Master's Thesis

ECHO: Digital Service Platform for Diabetes Management in Young Patients

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2021

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A thesis submitted to
to the Graduate School of Creative Design Engineering, UNIST
in partial fulfillment of the
requirements for the degree of
Professional Master of Design-Engineering

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06/15/2021 of submission
Approved by

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ECHO: Digital Service Platform for Diabetes Management in Young Patients

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ABSTRACT

Diabetes in the general young population is increasing because of which their risk of developing other chronic conditions has increased. Among these conditions, the most prevalent condition is the psychiatric illness that causes anxiety disorders, behavioral disorders, and mood disorders in the overall adolescent population. Recent developments in smart healthcare provided new opportunities for managing the daily life activities of young patients. Most of these patients once diagnosed with diabetes often develop stress and mental problems, which negatively influence their social awareness. Hence, it is important to break the vicious cycle of diabetes and stress for a healthy life because ignoring diabetes management may lead to undesirable health outcomes. Given this problem, this study found that smart healthcare could be a new opportunity for health management that provides a new healthcare service for young patients with diabetes. This study presents a mobile service for diabetes management called Echo digital service design. The service design offers significant suggestions and provides a guide for a smart management system for diabetes on a daily basis. Furthermore, the service design seems to help patients with several mental problems that interfere with their healthy diabetes management. Echo service design provides a platform for patients to modify their negative actions against diabetes management and reinforce positive habits for self-oriented care. This study sorts to provide the Echo service design to young diabetes patients using user-centered design methodologies and design thinking approaches. The results of this study seek to provide a meaningful impact of the service design on young diabetes patients. This study provided an opportunity to design the function in the echo service design application to give patients a sense of responsibility and authority to help manage diabetes and engage patients in medical care. The test results reveal that the service design application helps contribute to future studies on diabetes educations and brings innovative and high-quality health care services for young diabetes patients considering their mental illness.

Keywords

Digital Healthcare, Participatory Medicine, Echo Service Design, Diabetes Management

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Terms and Abbreviations

HBG	High Blood Glucose
LBG	Low Blood Glucose
PGHD	Patients Generated Health Data
SNS	Social Networking Service
BG	Blood Glucose
BGL	Blood Glucose Level
UX	User Experience
UI	User Interface
PD	Participatory Design
AAD	American Association of Diabetes

1. INTRODUCTION

1.1. Background and Motivation

Diabetes in the general young population is increasing worldwide (See Figure 1) due to which their risk of developing other chronic conditions is significantly upraised (Bernstein et al., 2013; Maahs et al., 2010). Among these conditions, the most prevalent condition is the psychiatric illness (Collins et al., 2009; Kakleas et al., 2009), which has increased the number of anxiety disorders up to 31.9%, behavioral disorders 19.1%, and mood disorders to 14.3% in the overall adolescent population (Avenevoli et al., 2015; Merikangas et al., 2010; Smart et al., 2014). Besides, research has shown that diabetes and stress hold a hard-to-break relationship, and individuals with high stress have a high risk of developing Type 2 diabetes (Joseph & Golden, 2017). When a patient developed diabetes, the care concerns are ultimately increased with the patient's level of stress. Hence, it is important to break the existence of the vicious cycle of diabetes and stress for a healthy life because it is easy to neglect diabetes management and make health get worse. The main problem associated with diabetes patients is that they do not recognize the importance of managing their mental health, such as that required in managing their eating habits with diabetes.

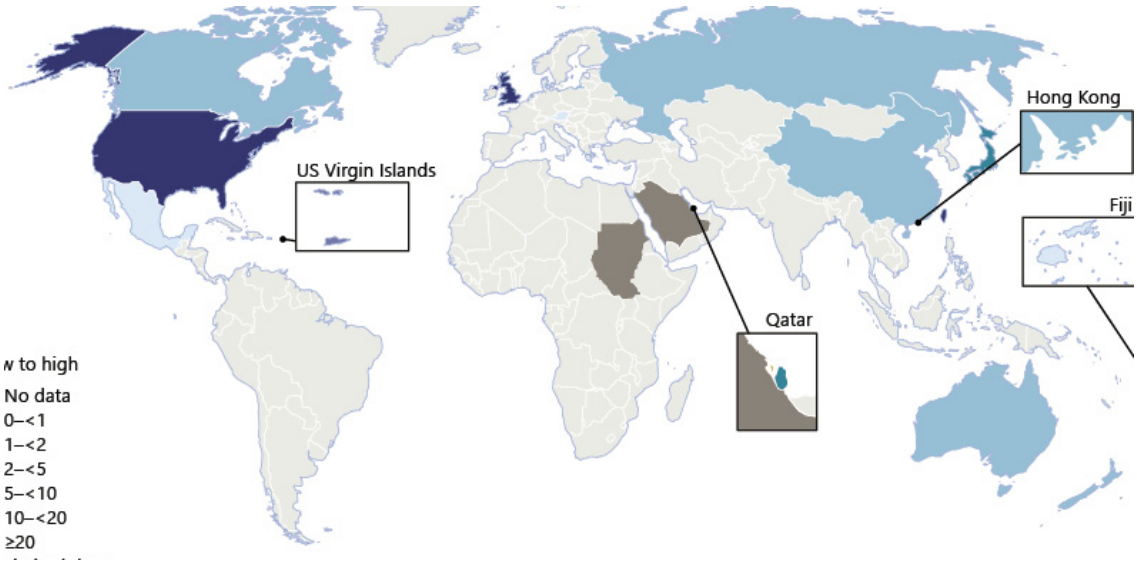


Figure 1. The prevalence of diabetes among the young population worldwide (Lynch et al., 2020)

The current trends in diabetes management applications present two main problems. First, there is a lack of proper features that function mental caring in most of the existing diabetes management applications. These applications are usually designed for recording patients' real-time data related to the disease, such as blood glucose levels, eating lifestyle, physical activity, and insulin doses which patients used to write on the paper called a diabetes note or digital input to the diabetes management applications. In this way, most of the available diabetes management applications only help patients to

record and only monitoring their activity results. Second, the presence of the blood glucose graph in the applications. Patients observe only a single interesting function, which is the graph of blood glucose trends. It seems that most of these methods provide a single function of displaying a record of their previous input data with a single page to the patients. In this manner, a patient checks the trends in the data with a particular category, such as the activity page, blood glucose page, and so on. The patients record their data not just to track it later but also to learn from the trends displayed in the data. However, the current diabetes applications provide the result of each data set with its trends on every single page. There is a gap between transitioning from one page to another page, which missed the learning relationship between each data presented on every page. It seems that these applications are designed in terms of good usability. Based on the aforementioned first, there is a need to research exploring the design situation through which a particular application allows patients to effectively manage their mental illness. Second, the research needed to provide alternative design solutions that can affirm a patient-friendly interface design in the management of diabetes.

1.2. Objectives

The current research efforts invested in the management of diabetes in the young population still present gaps in the current applications for diabetes management (Costa et al., 2009; El-Gayar et al., 2013; Goodwin et al., 2015). Because of irregular changes and fluctuation in eating habits lifestyle like consuming too much sugar, many young people are confronting with diabetes remained helpless, which demands the need for managing their diabetes (Silva et al., 2017). According to some recent studies, it is well established that how personal or self-management for diabetes is important. Personal trainers or self-management educations demonstrates that youth with diabetics utilizing trainers or management have a very positive effect than youth with diabetes not using trainers or other sources of management (Boakye et al., 2018; Nansel et al., 2007). However, people with diabetes needed another person or a trainer to come and assist them this is due to the lack of an application that provides not only monitoring but also self-management.

Most of the applications in the market deliver monitoring and tracking data functions. Unfortunately, they do not provide a self-management platform. So, people who want to manage blood glucose use other health care applications. But this situation is not allowing them to manage their diabetes in a good way. After looking into this problem situation, this study found that smart healthcare could be a new opportunity for management. because management is out of range for hospitals, unlike diagnosis and treatment. Self-management is not convenient and very costly in hospitals.

1.3. Design Approach

The design approach aims to tackle diabetic problems that cause high levels of stress, particularly depression from negative recognition. For this purpose, this study presents the design of Echo as a

healthcare platform that records glucose levels in the blood, targets diabetes patients for managing glucose levels, and supports mental care by meticulously analyzing patients' sentiments through a mobile digital service. This new platform seeks to change negative thoughts, which the patients develop while living with diabetes. As such, the platform provides an appropriate behavioral therapy to minimize the depression and stress caused by diabetic problems and improves the quality of life in different aspects of daily life.

It is crucial to monitor diabetes but the fact that the patients manage a large amount of data makes them stressful and as a result, they start avoiding their self-care. One of the platform's unique visual interface designed with user-centeredness makes it easier for patients to acquire their daily recorded data. To view the data between the blood glucose levels, the patient must zoom in on the magnified graph which enables the realization of each element's effect on the blood glucose levels. Moreover, the curiosity of patients about each element's effect on their blood glucose levels will push them to engage in checking their blood glucose levels on daily basis. We can see this as a reinforcing feedback loop between patient's data and patient's and between other patients, so I name the platform Echo which is Recalling a figure that echoes over and over again.

This study presents the design of a diabetes healthy lifestyle application (See Figure 2) by which this study seeks to determine how this design affects diabetes management with patients' mental health.

Figure 2. Echo Service application for diabetes management and mental health

2. RELATED WORK

2.1. Diabetes Care and Education

2.1.1. Current practices of diabetes care and education

Diabetes is one of the diseases that highly require self-management and self-regulated care. However, self-management for patients is not easy to learn on its own but the ability can be built by an individual's long effort and learning. Patients who stayed with diabetes care in a good condition have great confidence and willingness when it comes to self-management, even they give credits to themselves as self-care masters. It suggests that providing an effective method is important especially for pre-diabetics or people who are first diagnosed with diabetes. These methods include important features that can increase patient engagement with social support and participation. Diabetes patients continuously have to push with self-management to enhance their health conditions because self-management and lifestyle modification are related to self-education and care. To this end, there are seven methods proposed by the American Association of Diabetes (ADCES7). The ADCES7 Self-Care Behavior is an effective and powerful framework for self-management of diabetes and other related conditions (American Association of Diabetes, 2020).

ADCES7 is composed of healthy coping, healthy eating, being active, monitoring, taking medication, reducing risks, and problem-solving. According to ADCES7, problem-solving can be achieved when patients get the other 6 methods (Hill-Briggs & Gemmell, 2007). As shown in Figure 2, ADCES explained the problem-solving method that when patients come up with ways to solve a problem, they should try it and see if it works. A patient with diabetes developed, follow the treatment plan, check blood glucose levels regularly until finding good results which the patient intends to get from the tests. Diabetes also changes over time and a patient may need some new ways to manage it. ADCES further added that when patients succeed in solving problems makes them confident to identify and handle future challenging situations.

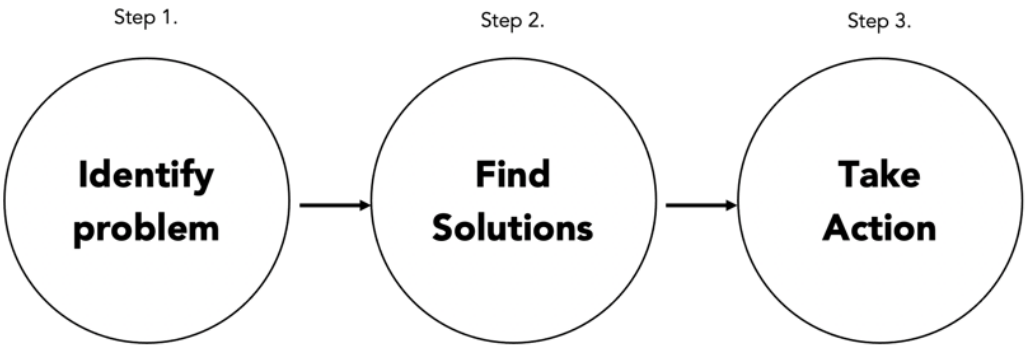


Figure 3. A problem-solving method with three steps suggested by ADCES

2.1.2. Cognitive Behavioral Therapy for Diabetes Management

The main focus of this study is on patients who developed depression due to different conditions of diabetes. These patients are usually unable to focus on their diabetes management because of distorted perceptions and depression caused by diabetes. Hence, it is important to address behavior and perception correction for better diabetes management. Previous studies suggest several methods that can be practiced to avoid depression, such as gradual muscle relaxation, behavioral therapy, breathing, and meditation. The cognitive behavior therapy (CBT) method is applied in this satiation to correct cognitive distortions by analyzing thought, emotion, and behavior. It is an effective treatment aimed at helping diabetics with depression to realize and change negative and self-destructive thinking patterns (See Figure 4). The counselor in the CBT program helps patients to identify factors that interfere with the self-management of diabetics and goes on to find solutions to overcome patients' engagement with depression. Through this process, patients could challenge and correct their attitudes for the situations that are going to happen in near future (Chen et al., 2006). Counselors of the CBT program suggest helping patients create positive reasons to be more active in treatment through counseling, and actively encourage them to turn cognitions that interfere with diabetes management into positive thoughts.

