

Original Article  
Medical Informatics



# Production and Provision of Context-Based Patient-Specific Educational Resources

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OPEN ACCESS

Received: May 23, 2022

Accepted: Sep 6, 2022

Published online: Nov 1, 2022

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Disclosure

The authors have no potential conflicts of interest to disclose

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## ABSTRACT

**Background:** Patient education is generally accompanied by instructive materials. The Korean government has recommended the provision of patient-specific educational materials (PEMs) via an electronic medical record (EMR) certification system. However, there are currently no clear standards or guidelines for including PEMs in current domestic educational materials. We investigated the benefits of integrating PEMs with the EMR certification system and the methods by which this integration can be achieved.

**Methods:** We developed and administered three structured Delphi surveys to 26 healthcare providers in clinical settings based on data collected from separate semi-structured advisory interviews with five experts. The surveys included the following topics: 1) expected effects of patient-specific education and health-related notifications/alerts, 2) desirable methods for providing PEMs, and 3) appropriate fee-setting and government support. We distributed the Delphi surveys via e-mail and calculated the average and standard deviation of the survey responses.

**Results:** PEMs are expected to have significant educational effects, such as the provision of surgery/intervention-related information, and will improve the understanding of various treatment processes/procedures. The preferred method for providing PEMs was via automatic request after receiving confirmation from healthcare providers. The provision of these materials was based on set fees and government support. The average fee per session was set at approximately USD 23 (as of October 2021, USD 1 = KRW 1,196).

**Conclusion:** In this study, we investigated the prerequisites, contents, methods, and fees related to the provision of effective and efficient PEMs. The study findings can facilitate the production and provision of PEMs.

**Keywords:** Patient Education; Electronic Health Records; Health Information Systems

## INTRODUCTION

Patient education refers to instructions regarding a patient's health, with the ultimate goal of long-term health improvement.<sup>1</sup> In addition to verbal education, patient educational materials increase the overall effectiveness of patient education.<sup>2</sup> The information in these

analysis: Park YE, Lee Y. Methodology: Lee Y. Software: Tak YW. Validation: Han JH, Tak YW. Investigation: Han JH, Tak YW. Writing — original draft: Park YE. Writing — review & editing: Park YE, Lee Y.

materials is mainly provided via face-to-face interactions; phone interactions with medical staff; written formats, such as educational pamphlets and brochures; online educational content; and audiovisual formats, such as video and audio materials.<sup>3</sup> The content of patient educational materials typically includes information and guidance about surgeries or procedures, tests, post-procedure self-care, diseases, preoperative preparation, and patient diets.<sup>4</sup> These materials supplement verbal education and facilitate at-home patient learning.<sup>5,6</sup> Furthermore, written educational information helps patients and guardians to retain more information and overcome the “one-way process” wherein experts deliver large amounts of information without tailoring the delivery to individual patients.<sup>7</sup>

The Korea Ministry of Health and Welfare and Korea Health Information Service implemented an electronic medical record (EMR) certification system in 2020.<sup>8</sup> This certification system encourages companies to develop standardized products by verifying the national standards for domestic EMR systems to facilitate the provision of quality medical services and promote EMR system improvements such as system interoperability.<sup>8</sup> The system’s evaluation criteria for “patient information provision” includes the “provision of patient-specific educational materials” (PEMs) and “patient healthcare information notification.”<sup>9</sup> Patient educational materials should comprise patient-tailored content to facilitate patient disease management and provide notifications about patient healthcare. In addition to the EMR certification system, national efforts should be made for quality control and verification of patient educational materials.<sup>10</sup>

Since 2015, the meaning and technical presentation of PEMs have been regulated by the Office of the National Coordinator in Health IT Certification Program Section “170.315(a)(13) Patient-specific educational resources” wherein patient-specific educational resources are identified based on patient data, such as a list of their medical conditions and medications.<sup>11</sup>

Previous studies have examined how patient educational materials in a specific field should be provided<sup>1,4-6,12</sup> and the materials that are the most effective.<sup>13-15</sup> Today, high-quality PEMs can be provided using an efficient tool, the EMR system. Thus, it is important to identify suitable conditions, including the socioeconomic policy environment, for the provision of PEMs via the EMR system. In this study, we examined the selection of patient-specific educational content, the methods by which these materials can be provided, and how these materials can be produced.

In this mixed-method research, we conducted expert interviews and Delphi surveys to produce and distribute PEMs. The study findings would offer insights into the fee-setting process and evaluation standards for the provision of these materials.

## METHODS

This study aimed to identify the requirements for the effective provision of PEMs and determine how these requirements should be implemented. To address this aim, we conducted a qualitative analysis of responses obtained through expert interviews to identify these requirements, and based on the results; we quantitatively analyzed the responses provided by clinical-field workers to the questions in the Delphi surveys.

