. Taken together, these findings suggest that selecting appropriate tools for ePRO administration based on respondents' demographic or cultural characteristics is essential for achieving favorable ePRO acceptance.

Older age has been reported to be significantly associated with lower adherence to ePRO [16, 17, 23]. In a prospective study conducted among French patients aged 75 years and older, 26% of the participants accepted ePRO, which was conducted remotely using a web-based app [16]. More than 52% of the participants did not respond to the ePRO due to technological issues, such as lack of internet access or discomfort with using the internet [16]. Additionally, a study performed in the US showed that patients aged 65 years or older exhibited a 6% decrease in adherence to ePRO, which was a significant difference compared to younger patients [17]. Similarly, in our study, patients aged 60 or older showed a significantly lower CR rate for ePRO than those younger than 60. However, considering that 87% of the older participants completed the questionnaires, the ePRO acceptance using our system appears favorable even among older patients. In our study, ePRO was requested from all patients attending our department, without selection based on their smartphone possession or daily internet use. Furthermore, given that more than 90% of Koreans over 60 use smartphones [26, 27] and most are reported to be familiar with KakaoTalk [28], the ePRO acceptance among our older participants likely reflects the real-world feasibility of implementing ePRO in clinical practice for elderly Korean patients, particularly when it was delivered through the familiar messaging app. In the meantime, we also found that 13% of patients in this older age group did not properly respond to ePRO, suggesting that there is room for

improvement in enhancing ePRO adherence among older patients. It is uncertain why these patients did not respond to the ePRO measurements, as we did not assess the reasons for non-response to the questionnaires. However, referencing previous studies, various factors have been identified that affect ePRO acceptance in elderly patients, including frailty level, socioeconomic status, technological barriers, and the modes of ePRO administration [16, 27, 29]. Future studies are needed to determine the causes of non-adherence to ePRO and to provide the most appropriate ePRO collection modalities based on the individual characteristics of elderly Korean patients undergoing cancer treatments.

Interestingly, we found that the timing of ePRO requests was significantly related to the patient's CR rate. The most appropriate time for requesting ePRO questionnaires was either more than one hour before the appointment or in the afternoon on the day before the scheduled visit. This finding suggests that patients may feel more comfortable and have sufficient time to review and respond to ePRO requests when they are delivered within this timeframe. Delivering ePRO questionnaires more than two days before a scheduled visit may have hindered appropriate responses, possibly due to difficulties in locating our ePRO request message among other personal messages. As our patients' ePRO were collected remotely using a mobile app and their completeness was re-checked on-site in our clinic, it is likely that our ePRO acceptance rate is higher than in situations where ePROs are collected solely through remote methods. This may be indirectly supported by the CR rate of 76% among our patients who received ePRO questionnaires more than two days before an appointment. From another perspective, however, the combination of remote ePRO collection via a messaging app, requested within a specific timeframe, and on-site feedback appears to be an effective strategy for maximizing ePRO acceptance, as indicated by a CR rate of over 92% among our patients.

Limitations

Our study has strengths in providing real-world data on ePRO adherence and identifying significant factors influencing the adherence among 1,488 patients with non-metastatic breast cancer following the application of an in-house ePRO platform. Since our ePRO platform utilizes a messaging app that is largely familiar to Koreans, we observed a favorable acceptance for the ePRO. However, we acknowledge the limitations of this study. First, our data were derived from a single institution, with only a one-year data collection period. Therefore, the data may be insufficient to capture long-term ePRO adherence among general breast cancer patients. Additionally, reasons for PR or NR to ePRO questionnaires were not available, as this

analysis was conducted retrospectively. Since the causes of incomplete ePRO are important for identifying areas of improvement in enhancing ePRO adherence, further assessments are necessary among those submitting PR or NR to ePRO questionnaires in future studies.

Conclusions

The collection of ePRO data and its integration into EHR was successful with our ePRO platform, achieving an overall CR rate of 89%. Patient age and the specific timeframe for ePRO requests were significant factors influencing complete ePRO acceptance. Patients aged 60 or older showed significantly lower ePRO adherence. Additionally, a specific timeframe, including more than one hour before a clinical visit or in the afternoon on the day before the appointment, was associated with a significantly higher CR rate for ePRO. These factors are expected to improve ePRO acceptance among patients with non-metastatic breast cancer.

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H Kim, WK Cho, and N Kim planned the study. H Kim, WK Cho, N Kim, and TH Lee conducted ePRO survey. JY Baek carried out data collection and analysis. JY Baek and H Kim drafted the manuscript. WC Cha designed the ePRO system. All authors reviewed and approved the final version of the manuscript.

Conflicts of Interest

None declared

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Supplementary Files

Untitled.
URL: http://asset.jmir.pub/assets/929ce3fe20d9ec0d8ec28969ed6adab1.docx

Figures

Rates of complete response (CR), partial response (PR), and non-response (NR) for electronic patient-reported outcomes surveys across first, second, and third requests.