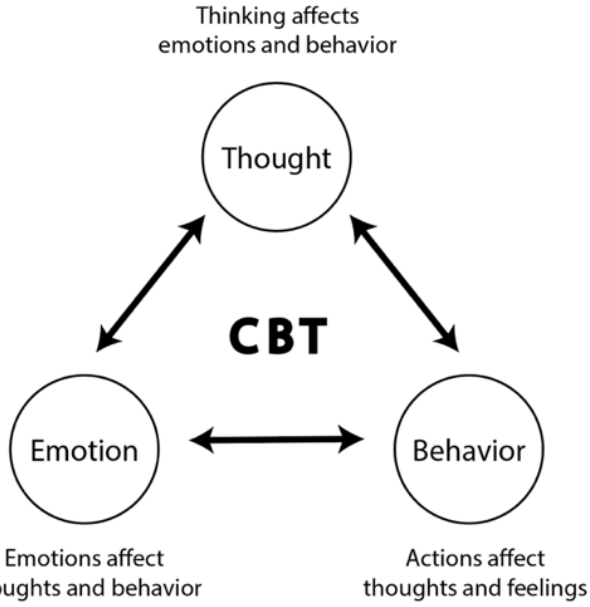


Figure 4. Thought, emotion, and behavior relationship

2.2. Online social networking platforms for diabetes patients

2.2.1. Patient's groups in online social networks

Online social networking has a big impact in guiding young diabetes to enhance their healthy lifestyle. Digital healthcare for diabetes is currently manipulating monitoring methods of diabetes,

diagnosing prediabetes, and raising the level of awareness among the patients and the general public (Fagherazzi and Ravaud, 2019).

Patient groups in online social networks are introduced for young diabetes patients. In these groups, they usually make their groups in a big community as a minor category. In a normal community that is not designed but still patients gather around here and share their personal stories and health data while their privacy is protected. This platform makes patients comfortable and confident in sharing their experiences. Sharing their health data and experience will lead them to help uncover great ideas and new knowledge.

2.2.2. 'Patients like me' platform

'Patients Like Me' is one of the prominent health information-sharing websites for patients. By sharing information on the patient like me site, patients can put their disease experiences in context and find answers to their questions (Koren et al., 2019). They can know detailed information about every medication, supplement, or device used to treat patients like them and learn about what works connect easily with patients that have the same conditions, experiencing the same symptoms, or using similar treatments and learn from patients like them. When the first login after joining the platform, a patient can see how many people are on this channel who have the same conditions in which they also can share with them their opinions and thoughts to ease their depression (See Figure 5).

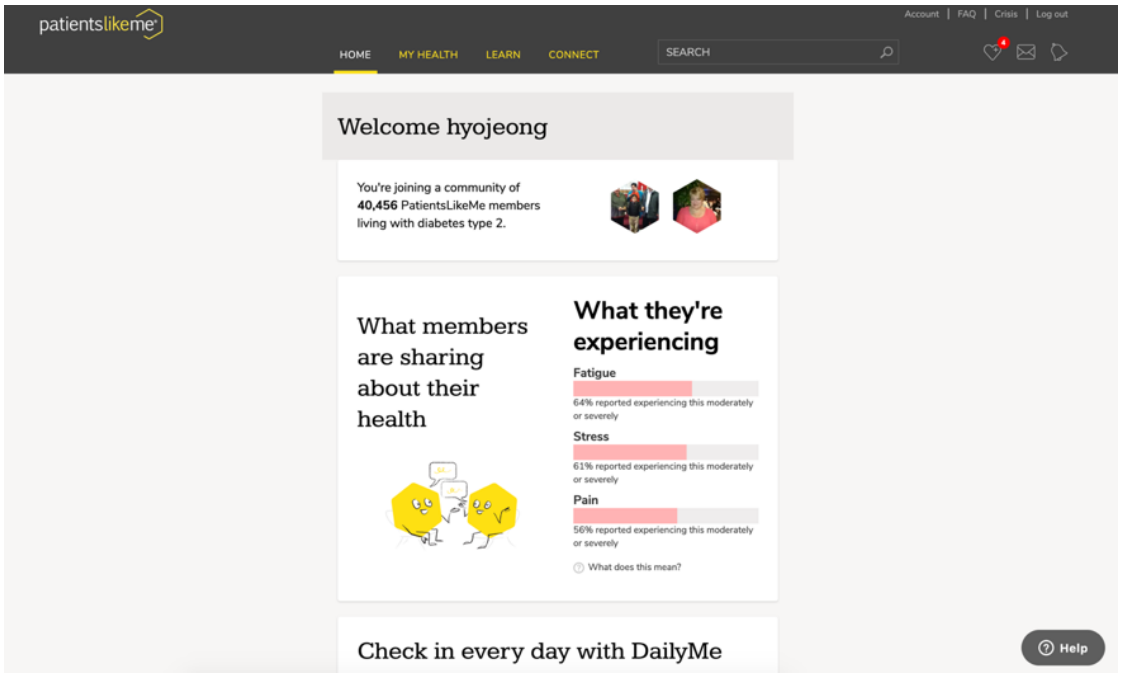


Figure 5. Patients like me main screen (Source: patientslikeme.com)

When people share their feeling or thought, there is no specific category for diabetics. There is only a title and contents box with an add image icon. One special thing is that user can check their feeling with the emoticon provided by the platform (See Figure 6 as an example).

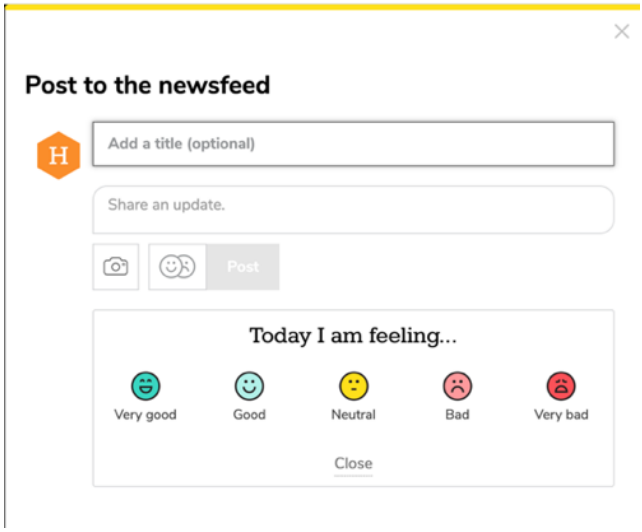


Figure 6. Patients like me writing screen with emoticons (Source: patientslikeme.com)

The posting function is also designed quite similar to a normal social networking service (SNS). But Patients like me have specific reaction buttons for patients that can express applause, support, and helpful behaviors. This represents a considerable difference from the normal SNS platforms. Users can empathize and cheer each other with these buttons. Most of the users use the 'Support button' more than the 'Helpful button' unlike the normal SNS platforms (See Figure 7as an example).

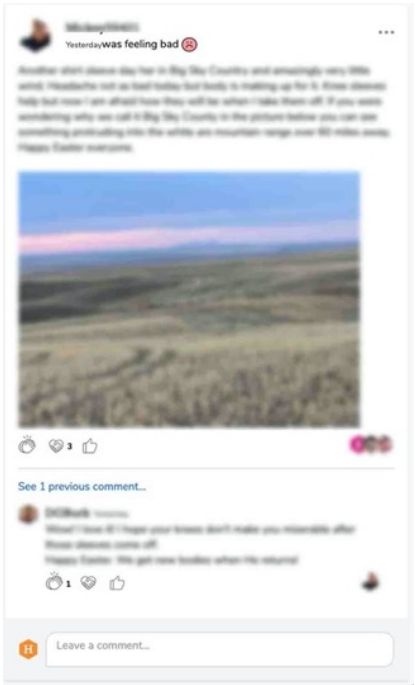


Figure 7. Patients like me writing screen for support and helpful behavior representation (Source: patientslikeme.com)

2.3. Digital Healthcare

2.3.1. Healthcare Services in the digital medium

The Healthcare domain is one of the most significant service areas with its complexity related to dealing with people's health and wellbeing. The reason for its complexity is that there are numerous issues related to health service efficiency, cost-effectiveness, and the capacity to extend the high quality and customized services that are central to people's health (Saviano et al., 2017; Faggini et al., 2019). Owing to the current pace of chronic conditions, digital healthcare is gaining more and more attention. The current development in digital healthcare signifies a huge expansion in the consumer market of digital healthcare services for patients as well as the general population for a healthy lifestyle and disease controls (Mun et al., 2017). This trend shows the significance of digital healthcare for the general public and, thus demonstrates the need for further research in designing digital healthcare services to reach more people with chronic conditions.

Digital health services work as a bridge between different actors, such as patients and physicians by mutually sharing their resources and experiences, which can also benefit the general public by fostering healthcare awareness. In particular, digital platforms have enhanced to gain access to health information and medical knowledge because of which patients, as well as the general public, can independently expand their understanding and awareness of their medical and health concerns (Realpe and Wallace, 2010; Patricio et al., 2018).

Digital health applications have been developed promptly to support people managing their diabetes. As such, many health-related applications offered on smartphones are accessible to provide diabetes management solutions for lifestyle mediations or medication modifications in reply to glucose-monitoring data (Fleming et al., 2020). Studies have shown that smartphone applications for diabetes management have positive impacts on the level of physical activity in patients with diabetes, which have in turn improve lifestyle behaviors and clinical outcomes (Bonn et al., 2018). For example, Babylon Health[1] is an application offering healthcare services through smartphones. The application allows patients and clinicians interaction with video consultations and thereby prescribing patients with medications. Babylon also enables disease symptom checking through artificial intelligence-based machine doctor that is accessible through chatbots (Barisevičius et al., 2018).

Several interventional studies are conducted on investigating the role of diabetes applications on smartphones in improving self-care behavior, such as glucose monitoring, balanced diet, and physical activity (Kebede and Pischke, 2019). However, there is a lack of evidence whether these applications improve the mental stress caused by diabetes in the young population.

According to research studies, new digital health care systems are introduced in the market very rapidly. For instance, 153,000 mobile applications that are related to health care systems were released

[1] For babylon details: https://www.babylonhealth.com/

in 2015[2]. There is a huge influx of technology that is trying to enhance the health care system worldwide.

Users need a very convenient way of utilizing any health care application. User interface (UI) design connects the users and health care systems in these applications. It is like a bridge between the systems and a user, without considering UI design a health care application could not perform at all. Users can be physically more active by using easy-to-use applications and they can manage their health very easily (Ahtinen, 2008).