### Respondent selection

Healthcare providers (doctors and nurses) with clinical experience, patient safety experts, medical information system experts, and patient educational content experts were interviewed and surveyed. These interviews and surveys were conducted from October to December 2021. The face-to-face advisory interview participants were selected based on the correlation of their specialties to the research topic. Moreover, all the face-to-face advisory interviewees were experts in tertiary medical institutions.

The expert interviews were conducted with one patient educational material expert who works in a material development/management department of a medical institution (patient education material expert 1, PM1) and two experts in patient educational material systems (material system experts 1 and 2, MS1 and MS2). MS1 is an expert in EMR system prescriptions, involving patient educational materials and automatic prescription functions. MS2 is an expert in EMR systems and patient educational material management. In addition, we also interviewed two patient education experts (patient education experts 1 and 2, PE1 and PE2). PE1 is an expert who has previously participated in government research on patient educational materials development. PE2 is an expert with clinical experience who had previously participated in government research related to patient educational counseling and examination policy.

### Questionnaire and survey design

We used a flexible, semi-structured expert interview format since we could not administer the same questions to all respondents due to their varying fields of expertise.<sup>16</sup> Semi-structured in-depth individual interviews are a set of predetermined open-ended questions and other questions that emerge from the dialog between an interviewer and interviewee.<sup>16</sup> The interview outline was provided to participants before the interviews. All interviews were conducted individually and recorded, and the questions were transcribed into Korean. The interviews lasted between 60 and 120 minutes.

For the surveys, we used the Delphi method of gathering the collective opinions of a group of experts regarding a particular topic.<sup>17</sup> The content validity of the Delphi surveys was ensured by involving expert panelists and conducting iterative rounds.<sup>18</sup> In this study, the survey questions were based on current research and information obtained from expert interviews. The questionnaires were administered via e-mail to 26 healthcare providers (doctors and nurses) with clinical experience. The respondents' perceptions or competencies regarding patient education differed depending on their respective clinical fields or level of clinical experience.<sup>19</sup> To achieve unbiased results, we selected specialists from various clinical fields, including cardiology, hematology, geriatrics, psychiatry, radiology, surgery, pediatrics, emergency medicine, internal medicine, neurology, pathology, plastic surgery, and otolaryngology, as respondents. According to Delbecq et al.,<sup>20</sup> if the backgrounds of respondents of a Delphi survey are homogeneous, 10 to 15 respondents are sufficient for analysis. Moreover, Witkin et al.<sup>21</sup> noted that the approximate size of a Delphi panel should generally comprise less than 50 participants. Furthermore, Hsu and Sandford stated,<sup>22</sup>

"If the sample size of a Delphi study is too small, these subjects may not be considered as having provided a representative pooling of judgments regarding the target issue. If the sample size is too large, the drawbacks inherent within the Delphi technique such as potentially low response rates and the obligation of large blocks of time by the respondents and the researcher(s); can be the result."

Considering the results of previous studies, we concluded that between 10 and 50 respondents would be appropriate for our survey. Therefore, we selected 26 survey respondents.

The three Delphi surveys were conducted via email. The first survey was administered as a questionnaire comprising four open-ended questions wherein the respondents were asked about the necessity for PEMs and health-related notifications/alerts (HNAs) and the prerequisites for their implementation. The second survey was a structured questionnaire comprising questions about the respondents' basic information, such as their affiliated institution, occupation, and career experience. Additionally, we included information on PEM-related certification items and posed seven questions about conditions required for the effective provision of PEMs to patients, preferred delivery methods if PEMs are provided via an EMR system, as well as the prerequisites and appropriate fees for PEMs. Furthermore, we provided information on the certification items related to HNAs and posed six questions about the conditions required for the effective provision of HNAs to patients, preferred delivery methods if HNAs are provided via EMRs, and the prerequisites and appropriate fees for HNAs. Each survey question could be answered on a seven-point Likert scale, through the provision of short answers, or through multiple-choice responses (single selection). In the third survey, after the results of the first and second surveys were presented, the respondents answered questions regarding their additional, comprehensive opinions (Fig. 1). The survey questionnaires are provided in **Supplementary Data 1**.

### Data analysis

In this study, each interview transcript was read by the researchers several times for accuracy. To prevent expert opinions from being interpreted and reported contrary to their intended meaning, each expert was asked to review their responses twice. The expert interviews were conducted in Korean, and the interviewees were asked to confirm the reports of their responses to the interview questions.