[2] For mobile application details: https://www.bmj.com/content/360/bmj.k6

3. DESIGN APPROACH

The design approach consists of two major activities: preliminary user research and post-user research. These activities aimed to tackle diabetic problems that cause high levels of stress, particularly depression from negative recognition. For this purpose, this study presents the design of Echo as a healthcare service platform that records glucose levels in the blood, targets diabetes patients for managing glucose levels, and supports mental care by meticulously analyzing patients' sentiments through a mobile digital service. This new service platform seeks to change negative thoughts, which the patients develop while living with diabetes. As such, the platform provides an appropriate behavioral therapy to minimize the depression and stress caused by diabetic problems and improves the quality of life in different aspects of daily life. The design approach for echo service design derives the core features of the service design to build a user interface design system through desk research and preliminary user study. Subsequently, the post-user research was conducted based on the design requirements. With the post-user research, the echo service design platform was verified, and detailed user feedback and ideas were obtained for each of its functions. The final design that reflects the idea of post-user research activity is presented below in the following contents and specifically in Figure 8.

3.1. Preliminary User Research

3.1.1. User research

The user research was conducted at the same time as the starting point of the design approach to meet actual diabetic patients to explain the purpose, background of the project, and to gather expert opinions. The most important purpose of user research was to see how the background and problems this study set to apply to actual diabetes patients. This will assist the design approach by providing a direction on how the project proceeds.

For user research, this study sorts to arrange semi-structured interviews with young diabetes patients (30 years old) but diagnosed with diabetes in their early 20s. For this purpose, we prepared questions related to diabetes. Since then, we drew out the patient's experience and listened to the patient's experiences and thoughts. Patient K was a service worker and had a personality that did not feel pressured to talk to strangers. So it was good to have an interview with patient K to set baseline questions for the rest of the study. The patient shared the feelings and experiences at the time when diagnosed with diabetes at a young age and provided different viewpoints that help us to further continue our design practice.

Patient K strongly appealed for the need for similar services for young people with diabetes. We observed that this patient was depressed and frustrated when diagnosed with diabetes (See Figure 9 as

an example). The patient added that the cause of depression was stress because of diabetes at a young age. If diabetes is not detected and timely responded to it, the consequences become more severe and hard to prevent complications caused by diabetes (KMI01). We envisioned this situation because the patient was a young diabetic however, the patient added that finding information about diabetes was easy either online or offline. However, it was rather difficult to follow too much information, and it lost credibility unless it was based on actual diabetes experience (KMI12). Besides, when the patient approached a doctor at the hospital, the advice from the doctor was difficult because the patient only received information based on blood glucose levels (KMI03). The patient also shared anecdotes with another patient of the same age at the hospital where they both had a deep conversation about the situation (KMI04). The conversation led the patients to talk about how not being stress or frustrated might help in developing the health quality and avoiding social pressure when met the same age patients with diabetes (KMI06). We gained insights from these interviews which let us focus on the need for experience-based information sharing and mental care for young diabetics. The details of the interview transcriptions are provided in Appendix 7.1.1 (See Table 18). This interview provided us a baseline or a cornerstone insight on setting questions which this research designed.

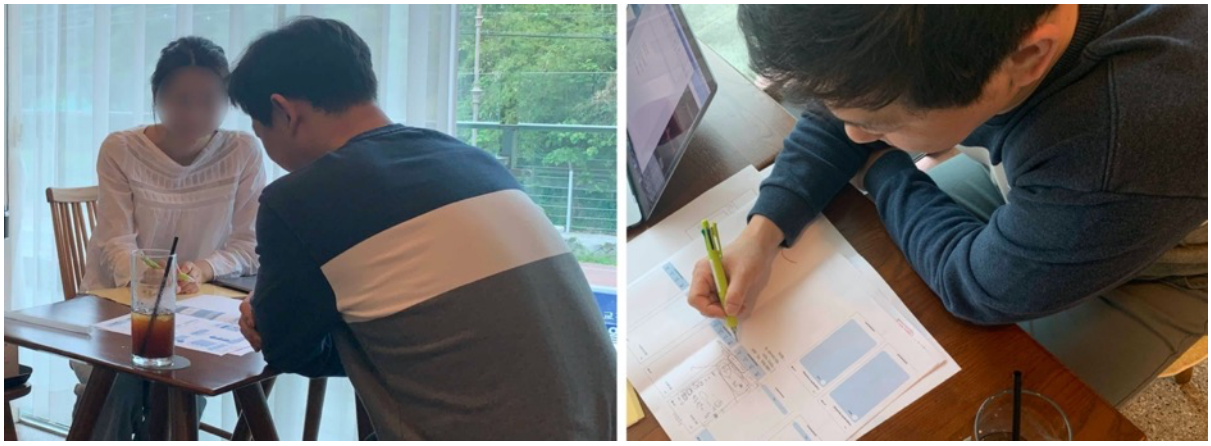


Figure 8. User research interviews with patient K

3.1.2. Persona

Persona is a virtual user who reflects the reality of young diabetes patients discovered through user interviews and online observations. We used persona throughout the project by reminding a user's goal, motivation, etc. Persona A in this project was diagnosed with diabetes, which acquired fear of complication and found it difficult to manage diabetes. Persona A was mentally affected because of an unexpected diabetes diagnosis and the stress of checking health conditions earnestly with a sudden lifestyle change. This persona added that the experience goal was "I want to reduce stress from managing my health, such as diet records and weight loss", which has disturbed the persona of continuous checking to keep healthy. Due to this, the persona acquired negative emotions and feelings, quite often being lonely, getting anxiety, and other mental health problems (See Figure 9).

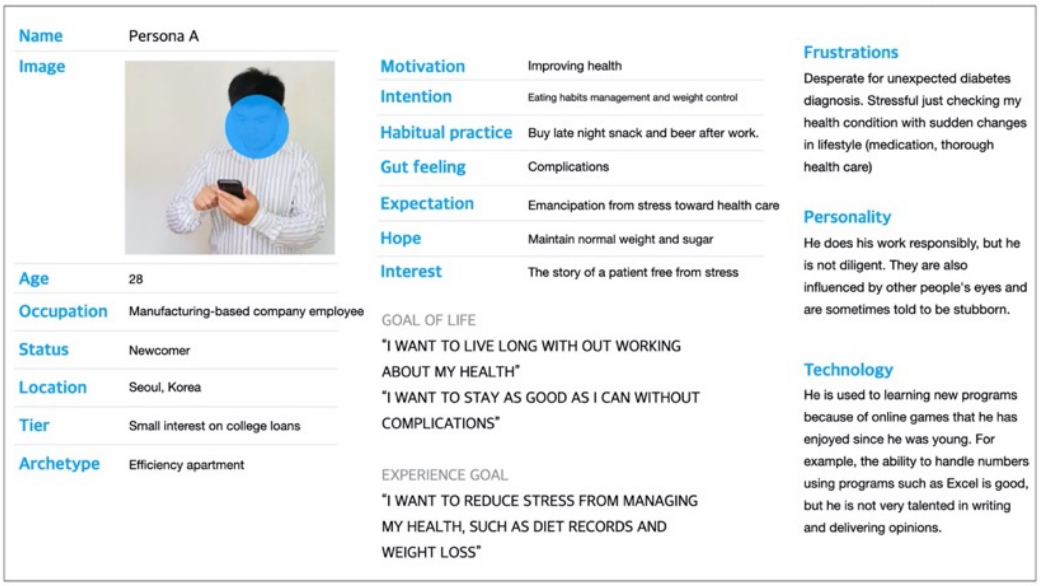


Figure 9. The main persona of study (Persona A)

3.1.3. Competitive analysis map

Competitor research is a design approach that can identify what features the existing services provided to users with convenience. As such, this study seeks to find how the proposed service is different from other services and how the existing applications manage mental care for young diabetes patients. Competitor research aims to gain insights into new services by identifying what existing applications were missing in terms of diabetes health care.

First of all, among the existing diabetes applications, the five most frequently found in the diabetes online community were analyzed in three categories: Things they do well, reference, Things they could do better (See Table 1, Table 2, Table 3, Table 4, Table 5) the competitive analysis map allowed us to set the position and goal where our proposed service should be placed (See Figure 10). It was easier to get professional information, such as diet coaches and information news from health care applications than from diabetes applications. Although the blood glucose graph was also well constructed, no analysis of the causes of blood glucose level was available. The records of blood sugar levels, meals, and exercise could only be checked. Insight, the biggest gain from competitor research analysis, the competitive application more focused on 1:1 coaching and communication with doctors, but this project will more approach that helped individuals make efforts in terms of service functions to improve mental health care and diabetes management habits.

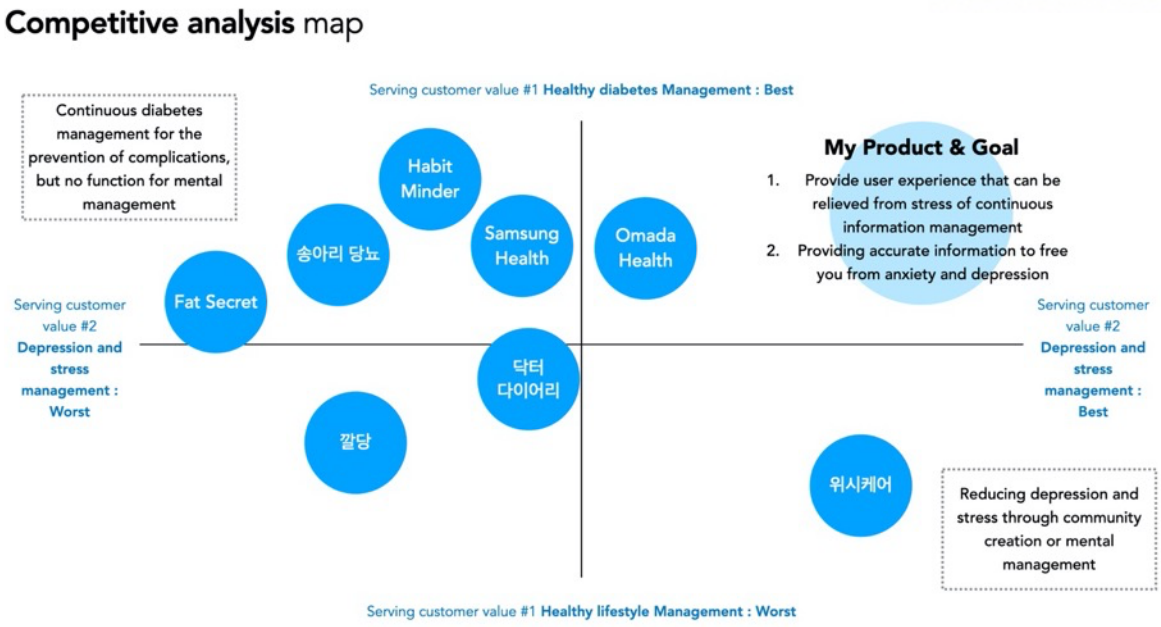


Figure 10. Competitive analysis map

Table 1. Competitive analysis: A

Service	**Omada Health**
Things they do well	Professional health coach, Connected health devices, Online community, Weekly interactive lessons, insightful health metrics
Reference	By providing diabetes information weekly rather than daily, users can recognize it as a piece of model information that they can use to manage their health condition. Moreover, simple and accurate design under typography rules makes it easy to get information from apps.
Things they could do better	Diet control/weight management is not set according to the 'exchange unit' that is difficult for diabetic patients to get used to.

Table 2. Competitive analysis: B

Service	**Doctor Diary**
Things they do well	Dedicated glucose meter device provided. Bluetooth connection for easy recording, Market for diabetics
Reference	Check health food information for diabetic patients in the market.
Things they could do better	This app has a relatively large number of users by having their glucose measurement device linked with the app but does not properly serve the community. Advertisement and service notices are posted together in a community where users can communicate with each other but failed to fulfill their community functions for communication.

Table 3. Competitive analysis: C

Service	**GGAl DANG (깔당)**
Things they do well	Automatically a 1:1 matching every morning walking competition. Self-Health Report provided once a month.
Reference	Check health food information for diabetic patients through the market Game format allows you to create fun habits.
Things they could do better	The UI design of the blood glucose report, graph and takes the current blood glucose note style(chart-based) which people used in a notebook. So, there is a limitation to check the data in the app quickly.

Table 4. Competitive analysis : D

Service	**Wish Care**
Things they do well	The medical information management/timeline/blood sugar/blood pressure level etc. is to be delivered through individual charts. Diabetes Shopping / Diabetes News. Community: 1:1 Message - Direct message between close friends.
Reference	Check the daily walk record through the alarm.
Things they could do better	The main screen is very compact with information. It is difficult to check the exact information on the main screen that shows the user's status because various information is exposed to the main screen. The page for users to input their data such as the figure of blood glucose, dosing information, activity is designed so complicatedly. Users are confused by requiring all information to be entered on a single screen. Conversely, the page showing the user's record is scattered with each information, making it difficult for the user to identify the association between records.

Table 5. Competitive analysis: E

Service	**SongAri Diabetes (송아리 당뇨)**
Things they do well	Deep and professional content. Systematic learning. Kind answers to questions. Differentiated services for gestational diabetes
Reference	Information on the 'change unit' of the food group exchange table is provided, which is said to be the most confusing and difficult for diabetics to start experiencing diabetes. Characterized by providing professional data such as reading professional books, easier information transmission through video
Things they could do	Limitations to non-specific filtering in obtaining information from food group exchange

better	tables.

Table 6. Health manages apps

Service	Samsung Health	Fat Secret	Habit Minder
Things they do well	Healthcare by contacting people	An application that helps the user manage their eating habits after setting goals. Calculating calories from a recorded diet.	Creating habits with alerts, recommending actions with alerts Provides a variety of habit categories.
Borrow this	Works with Samsung Health products for easier management	Advantages of this app: Calculating calories, Goal Setting	Statistics for each habit are accurately calculated.

3.1.1. Ideation workshop with user story

The ideation workshop was conducted to get a detailed function for the project. The main purpose was to see how the service designers, UX designers, and industrial designers portrayed the idea in the context of the overall purpose and direction for the project (Table 7).

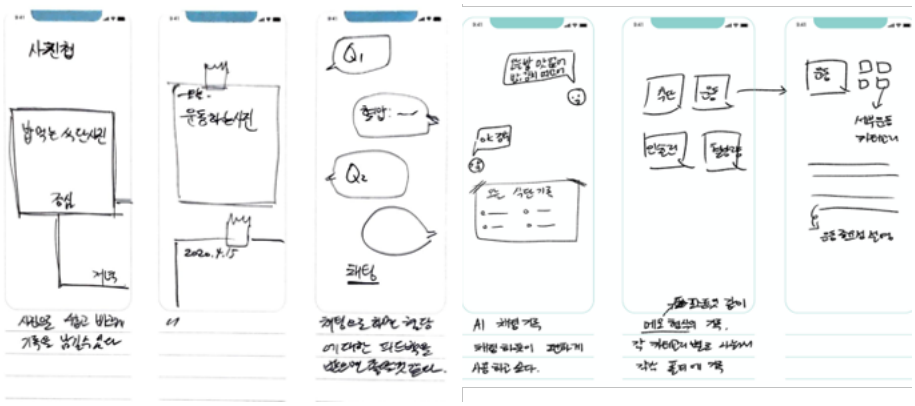
I used user stories and ideation sheets for this workshop. First of all, a user story is a design methodology that organizes the functions needed to achieve the goal in writing. Using a sentence structure called 'As ~ so that', I write down the goals that target users want to achieve (Table 9). Afterward, each user story was explained, and designers drew their ideas related to the user story on the ideation sheet.

A total of 8 categories of design were available through the idea session (Table 8). Each idea was subsequently interpreted through the affinity diagram (3.1.2) and used as a tool for interpretation in designing the final function.

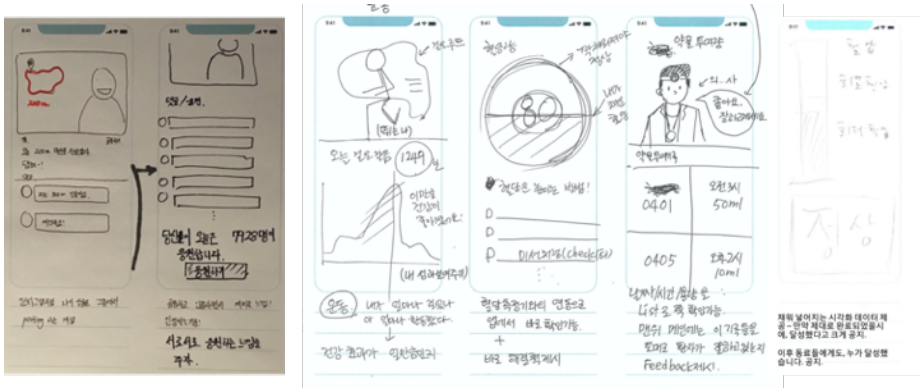
Table 7. Ideation workshop participate

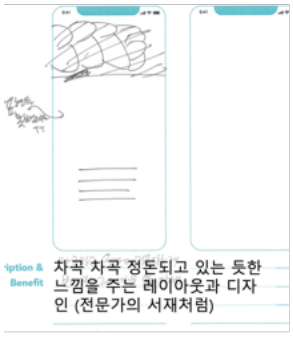
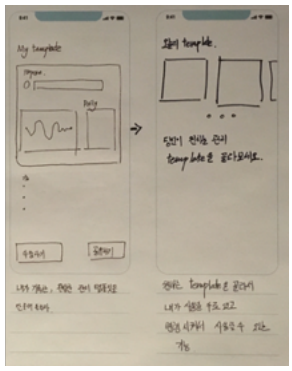
	Name Abbreviation	Major
A	LJY	UX Designer
B	HGU	Industrial Designer
C	LMH	Industrial Designer
D	KJY	Industrial Designer
E	BYJ	Industrial Designer
F	JWI	Industrial Designer
G	JSW	Service Designer

Table 8. Idea from ideation workshop

Name of Idea Group	**Source for Idea**
Easy to Record	Easily and conveniently record using recording function, suggest a solution to check it directly in the app by linking it with a blood glucose meter, record in memo format like a post-it, and record it easily and quickly through photos 
Funny to record	Like writing a diary in a fun way, recording it in a dynamic layout, projecting yourself into the character, developing the character, motivating, and competing with friends like a game character's ability. Exercise is a fun visualization of me running in the path of my steps, and I can see my health effects.

Record by community	Like Instagram, the concept of posting my activities in a group, "I support you" sharing, authenticating, and having fun, being recognized. Let's give each other a feeling of support. A word from the doctor. Feedback can also be obtained
Motivation by Community	Form a community where you can communicate freely by modifying and uploading your journal. To get advice from a knowledgeable person like an intellectual in the community. Gathering and overcoming various information. LV. once a day to advise high patients. Community space, experience sharing for each category. Share other people's success within the community / Visualize achievement / Challenge format There's a "cheering, clapping" button that people can cheer for, like "Like." Like a one-line review, the treatment process can be recorded and shared 1-2 times a week like a diary. Share it, and you can look at others and see how much they can improve. Layouts and designs that make you feel like you're tidying up.



Personal Template for manage diabetes	I create a complete care template that I record. I can choose the template I want and use it, or I can modify it. I can see a template of a patient with symptoms similar to mine.  
Body check function using characters	Provide current status details when you click a character. Select a body part from the empty dummy illustration and enter the status of the injured area only. More intuitive expression is possible with indicators and parts. Click human illustration and remind the screen pop-up to see if there are any injuries at the end of the day. It would be fun to record the entire body of the character, the accessories worn on the day or the same day. When entering the status, the part is zoom out and the option appears to click on the wound type.

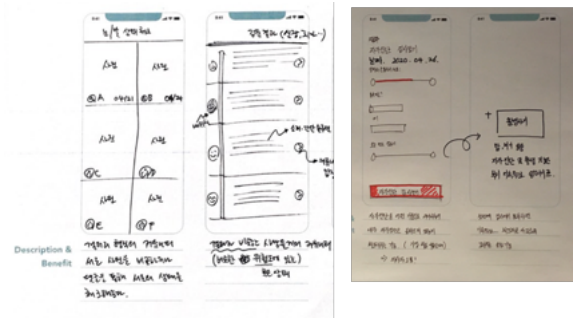
	
Continuous check function based on set settings	A function that helps you check and continuously check what self-diagnosis should be recorded based on the settings you have set, whether you have done it right or not 
Check function through information provision	Ability to chat or get AI informed and checked 

Table 9. User story

	1. Forming health care habits and managing diabetes without the burden
1	As a 30s - 40s diabetic patient, I want to form a lifestyle for my health into a habit. So that it can be freed from the burden of steady drug use and periodic examinations.
1-1	As a 30s - 40s diabetic patient, I want to enter my records in an easy way, such as chatting. So that I will eliminate the burden of high and complex diabetes management.
1-2	As the 30s - 40s a diabetic patient, I want to form my health record habit through a plan that sets a specific period of my own. So that I want to continue to take care of my health through habit formation.
	2. Take care of stress, relieve anxiety
2	As a 30s - 40s a diabetic patient, I want to get positive minds and effective information. So that I can remove the negative thoughts and anxieties that come frequently
2-1	As a 30s - 40s a diabetic patient, I want to share the process of my efforts with the other patient with my own blog. So that I get motivated, and I can see the process of becoming a master of the category of diabetes management.
2-2	As a 30s - 40s a diabetic patient, I want to get a stress relief system that fits me. So that I will be leading an active lifestyle as a driving force in this.
	3. Understand my condition and get information through self-diagnosis
3	As a 30s - 40s a diabetic patient, I want to regularly conduct self-diagnosis. So that I can escape uncertainty and anxiety about my condition.
3-1	As a 30s - 40s a diabetic patient, I want to know the risk of diabetes through self-diagnosis tests with accurate indicators. So that I will be able to start quickly losing weight and preventing diabetes as possible.
3-2	As a 30s - 40s a diabetic patient, I want to check regularly the abnormalities found in my body through indicators. So that I can prevent complications of diabetes and consult with my doctor based on data.

3.1.2. Affinity diagram

The affinity diagram is a tool to help to get new insights with a variety of information that was gathered from previous design work. from the affinity diagram I could find five idea groups and by utilizing these categories I was able to design the function of my project in 4 different ways. (See Figure 11)

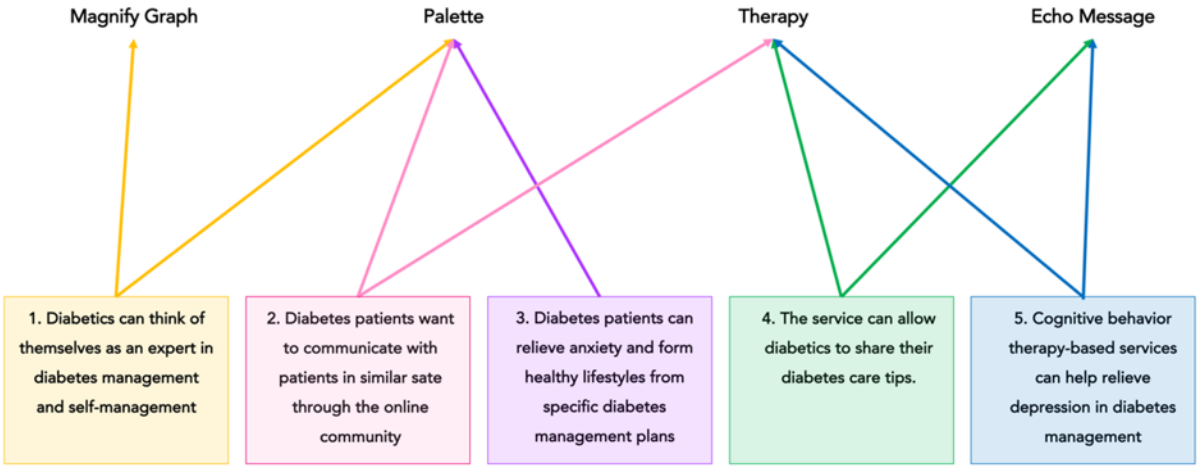


Figure 11. Echo function by main idea group

The first function is Magnify Graph. This function works by simply touching. So, whenever patients clicked on the blood glucose level, the related record with blood glucose pop up. Which was designed by two main ideas from the affinity diagram. The first idea for Magnify Graph is 'Number 1. Diabetics can think of themselves as an expert in diabetes management and self-management and the second idea is 'Number 5. Cognitive behavior therapy-based services can help relieve depression in diabetes management'. There is an information source for coming up with a second idea which is; 'feeling depressed or frustrated that you have not reached your target level while measuring blood sugar. In this case, it is necessary to look carefully at the linkages of thoughts, feelings, and behaviors so that they do not result in neglect of treatment'. I could find this insight from CBT care for diabetes. So, when I was designing a Blood glucose graph, I was trying to design not only a graph that tracks the data but also analysis the reason for BG, so that patients see their data with the curiosity of results not the only number of figures. And this situation makes patients analyze their data more intelligently and it gives patients confidence in their actions (Figure 12).