In this study, expert interviews were not conducted for analysis but rather to obtain advice from subject experts. Therefore, rather than analyzing the contents of the expert interviews, we

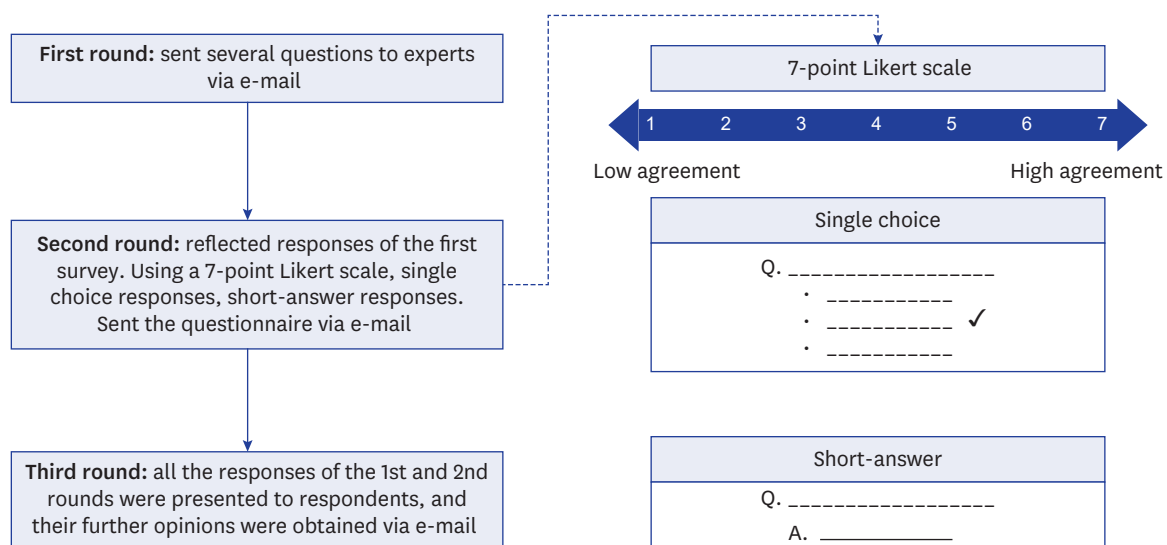


Fig. 1. Delphi survey process with response methods.

sought to obtain specific consultation criteria. Specifically, the criteria represent meaningful expert insights that were used to develop the questionnaires for the Delphi surveys.

Subsequently, among the three surveys conducted, we calculated the statistical results for the second questionnaire. For responses that used a seven-point Likert, wherein 1 represents the lowest agreement level and 7 represents the highest agreement level, we calculated the average and standard deviation and ranked the results according to their value. Additionally, we determined the total range of all responses and calculated the average of the responses regarding fees. Finally, we ranked the responses to multiple-choice questions using the statistics of the response values and calculating their respective percentages.

### Ethics statement

This study was approved by the Institutional Review Board (IRB) of Asan Medical Center, Korea (IRB 2021-1757). Respondents were assured anonymity and confidentiality, and web-based informed consent was obtained before the online survey.

## RESULTS

### Advisory interview: semi-structured in-depth interviews

We identified three major themes through the expert interviews. We classified the contents obtained from the five expert interviews based on the three themes as follows.

#### *Theme 1: Providing PEMs for patients via the EMR system*

The first theme of the advisory interviews was the status of PEM provision in medical institutions and the importance of improving the quality of PEM provision.

The responses showed that the medical institutions where the interviewees worked provided PEMs to patients using various methods, which we grouped into three categories as follows (Table 1).

- A. Methods for developing PEMs
- B. Methods for prescribing PEMs
- C. Methods for providing PEMs to patients

First, some medical institutions were developing educational materials based on institutional data or outsourcing from external companies or institutions. Second, most of the material prescription methods were directly selected by healthcare providers and subsequently

**Table 1.** Status of the provision of patient educational materials at medical institutions

Descriptions
A. The methods for developing educational materials
A1. Self-developed in a medical institution
A2. Outsourcing from other companies/institutions
B. The methods for prescribing educational materials
B1. Selected and prescribed by the medical staff (passive)
B2. Prescribed by the electronic medical record linking system (automatic)
C. The method for providing educational materials to patients
C1. Transmit educational materials through a URL link
C2. Transmit materials through a medical institution's application
C3. Provide physical educational materials, such as brochures and pamphlets
C4. Provide and monitor materials directly through the electronic consent form

prescribed to patients. Finally, the methods for providing educational materials to patients included PDF, audio, videos, URL links, medical institution applications, or paper education materials such as brochures and pamphlets.

Most medical institutions in which the interviewees worked provided similar educational materials. One medical institution prescribed educational materials via the EMR system (Table 1, category B2). Specifically, clinicians could automatically prescribe appropriate educational materials for each patient through the order-linked rule in the EMR system. Another medical institution provided materials to patients as an electronic consent form (Table 1, category C4). This provided educational materials directly to the patient and obtained consent that confirmed that the patient had received the educational materials; thus, this method is a two-way process.

Next, the expert opinions on the provision of PEMs were as follows. The experts thought that it is better to provide patients with limited (need-based) rather than comprehensive content in PEMs. PE2 stated,

“A lot of educational materials are next to their bed so that they can see them whenever they want to. But patients rarely read them, and they do not even remember that they are there. Therefore, I think it would be nice if we could provide what patients really need rather than a lot of content.”

Another expert stated that since the provision of PEMs for patients is currently unidirectional, healthcare providers cannot determine whether a patient has accessed the educational materials. In other words, assessing the utilization rate of the PEM-related URLs sent to patients is difficult. Accordingly, MS1 remarked that

“Since the content (educational material) provision is one-way, there is no system that currently receives data in reverse regarding the utilization rate of the URL sent.”

Therefore, we identified another theme, i.e., improving the conditions of PEM provision based on the current situation.

#### *Theme 2: Conditions for PEM provision*

The expert indicated that patient health literacy and a feedback system (performance evaluation) after the provision of PEMs are a prerequisite for providing PEMs.

First, PE1 highlighted the need to consider the patient's health literacy:

“Some patients really understand the materials, while others do not. Just providing educational materials to each patient is not the end of the clinician's duty. There is a payment system, such as the bundling fee, that evaluates how the total outcomes of patients improved, even if the resources are administered differently depending on their adherence to treatment or education. This system can evaluate whether the patients were educated properly, instead of a payment method that is used for all the patients simultaneously and provides the same resources to all patients.”

Additionally, PE2 expressed another opinion on the difficulty in considering patients' health literacy in the provision of PEMs as follows:



“From a producer’s point of view, it is practically difficult to consider health literacy because how each sentence of the educational material will be interpreted by each patient should be considered and modified differently.”

Next, after providing PEMs, an expert provided an opinion that a feedback evaluation system was needed. PE1 explained that

“Educating patients is not just about providing knowledge. It is about asking for behavioral change. In fact, though they do not understand perfectly, it is okay when their behaviors have changed, and healthcare providers should assess whether the behavior of the patient has changed. The educational fees should be paid only after checking whether the patient’s behavior has changed and after another cycle of giving feedback again if their behavior has not changed. Therefore, there must be an evaluation system, and it would be better if we could provide feedback in the EMR system.”

Additionally, experts mentioned important areas directly related to the patient’s life and areas that can lead to changes in patient behavior to prevent/respond to educational and hazardous events. PE1 stated that

“Clinically critical content should be emphasized. Education to address a patient’s curiosity may not be directly related to both the patient’s health and survival. However, countermeasures to prevent side effects of surgery should be taught, specifically, for the safety of patients who have undergone major surgery.”

PE2 also commented that

“It would be good to provide priority education on patient safety. Moreover, it is very important to let patients continually discuss their condition with the medical staff. Such patient’s history and condition help healthcare providers treat patients and develop treatment plans.”

### *Theme 3: Government support for PEMs*

Next, we obtained expert opinions regarding the appropriate fees and government support for the effective provision of PEMs. PE1 stated that

“Whether the target disease of the educational material is common or rare, the material needs to be updated regularly. The educational materials about rare diseases should be more detailed because there are fewer resources. Therefore, updating and developing educational materials must be supported. For instance, in Europe, insurance companies are the major supporters.”

PE1 agreed that the Korean government should be responsible for updating and developing PEMs since the National Health Insurance Service is a single entity that provides health insurance to all citizens living in Korea.<sup>23</sup> Additionally, PE2 described an approach regarding the fees for PEM provision:

“Eventually, there should be evidence for the cost to be paid.”

“If PEMs are provided at the price per action (fee-for-service), the institutions will send several texts to patients, and that is why patients cannot receive important information.

Considering the efficiency of work, I think it is better to charge based on a case payment system (diagnosis-related group) rather than a fee-for-service system.”

#### Additional opinions

Additionally, some experts believed that the provision of PEMs through the EMR system would be more helpful in primary care centers rather than in secondary or tertiary referral hospitals. PE1 commented that

“Even in our hospital (tertiary hospital), each department develops its own patient educational materials, and it is very accurate. However, there are a variety of patients with various diseases in the primary care setting. Therefore, EMRs will be helpful when the primary-care providers want to match the educational materials to the patients’ needs.”

Regarding the automatic sending function in the provision of PEMs, PM1 indicated that it provides appropriate content to individual patients promptly and is almost “patient-specific.” Furthermore, MS1 stated that wide-ranging PEMs could be provided to more patients if multiple-condition mapping was used to expand the automatic sending function.