Figure 12. Magnify graph sketch

The second function is Palette. Palette is a feature designed to schedule diabetes by anticipating a new day for diabetics. there are also good ideas for this function from the affinity diagram. The first one is ‘Number 1. Diabetics can think of themselves as an expert in diabetes management and self-management and the second one is ‘Number 2. Diabetes patients want to communicate with patients in similar sate through the online community’. And the last one is ‘Number 3. Diabetes patients can relieve anxiety and live a healthy lifestyle from specific diabetes management plans’. Especially in idea number 2, there is an insightful source for designing this function is that ‘In the community, diabetics are both information providers and information consumers.’. Based on these insights, I continued to think about how people in the community can share and develop their own diabetes management tips and gain self-confidence as experts in the process. At first, I focused on communication between patient users like ordinary social networks (See Figure 13), but I focused again on the nature of why they communicate in the community. It was ultimately to better manage their diabetes. I was able to bring up the current Palette idea of proceeding with individual diabetes management scheduling which is based on the community's information (See Figure 14). Palette provides a user experience of personal scheduling for better diabetes management and communicating and develop essential information with other users through the community.

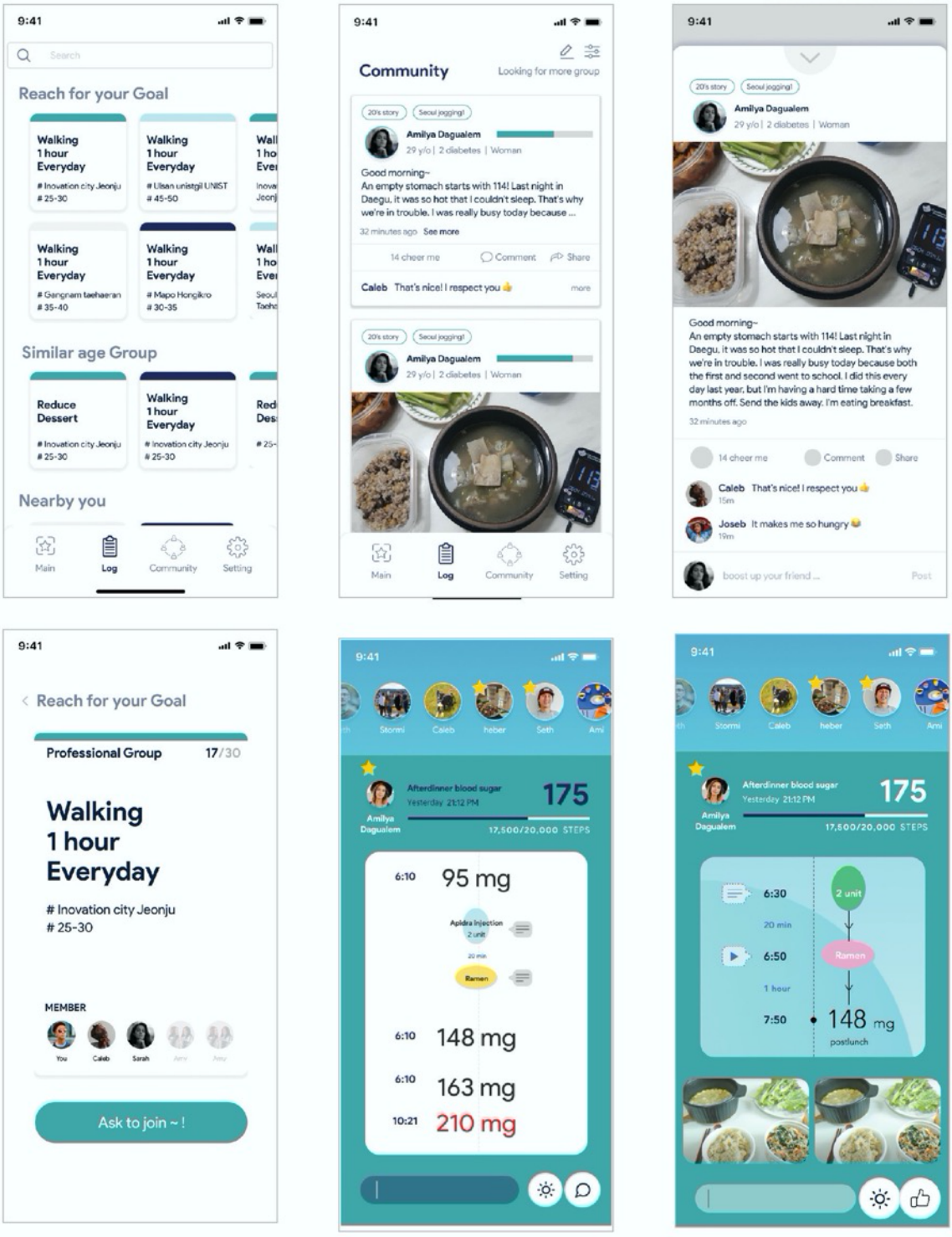


Figure 13. Pallete Sketch A

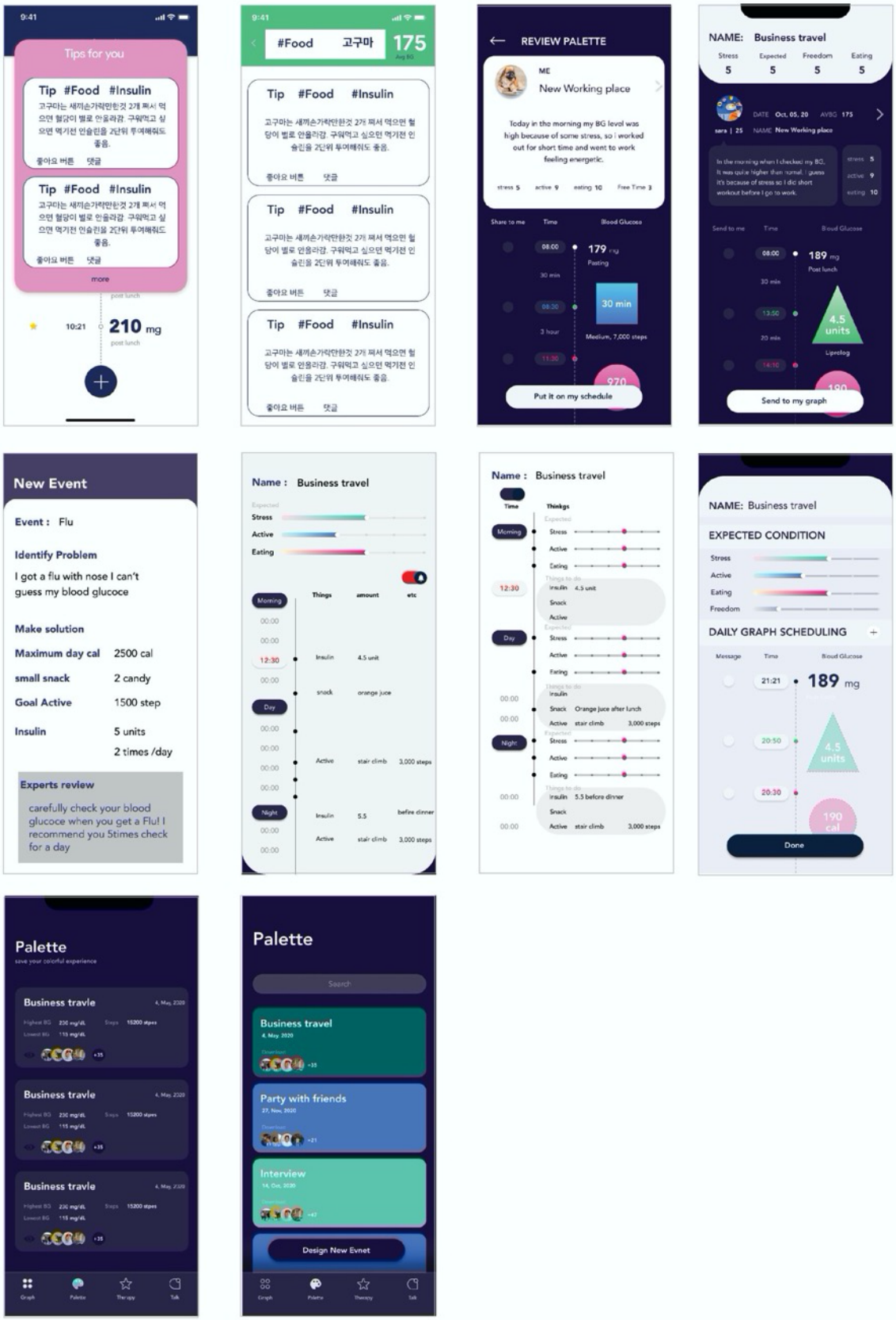


Figure 14. Palette Sketch B

The last main function is Therapy. Patients can change negative thoughts by provided appropriate intervention based on cognitive-behavioral therapy (Figure 15). Therapy is designed by three ideas from the affinity diagram. The first one is ‘Number 2. Diabetes patients want to communicate with patients in similar sate through the online community.’ The second one is ‘Number 4. The service can allow diabetics to share their diabetes care tips.’ The last one is ‘Number 5. Cognitive behavior therapy-based services can help relieve depression in diabetes management.’ Therapy is specially designed through the insight from CBT and the patient’s community.

Figure 15. Therapy sketch

In addition, Echo Talk, a community function for communication among diabetics, was designed. Echo's Talk is a special community function that allows users to view the status of care of recommended peer patients based on user's diabetes information. Here, the patient can send and

receive simple messages. Finally, I designed Echo Message which is designed by Conversion UI, and also general recording screens that allow diabetes management to be recorded from time to time.