#### Delphi surveys

*Survey 1: Open-ended questionnaire, 26 respondents: basic demographic information*

Fig. 2 presents the respondents’ demographic information obtained from the open-ended questionnaire. Approximately 87.5% of the respondents worked in medical institutions, while the remaining 12.5% worked in non-medical institutions. Nearly 75% of the respondents who worked in medical institutions were employed in tertiary referral hospitals, while those who worked in non-medical institutions were either employed in start-ups, general companies, or governmental institutions. Among the respondents, 70.8% were doctors, while 29.2% were nurses. There were 17 (70%) respondents with over 10 years of experience. All the nurses (8, 29.2%) had more than 10 years of experience and worked in tertiary referral hospitals.

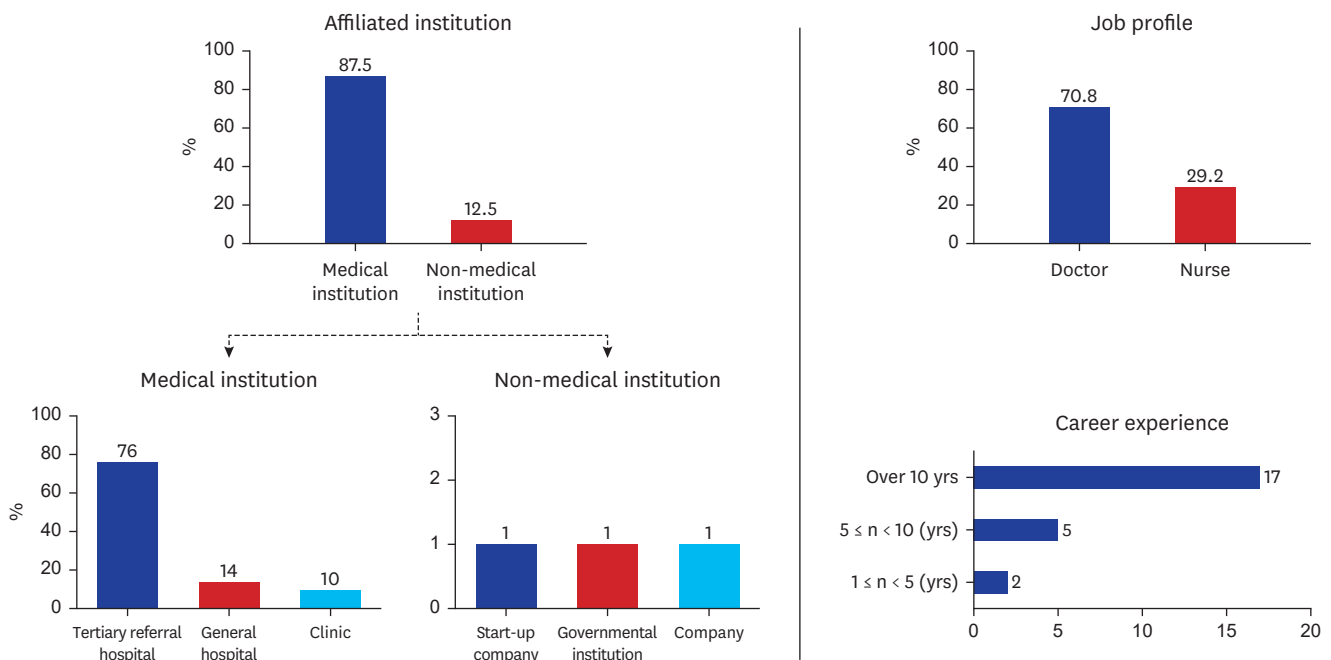


Fig. 2. Demographic information, including respondents’ affiliated institution, job profiles, and years of career experience.



**Table 2.** Survey 1 questionnaire

Open questionnaire questions	
1	Do you feel the need to provide patient-specific educational materials to patients while providing patient care or treatment-related tasks? Why?
2	What do you think should precede the EMR certification criteria (F061, F062)?
3	Do you feel the need to provide health-related notifications/alerts to patients while providing patient care or treatment-related tasks? Why?
4	What do you think should precede the EMR certification criteria (F061, F062)?

EMR = electronic medical record.

First, responses regarding the necessity for providing PEMs were controversial. The respondents stated “repeated work reduction,” “improved understanding through pre-education,” “help regarding coping with side effects,” “increased patient satisfaction,” “supplementing of insufficient education during hospital treatment,” “education in stable conditions/situations/places,” and “consideration of health literacy” as reasons for the necessity of PEMs. In contrast, respondents who expressed the opinion that PEMs are unnecessary were concerned that their workload would increase and instead preferred to provide platforms for patients to search for necessary PEMs.

Next, regarding the prerequisites for providing PEMs, many respondents highlighted “standardization and quality management of existing educational materials,” “EMR system linkage,” “cost/personnel/labor,” “education prescription fee,” and “health literacy production.” Other responses included “continuous updates of educational materials,” “academic consensus on educational content,” “placement of healthcare providers dedicated to patient-specific educational materials,” “expansion and distribution of educational devices,” and “creation of scenarios according to the patient.”

We inquired about the need to provide HNA (Table 2). Respondents who found it necessary answered with “shortening of medical hours,” “preventing communication confusion,” “emergency information notification,” “improving medication/injection and lifestyle management,” “reducing work,” and “setting outpatient/examination/visit dates.” On the contrary, those who responded that it is unnecessary provided reasons such as “the need for simplification,” “the need for excessive alarm dependence,” “responsibility for providing notifications,” and “the ambiguity of the term health care.”

When asked about the prerequisites for HNA, “notification items standardization,” “EMR system linkage,” “cost,” “patient notification consent and transmission system development,” and “government support” were reported. Additionally, responses including “clarity of legal responsibility,” “selection of patient groups, where notification is important,” “setting of notification grades according to urgency,” “linking of patient personal information,” “provision of a specific set of healthcare categories,” and “provision of notification feedback services” were provided by the interviewees.

#### *Survey 2: Structured questionnaire, 24 respondents*

##### *1) Contents of PEMs*

The main condition for the effective provision of PEMs via the EMR system was identified as the provision of information related to “surgery/intervention” ( $5.87 \pm 3.62$ ) and “diagnosis/diseases” ( $5.83 \pm 3.29$ ). In addition, the most expected effect of providing PEMs to patients were “enhanced understanding of the treatment processes and procedures by patients” ( $5.91 \pm 3.89$ ) and “beware of contraindications related to disease/treatment” ( $5.54 \pm 3.15$ ). The remaining survey results are provided in **Supplementary Data 2**. Other opinions regarding the conditions for the effective provision of PEMs are as follows:

- Currently, there is a clear limitation of PEMs for only one condition item; however, PEMs for a combination of several items are required.
- It is necessary to differentiate the provision of information based on patient-specific functional state and frailty.
- Non-drug treatment guidance is needed.
- In the case of disease/drug information, the effectiveness of PEMs will vary depending on the severity of the disease or the level of the information supplied.
- Self-care content (such as disease management) is required for patients.
- Diseases and surgery may vary by the patient; hence, providing patient-specific resources will be ineffective.

Other opinions regarding the expected impact of PEM provision are as follows:

- The impact of PEM provision will differ depending on patients' interests and educational level.
- There will be few cases where patient-specific resources will lead to changes in patient behavior.

## 2) Provision method and necessary conditions for PEM

The preferred delivery method for PEM via the EMR system was “when healthcare providers enter a prescription or diagnosis, patient-specific material is sent after a separate confirmation process or selection process (auto request-sending after confirmation)” (41.7%). The most necessary conditions for the provision of PEMs were the “arrangement of national insurance fee for PEMs” ( $6.58 \pm 6.78$ ) and “government support for the development of a PEM-provision system” ( $6.33 \pm 4.72$ ). The remaining survey results are provided in

**Supplementary Data 2.** Other opinions regarding the preferred delivery method were:

- There are likely to be many inquiries due to automatically sent a content that may differ by the patient.

Other opinions regarding the necessary conditions for PEM provision were:

- Positive feedback is needed, such as higher fees for high-quality material, through quality management and post-evaluation.
- In the introduction stage, there should be the selective provision of healthcare providers and the adoption of conciliatory measures to establish the provision of PEMs.

## 3) Criteria for determining PEM fees

Regarding when PEMs can be provided to patients via the EMR system, “the number of cases for which PEMs were provided” (50%) was the most appropriate criteria for setting PEM fees, and the appropriate fee per session was proposed at an average of KRW 27,547 (approximately USD 23; overall range: KRW 700–100,000). The remaining survey results are provided in

**Supplementary Data 2.** Another opinion on the criteria for a fee was

- If a patient or guardian who has received educational materials understands the content, a simple questionnaire response should be provided.

## 4) Additional opinions regarding the provision of PEMs through the EMR system

- A question-and-answer and feedback system is needed to help patients properly understand the material.
- When linking fees, close attention should be paid to each fee as if the healthcare provider was prescribing rather than automating them.

- To establish the PEM fee system, a step-by-step introduction must be conducted, and a long-term application roadmap should be established and applied.

#### 5) Contents of HNAs

The most effective conditional items for providing HNAs through the EMR system were information on “diagnosis/disease” ( $5.50 \pm 2.77$ ) and “drugs/side effects of drugs” ( $5.50 \pm 3.02$ ). The most expected effect of providing HNA to patients was “the ability to check the information at all times” ( $6.25 \pm 3.85$ ). The remaining survey results are provided in **Supplementary Data 2**.