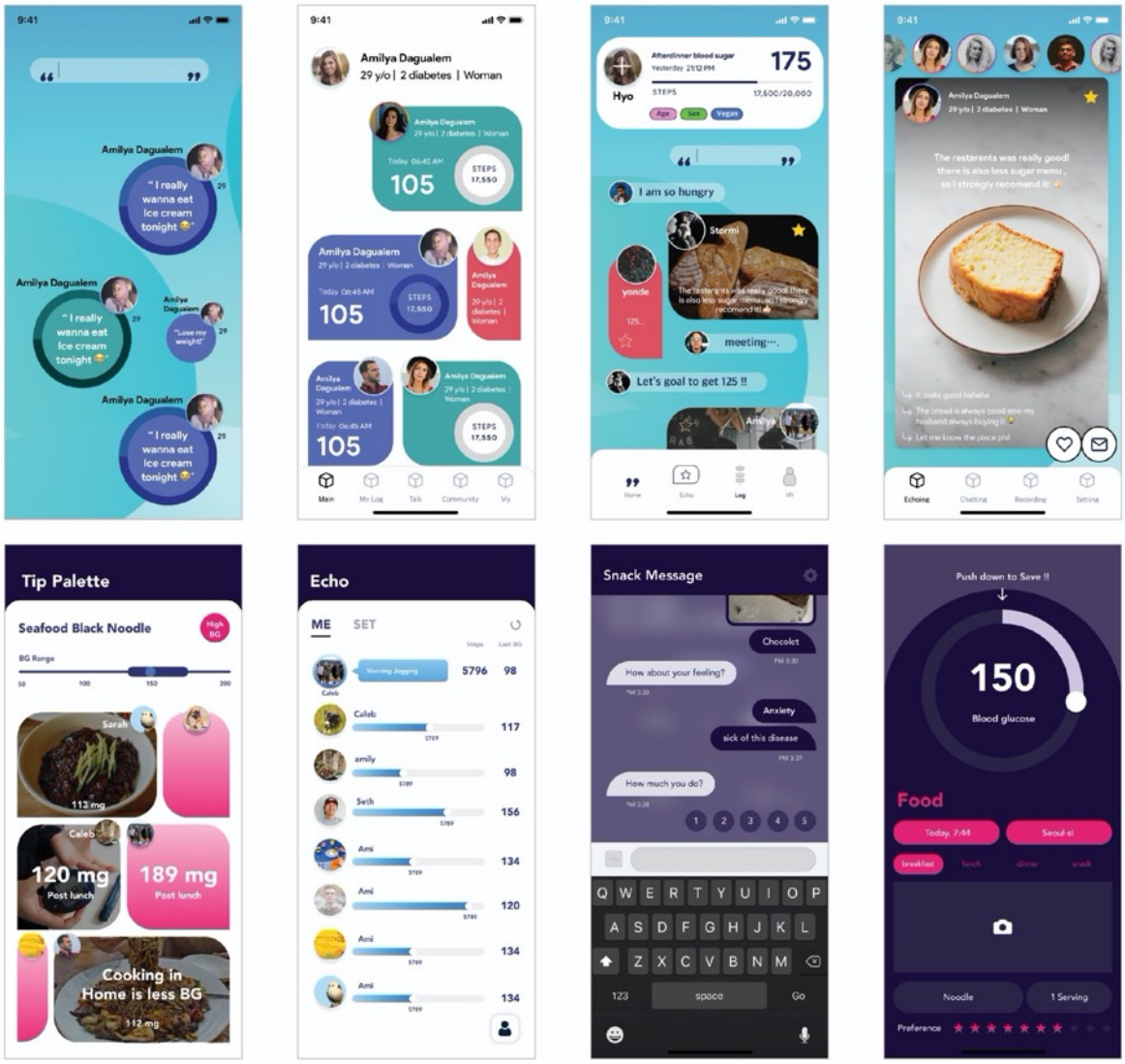


Figure 16. Other function sketches

3.2. Post User Research

The background of this test was to ensure that the service idea designed through Primary User Research was useful, serviceable, and aesthetic in line with the actual diabetes experience and expectations.

For the Palette function, the user conducted a pre-task to think about his or her experience in personal space before the interview and a test using an idea sheet. This aims to obtain various ideas from real users about how Palette's ideas, a special echo function, are organized on mobile screens, compare them with current Echo UI, and draw better screens.

Magnify Graph conducted prototyping tests with minimal functionality. The purpose is to understand whether the user understands the role of the designed component well, check the usability of the product, and derive improvement measures to major discovery problems.

Finally, the user journey chart helped the interview to easily understand the scenario of the entire service, and the satisfaction assessment and opinions for each function were available.

3.2.1. Participants and deployment

I recruited 3 participants for the post user test and the criterion for recruiting is considering age. I was looking for born in 2002 ~ 1983, it's 20's or 30's. And also, within a limited interview, users with stories were selected and met without difficulty in conveying their stories.

Patients SY (Female, age 31, Pregnant diabetes, 2021 confirmed for diabetes) is the participant who worked the hardest on diabetes management because the goal of "healthy baby birth" was clear. and she also had experience with the blood glucose app, but she was stopped using the application and moved to write general notes because it was difficult to see her diet and blood sugar levels at a glance. She is the most welcoming user of the features of the Magnify graphs.

Patients JI (Female, age 32, Type 2, 2004 confirmed for diabetes) is also diabetic but she was determined to manage diabetes is because her children who were elementary school students, were diagnosed with diabetes. Therefore, she talked about her experience and know-how in diabetes management for more than an hour. She was also managing her own and her children's blood glucose at the same time with a blood glucose notebook.

Patients SA (Female, age 38, Type 2, 2020 confirmed for diabetes) is single and a math teacher for children. SA was a hardcore user who lost more than 10kg last year after confirming diabetes. Because of this, I was able to hear the pain points and various experiences from her, especially in exercising and diet management. She shared her experience in the community for more than an hour as a passionate diabetic community user.

Although many users did not meet due to limited periods and various definitive issues, they were able to get various ideas for the improvement of the service by meeting users who could tell their stories without hesitation.

All the tests were carried out in the schedule below. During the interview, there was a slight change in the time required for each stage, but in cases **No. 4** and **6**, the test was conducted accurately for a given time(30min, 15min). In particular, in **No. 7**, interviewees freely talked about their opinions by looking at the entire process of Echo, and at this stage, they were able to get more in-depth opinions. Since Echo's design is revealed to the user in **No. 6** and **7**, the test was conducted by placing an idea work such as **No. 4,** which requires the user to receive the user's ideas first.

Table 10. Test timetable

	Time	Fixed time required	Contents
1	00:00-00:10		Introduce each other
2	00:10-00:15		Ice Breaking
3	00:15-00:30		Explain 'Pre-Task'
4	00:30-01:00	30min	Ideation Sheet (For Idea Palette)
5	01:00-01:05		Break Time
6	01:05-01:20	15min	Magnify Prototyping Test
7	01:20-02:00		Echo User Scenario Test + unconstructed interview

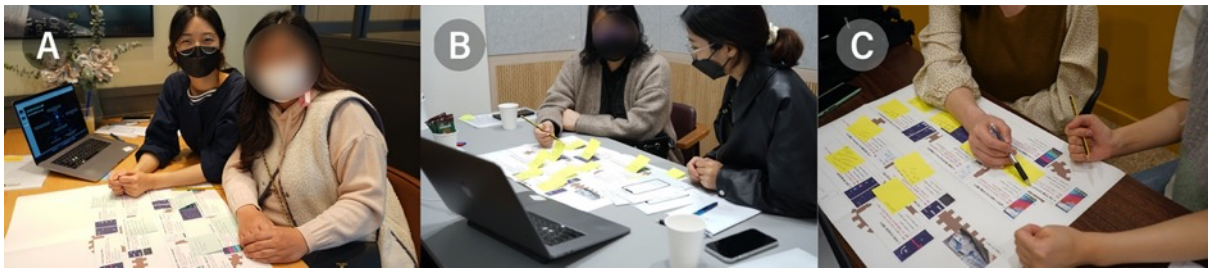


Figure 17. Participants - A)SY, B)JI, C)SA

3.2.2. Qualitative interview with the toolkit

The purpose of using an ideation sheet at the post-user research is to see how the specific function of this research is configured on the screen by the user and compare it with user design and the present design by pre-research. It's quite different from previous ideation work at the pre user research, this time ideation sheet was not only used to get an idea but also explain and compare the function of Palette as a toolkit in the qualitative interview. First, this session also was considered as a co-design workshop but because of the confidential issue of patients and the situation of the COVID19, it's decided to have a personal interview. So, we used 'Pre-task' for a personal interview to make the interviewee deeply into the contents even he or she participate in the session alone, not with other patients. The question was composed to see how people find their solution when they meet the problem in diabetes management, which is the goal and objective of the Echo palette. This 'pre-task composed of some of the questions followed (

Table 11).

Table 11. Question of 'Pre-Task'

	Question	Explanations
1	How do you expect your condition and blood glucose on the day	Divided into breakfast, lunch, and dinner to expect blood glucose and condition during the usual check time
2	Why do you expect to like the answer to question 1?	Same with Question 1. So people anticipate each session.
3	Please plan your special day schedule based on your diabetes management	Make sure to schedule freely in their own way with a large space See (Figure 18).
4	What factors make you to succeeds in your plan? if you have any effort and compensation?	Empty space to get their own answer
5	Is there any information that helped you to make a schedule? Or do you need any information for better scheduling?	Empty space to get their own answer

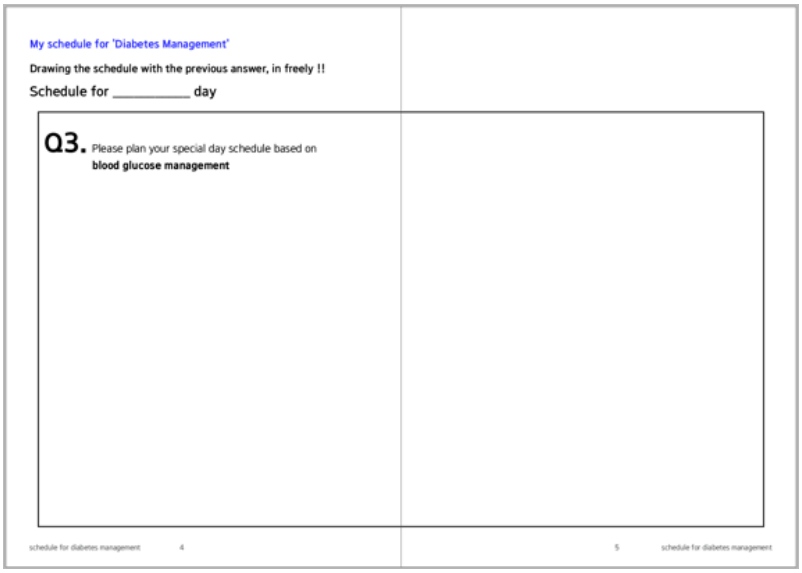


Figure 18. Question 3 page

The ideation sheet's special goal was that how people draw the function and their idea about the Palette function on the sheet so make them understand the function of the palette in the interview session could not be enough. The special purpose of the ideation sheet is that making people understand the function of the palette by making them draw the function and their ideas by themselves about the palette function on the sheet.

So this pre-interview task helps interviewees to think and understand the objective of the Echo palette more deeply in their own space before they come to have the interview. In other words, the goal of

'Pre-task' will make interviewees think about the problem in their diabetes management and find a solution themselves with some information which is the function and objective of the Echo palette. The 'Pre-task is composed of a small book, a pencil with three colors, a sticker, a roller, and a pencil with an eraser to give them many options to draw (Figure 19).

Figure 19. 'Pre-task' for ideation work in test

The interviewee answers the question so that they could think about the contents which are Palette wants to offer to the user. After that, the user will see the ideation sheet in the interview. First, the interviewee sees an ideation sheet in which folded the A4 in half (See Figure 20). And after they draw their idea on the ideation sheet, they can open the folded sheet in half and they see the entire contents of the ideation sheet (Figure 21). The folded half has printed with the Echo screen design with function of Palette which is same with the function drawn by the interviewee.

Figure 20. Half of the ideation sheet only for drawing

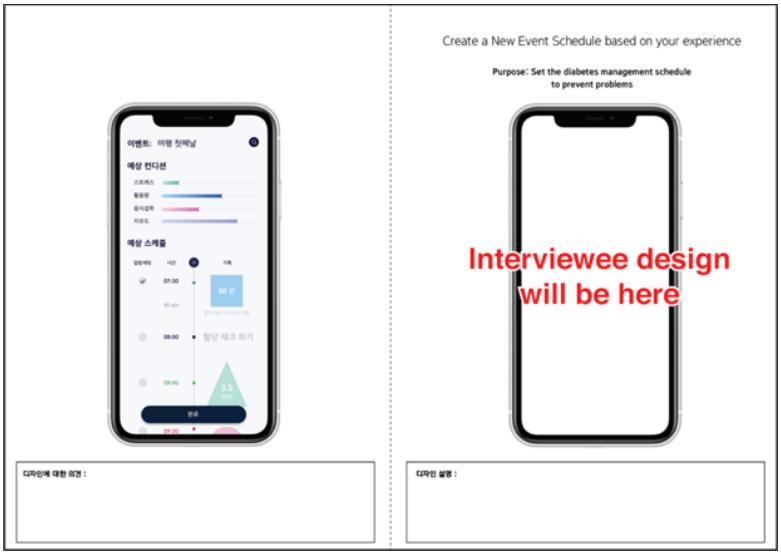


Figure 21. Ideation sheet page for comparing the Echo design with the user's idea

When the user draws their idea on the ideation sheet, they can get a reference from their answers in pre-task (See Figure 22). Through the Pre-task, the user can first think about the function of the palette and they can draw and express their idea on the sheet. The table below describes how the sheet is organized (See Table 12).