Other opinions on conditional items that are expected to be effective are

- Regarding surgery/intervention and examination/test results, simple provision without explanation can reduce efficient time utilization during face-to-face treatment. Therefore, selective provision is required.

Additionally, other opinions on the effects that are expected to be effective are as follows.

- It should not be expected that the patient will unilaterally understand the information provided in a timely and appropriate manner.
- It is necessary to provide time-series and management information to chronically ill patients, such as those with diabetes.

#### 6) Provision method and necessary conditions for HNA

The preferred delivery method for HNA provided through the EMR system was “automatic request-sending after confirmation” (33.3%) and “passive request-sending after confirmation” (33.3%). The most important provision conditions were “support from the government” ( $6.25 \pm 4.27$ ) and “arrangement of a fee scale” ( $6.21 \pm 5.29$ ). The remaining survey results are provided in **Supplementary Data 2**. Other opinions on the necessary conditions were:

- Providing health information burdens healthcare providers, and they must be appropriately compensated.
- HNA can be introduced only when it is recognized that there will be an increase in workload due to the provision of health information.

#### 7) Criteria for determining the medical fee for HNAs

The appropriate fee per session was an average of KRW 22,014 (approximately USD 18.4; range: KRW 100–100,000) for HNAs provided to patients through the EMR system. The remaining survey results are provided in **Supplementary Data 2**.

#### 8) Additional opinions on the provision of HNAs via the EMR system

- It is not appropriate to link HNAs with fees.
- Information must be standardized.
- The scope of the content provided should be limited to prevent health information from becoming a burden for clinics or medical institutions.
- Quality control is necessary for the provision of HNAs.
- The HNA system should have established mechanisms to prevent the widespread dispatch of information about specific medical opinions or situations that may lead to misunderstanding of information by patients, such as anti-vaccine information.

#### *Round 3: Additional opinions, 13 respondents*

Additional opinions and meaningful comments are as follows:

- It is necessary to develop and systematically manage PEMs, consideration of the health literacy of patients/guardians.

- Quality management of educational content and the process of receiving confirmation from healthcare providers are essential to accurately provide PEMs.
- In the case of HNAs, the system and fee policy must consider the elderly with poor digital accessibility.
- There were generally no disagreements regarding fee amounts; however, there were additional opinions on the fee-setting (including examination fees or incentives that are applied by medical institutions, such as in the Picture Archiving Communication System) methodology as well as supplementary procedures to verify the delivery effectiveness of PEMs or patients' understanding.
- Additional work burden or personnel may be required to provide PEMs. Thus, system stabilization and certification are essential for users to trust and use an "automated sending" system.

## DISCUSSION

In this study, we assessed effective strategies to help produce and provide PEMs, especially through EMR. We identified the conditions required for the effective provision of PEMs. The most effective content in PEMs was classified based on "surgery/intervention-related information" and "diagnosis/disease-related information." The important expected effects were "understanding of treatment process/procedure" and "beware of contraindications related to disease/treatment." These results differed from experts' opinions that suggested "patient's behavioral changes" and "caution against contraindications" as priorities. To narrow this gap and develop an effective best practice, continuous and active communication with related experts and field healthcare providers is necessary.

The method of sending PEMs after confirmation by healthcare providers according to the automatic request for educational materials/notification through the system was preferred (41%). This preference is due to the expectation that the automated request for educational materials/notifications will reduce the additional burden on the healthcare providers and concerns about the accuracy of providing materials through the system.

Per the expert interview responses, one institution used the automatic prescription system. Currently, most clinicians spend more time manually prescribing educational materials using electronic health records (EHRs) rather than interacting with patients.<sup>24</sup> According to previous studies, the average clinician consultation time was  $3.7 \pm 3.3$  min in Hwang's study,<sup>25</sup>  $2.3 \pm 0.7$  min in Aharonson-Daniel et al.,<sup>26</sup>  $6.7 \pm 8.6$  min in Park's study,<sup>27</sup> and  $4.2 \pm 2.7$  min in work by Lee et al.<sup>28</sup> Focusing on domestic research, the average treatment time is 4.9 min. During this relatively short period, it takes more time for physicians to fill out patient charts using the EHR system than using paper charts.<sup>29</sup> Additionally, a recent study reported that family medicine physicians spend almost half (4.5 hours) of their work hours filling EHR.<sup>30</sup> Several studies have reported that using the EHR system increases a physician's workload and ultimately causes burnout.<sup>31-34</sup> It would be burdensome for clinicians to prescribe educational materials suitable for each patient's clinical situation within the treatment hours. PEMs, automatically prescribed through the EMR system, could relieve this burden. The automatic prescription function of the system must be expanded and developed to increase system accuracy.