Figure 22. Use 'Pre-task' in the ideation session

Table 12. Contents on the ideation sheet

	Question for ideation sheet	Related Pre-task Question Number	Echo Screen
1	Design a page to expect your condition on a new event day	1,2	The screen of expected condition in Palette
2	Design a page to get the information you need to schedule	4,5	The screen of searching information in Palette
3	Design a page to make a diabetes management schedule	3	The screen of making the schedule in Palette

Interviewees explained the reason for the ideas they expressed on the ideation sheet and how they think about the design of the Echo. During the interview, It was not easy to express their idea on the sheet, but they quite enjoyed explaining their thoughts after they started to draw and interviewees could start the ideation work without strange feeling about the function of the palette because they already had an experience of scheduling pre-task. And they also explained their opinion by text and speaking so the result could be analyzed after the interview is done.

First, ideation sheet number 1 determines what content users think for preparing their diabetes management. The most talked-about by the interviewee to prepare the one particular day of diabetes management was that food, activity, and stress. These three are mentioned to a similar extent (SYIS01, JIIS01, JIIS05, SAII01, SAII02, SAII05) and this result was similar to Echo contents.

Moreover, interviewees said new content to manage diabetes such as quality of sleep and some particular things like anticipating the location in advance. The interesting point was that one interviewee used quality of sleep as the unit of stress when she finds the problem of diabetes management because she said checking the weather can enough sleep or good night's sleep-related with mental condition (SAII02). Among the interviewees, one said a lot about the unit of each content and there was also an interesting common opinion that the way of checking was different with each content. For example, when it comes to activity, most of the interviewees said the amount of activity can be a predictable unit for exercise but for the meal, the content of the food for instance quantity of carbohydrates was more important than the amount of food in general. (JIIS01, JIIS05, SAII05).

And second, interviewees not directly talked about freedom as a problem in diabetes management but after they saw and got a piece of information from Echo design, they agree of checking freedom as a problem in diabetes management and they share their opinion about freedom. They said that sometimes they could not handle diabetes management even they want because the surroundings didn't keep up with them. So they said they need to think about how much they can handle their circumstances.

The way to check the freedom option was different with each interviewee, but the one all of the interviewees want to do is expect the day in more detail with the specific unit on each content (SYIS03, SAII03, SAII07). There are a wide variety of stories about the way of checking diabetes management on the mobile screen. The first sheet by interviewees is followed (Figure 23, Figure 24, Figure 25)

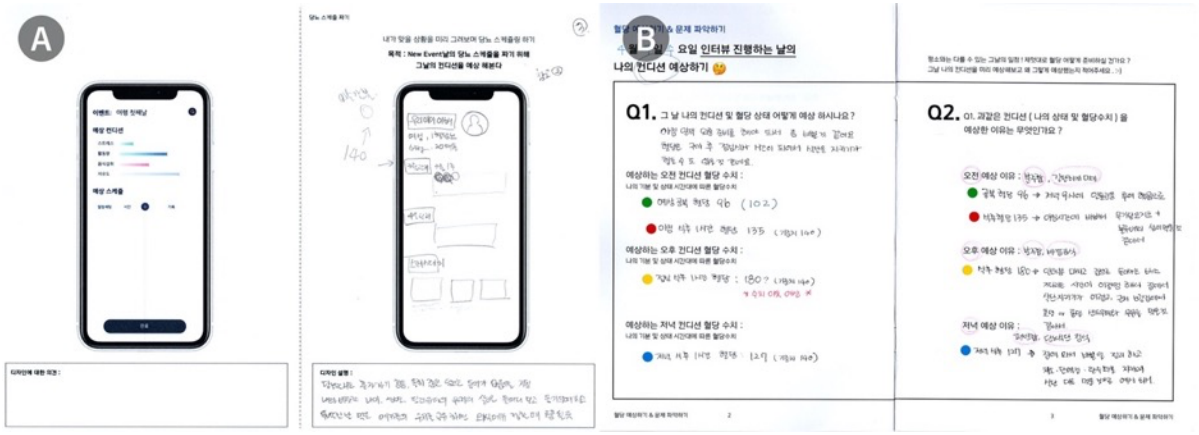


Figure 23. A) Participant SY's No.1 ideation sheet, B) Related pre-task

Figure 24. A) Participant JI's No.1 ideation sheet, B)Related pre-task

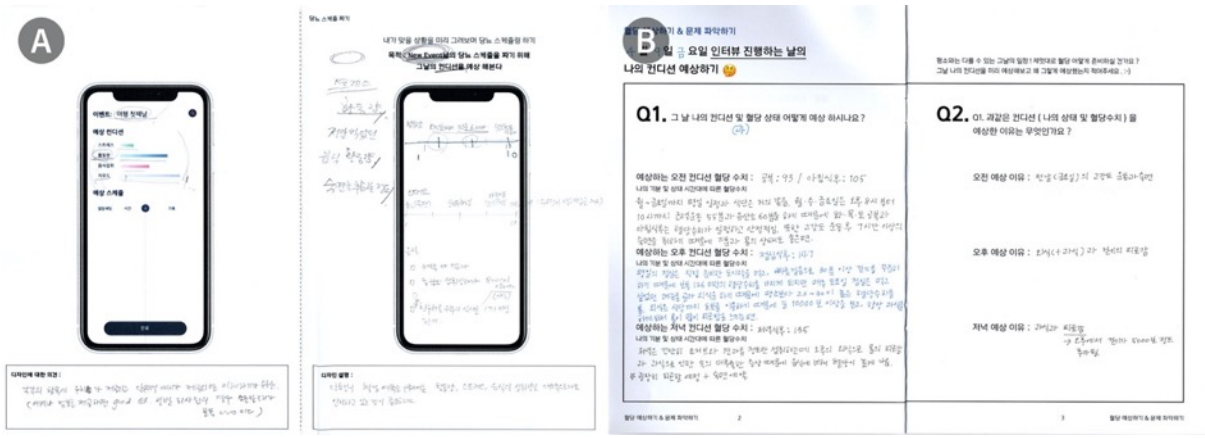


Figure 25. A) Participant SA's No.1 ideation sheet, B) Related pre-task

Second, with ideation sheet number 2, After they get pre-task in their home, a few of the interviewees asked me about the goal of pre-task number 2 which is related to ideation sheet number 2. (Figure 26, Figure 27, Figure 28). The question was: What *kind of information you used for making your scheduling and writing if you need more information*. This inquiry goal was to know what kind of information they use to plan their diabetes management and also to find their needs so that Echo's contents can be designed more cooperatively. But this could be a confusing question for them. Also, they couldn't reach to find the information which will help them. So, I just gave a message to them to write down the information you have been wondering about while managing diabetes and finally they could finish answering pre-task number 2. We need to know here that the intention of pre-task number 2 was to check people whether know the methods that help them make a solution after finding the problem in managing diabetes. By looking at this situation, we can find that interviewees even don does not know what information or methods will help them to solve the problem in managing diabetes. In other words, thinking about methods that bring solutions was not used and difficult for diabetics. On pre-task number 3, interviewees made diabetes schedule as a solution for new-day situations with their thoughts even if it's not the best way to create the right solution because the process of agonizing over creating a better solution was what they had not practiced. So before

starting to draw an idea on the ideation sheet, I explained the situation again to the interviewee. I said when diabetics meet the problem, we can make a solution by ourselves at that time we can use our previous data or friends' data to solve the problem. When we find these data what specific information do you want to know? And after they got more explanations, they start drawing their ideas.

One interviewee said if she could see the usual condition and style of meal intake will also be helpful to solve problems on a new day (SAII08). They all liked the function, especially when they figure out records from people who had similar experiences with them. They also said they will refer themselves to information but still see other friend's experiences for getting motivation. (SYIS07)