In this study, the most necessary basis for providing PEMs was the "arrangement of the fee scale" and "government support." Experts agreed that material tailored to the patient's health

literacy level should be provided, and their degree of understanding should be confirmed. It is appropriate to set the fee according to “the number of cases provided educational materials (50%). The different results of the prerequisites for providing educational materials and the fee-setting criteria are due to the burden of developing additional systems to evaluate health literacy, patient understanding, and additional human resources.

We found that most medical institutions did not have a system for further monitoring the patients after educational materials were provided. When the government establishes a feedback system for providing educational materials in the future, a monitoring system should be established for quality management and confirmation. For example, a medical institution using electronic consent forms can be an efficient way to manage information on patient feedback.

The average response of the appropriate fee for PEM was KRW 27,547 (range: KRW 700–100,000, approximately USD 23), and for HNA was KRW 22,014 (range: KRW 100–100,000, approximately USD 18.4). When considering resources for providing PEMs, a cost higher than that of HNAs should be set. However, regarding the responses related to PEM fees, we found meaningful response differences between the doctors and nurses. The average response of doctors regarding a PEM fee was KRW 32,300 (approximately USD 27), while the nurses proposed a fee of KRW 7,814 (approximately USD 6.5). Additionally, the average response of doctors to a fee for HNAs was KRW 25,353 (approximately USD 21), while that of nurses was KRW 7,042 (approximately USD 5.9). This difference can be attributed to the opinion that insurers should pay for patient education and that PEM system updates and developments should be included within the scope of payment, as previously mentioned during the expert interviews.

The average fees determined in these surveys coincide with the fees determined by pilot projects conducted by the Korean government. In 2018, a pilot project for the provision of management education counseling before and after surgery was conducted by the Ministry of Health and Welfare and the Health Insurance Review & Assessment Service. An amount of KRW 25,300 (approximately USD 21, i.e., 20% of the patient's burden rate) was established as the fee for educational counseling per patient by disease.<sup>35</sup> This fee was applied in practice in 2020, and it is similar to the current guideline fees for patient education, considering the system preparation and human resources involved in the provision of PEMs.

The study findings are subject to the following limitations. First, this study does not consider the needs of the patients who receive educational materials since the surveys in this study were conducted on healthcare providers. More effective and satisfactory PEMs can be developed if additional research is conducted, considering the patient's perspective. Second, further studies involving larger sample sizes are needed to draw a firm conclusion. Thus, future research should use a larger sample size since that of the current study only surveyed a limited number of people ( $n = 31$ ). Lastly, although we recruited experts from various specialties, the possibility of bias in selecting participants for the expert interviews cannot be completely excluded.

We drew four major conclusions from the findings of this study.

First, to provide effective PEMs, the accuracy or relevance of the context-based material that will be provided to the patient is important. Therefore, a specific follow-up study is required to determine the accuracy and relevance of PEMs in a clinical context.

Second, for PEMs to be distributed automatically through an EMR system, it is necessary to supplement it with a non-interruptive system that does not interfere with existing workflows and to obtain healthcare providers' trust in the system. Thus, future research must be conducted to determine how user trust and coordination in the PEM delivery system can be obtained to avoid interference with existing workflows.

Third, when developing PEMs, the following two conditions must be considered: 1) clinical processes, such as diagnosis, surgery, and medication, and 2) the patient's health literacy level. Thus, further research is required into the method by which an EMR system can reflect both a patient's medical condition and their health literacy level and the effectiveness of this method.

Lastly, a specific system is needed to specify how the government will compensate medical institutions that provide PEMs. Based on this policy support method, we focused on how to provide incentives to medical institutions. Further pilot projects must be performed to improve patient health and ultimately achieve national-level health effects.

Overall, the provision of PEMs can be summarized as a national- and institutional-level task. At the national level, a foundation must be developed for the widespread expansion and dissemination of context-based PEMs. At the institutional level, such as in medical institutions, it is necessary to design and operate PEM systems actively. Thus, additional research regarding the effects of PEMs is required.

The findings of this study provide support for the effective education of patients and medical staff by facilitating the quality control of newly produced PEMs beyond those previously produced without appropriate standards and by selecting the type of PEMs that should be provided according to the patient's clinical context, reflecting the opinions of medical professionals with clinical experience.

The results of this study can help small clinics, governmental bodies, policymakers, and system developers by providing methods by which PEMs can be produced and provided to patients. In addition, the study findings may enhance the production of PEMs in the absence of appropriate standards. Follow-up research is required to gain further insights into effective patient education, focusing on patients, healthcare providers, and the government.

## SUPPLEMENTARY MATERIALS

### Supplementary Data 1

Survey questionnaire

[Click here to view](#)

### Supplementary Data 2

Survey results

[Click here to view](#)



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