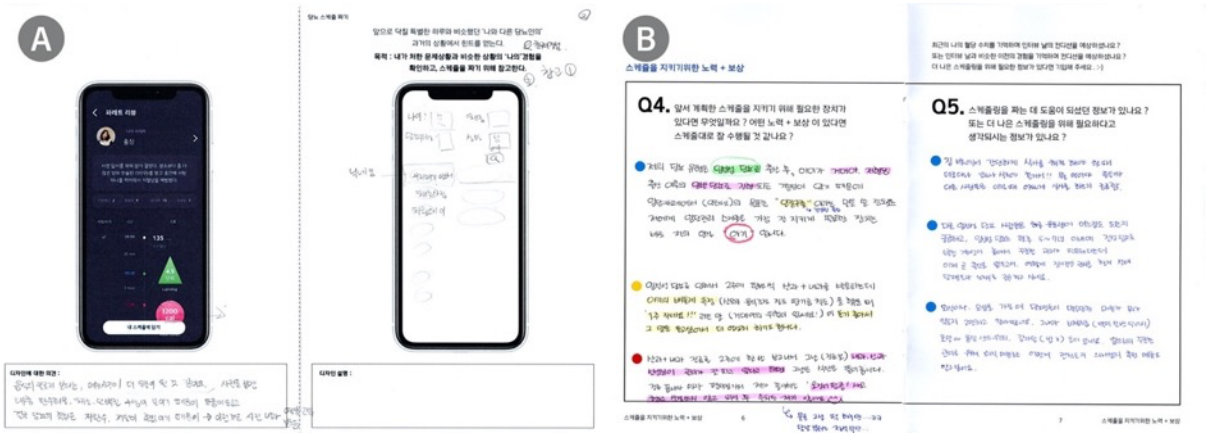


Figure 26. A) Participant SA's No.2 ideation sheet, B)Related pre-task

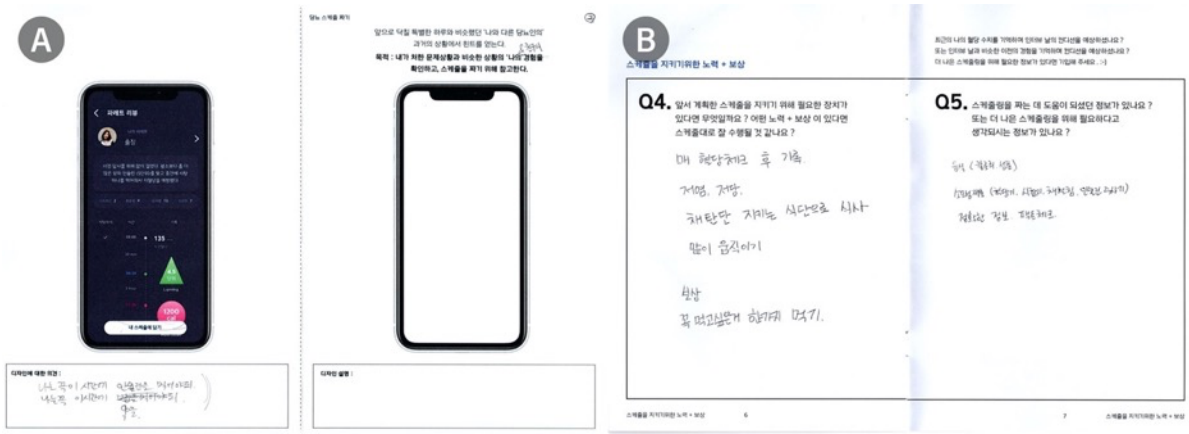


Figure 27. A) Participant JI's No.2 ideation sheet, B) Related pre-task

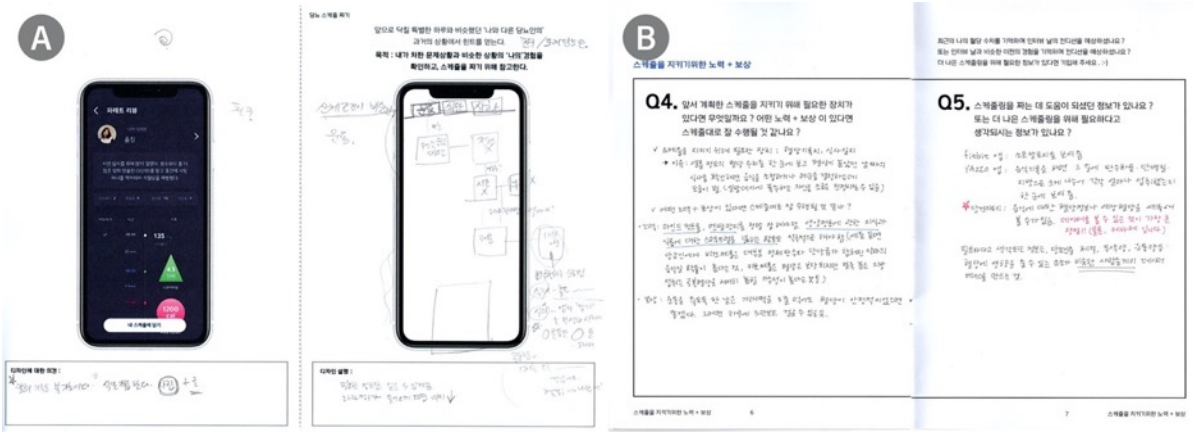


Figure 28. A) Participant SA's No.2 ideation sheet, B) Related pre-task

Lastly, with ideation sheet number 3, the interviewee detailly talked about making a plan for a new day as problem-solving. They fully understand what they can do with the Echo palette through the previous two interview sessions, and also, they agreed and understood the planning and preparation process for diabetes management. What was seen as a common feature in this session was that interviewees talked about more detailed preparations for each category of activity, diet, etc. interviewee SY gave me many opinions about expressing how to check intake. She said checking intake with color-coding will also be a good idea as a traffic light with all of the intake. Furthermore, interviewee JI emphasized preparing insulin does because she has a child with child diabetes. She said for child diabetes, and they are always confused with insulin, so plan the insulin does need to be more detailed. And lastly, interviewee SA was focusing on the exercise, and she said she wants to make a schedule with exercise when she can do it in a day with a very detailed plan (Figure 29, Figure 30, Figure 31)

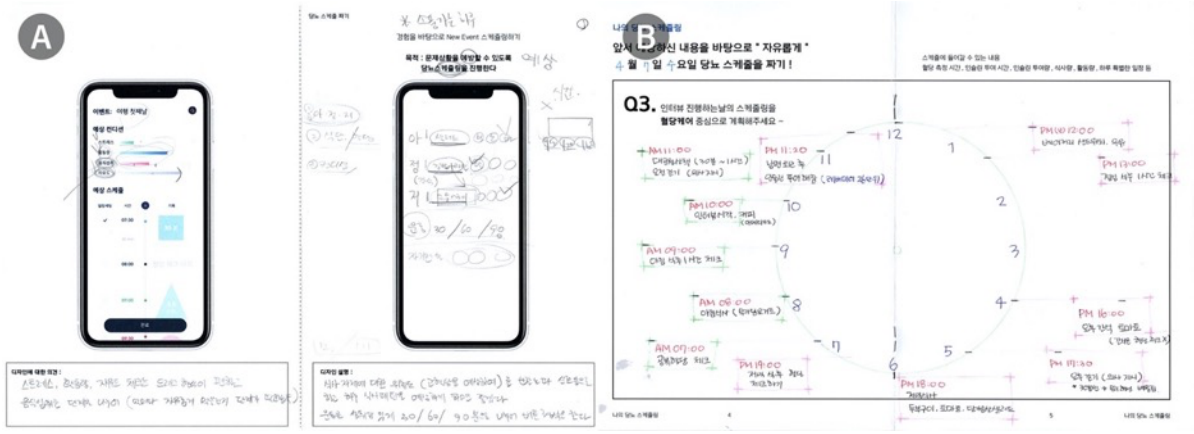


Figure 29. A) Participant SY's No.3 ideation sheet, B) Related pre-task

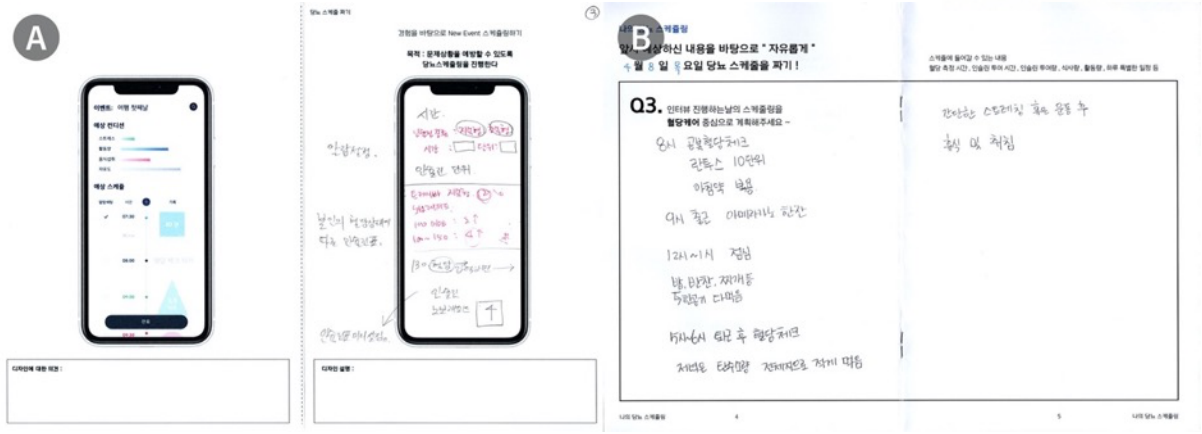


Figure 30. A) Participant JI's No.3 ideation sheet, B) Related pre-task

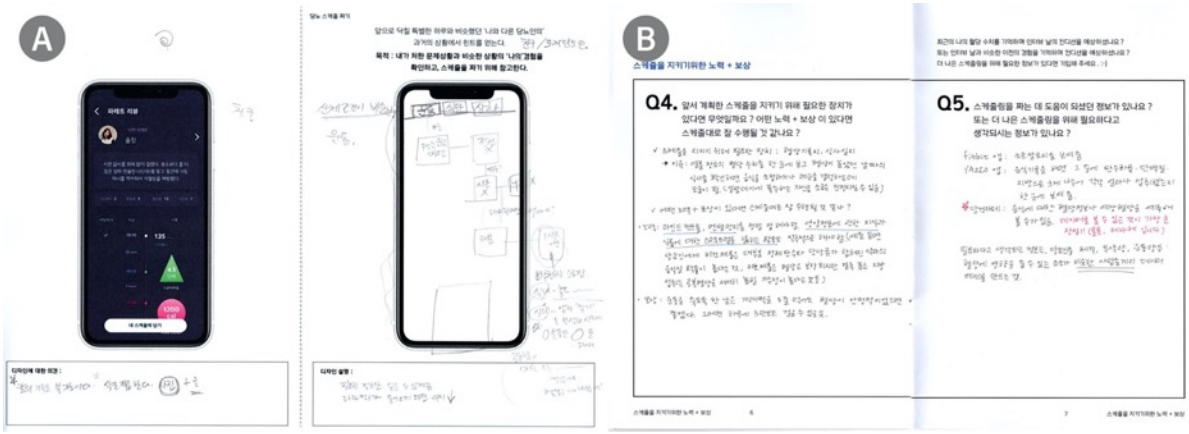


Figure 31. A) Participant SA's No.3 ideation sheet, B) Related pre-task

3.2.3. Usability test for magnify graph

According to Nielsen Norman Group[3], we can uncover problems in design and discover opportunities to improve the design and learn about user's behavior and preferences through usability tests (Figure 32). Echo Magnify Graph, these three things are one of the reasons for having a usability test. We can see the user's understanding of the function of Echo Magnify Graph and also check the usability.

However, in this step, for this project, discovering opportunities to improve the design has to be the main goal of this interview for magnify graph. Magnify graph is one of the parts of the design which has a strong user story (Figure 33). Here users can learn the reason for their BG level by a factor from them, so how to get the user to read the relationship between BG and other factors has been a continuing question on the magnify graph. So, I decided to have a qualitative usability test so that the user can observe how the interviewee uses the service and talking with them directly so that the test can collect insight and see more scrupulously than the quantitative usability test. For Echo magnify graph, I do not need to see the number of people's results that just reach to task goal or not, we need

[3] Nielsen Norman Group: https://nngroup.com

to listen to the interviewee's voice with how they read the graph and whether if they get insight for them about diabetes care or not so we do not give too many details for the task, the task was that 'Find the highest blood glucose on the December 13 (screen day) and please explain about the reason'. We can see how the user finds information from magnify graph and also how they can explain the reason for high blood glucose.

In other words, whether or not information can be checked by clicking on the highest blood glucose is not a must-have result in this test. This is because the function that gives related information when you click on blood sugar is usability that users can easily acquire once they use it. Therefore, what I wanted to know in this interview was to find out the purpose of the graph, "Look at a glance at the cause of my blood sugar impact," and to find ways to improve the design by listening to the opinions of users who responded.

Figure 32. NNgroub, why usability Test?

Figure 33. The main screen of magnify graph

Table 13. Prototype test analysis

TASK: "Find the highest blood glucose on December 13 (screen day)."			
	Step. 1 function satisfaction	Step. 2 task success/failure	Step. 3 usability for successful tasks
Patients SY (32)	5	O	5
Patients JI (33)	5	X	3
Patients SA (38)	5	O	4

The First participator, the Patients SY she clicked the highest BG right after starting the test. It took just a second. And after 20 seconds, she explained the reason why the BG elevated the most only by reading data on the Magnify Graph. She said there are only several BG levels on the first screen, so if she clicks the BG, she will get more information about it (SYP01) and she gave a very positive assessment of the overall function. When we talk about usability for a successful task, she said it was so easy and handy to use because it's designed in a simple way (SYP02) she also mentions that she wants to see the monthly BG report to share with a doctor (SYP03).

The second participant, patient JI gave five scores for user satisfaction even if she couldn't succeed in the task. She failed the mission because she has never expected to get another information on the BG

graph without BG level (JIP03). This was due to her previous experience. When she heard the diabetes graph, she could only think about the graph that recorded only BG levels without other information such as meal intake and activity. But after she heard about Magnify graph, she was delighted with the function and interaction. Especially she liked the point that it shows all of the information at once. She also shared her experience, and she said that she wanted to use a diabetes application. She was looking for an application, but finally, she couldn't find an app that she likes because if she saw one diabetes app, this app is connected with other healthcare-related apps to function well. this means she is forced to use two or more applications for recording BG and managing health (JIP02). But she said it's really good to use Echo because she can record her BG and manage intake, and active with BG easily and everything in one application. Finally, she asked for one thing about design. She said she wanted to emphasize the mark is indicating the difference between food intake time and BG measurement time. Even if there are the same blood glucose levels, they have a huge difference between level immediately after meal and level from hours after a meal (JIP04). So, she asked for the mark of time gab to be designed with more clarity and emphasis (See Figure 34).

Figure 34. Mark for time gab between eating and BG level

Third participate patients SA, first, she clicked the other page on the bottom bar after listening to the task, and then she came back to Magnify graph. And she clicked the highest BG. She was satisfied a lot with Magnify Graph because it's related to her experience. She also said that she was looking for her meal intake and the other record if she found high BG on the BG note, which is her note to record BG. And she said to find the relationship between BG and other records not only happen right after

she checked her BG but it also happens when she sees her record again after. She usually recorded her meal intake by the picture to compare her BG level and meal picture by note and phone (SAP01). And she strongly asked for the picture for the meal record to see more detailed information of the meal, and she said just showing calory could not affect (SAP02). Finally, she gave Magnify Graph the idea that high BG level and low BG level records have to be designed differently than normal BG. Plus, if the app could give a piece of simple information to correct out of normal BG level, it will be really helpful to people with diabetes (SAP05). She also was so satisfied with the general function of Magnify graph (SAP03).

Figure 35. Prototyping test field image

3.2.4. Explain user scenario

The user scenario test aims to get a user's opinion about Echo's function, especially Echo Therapy, Echo Message. In the previous two sessions, I spent more time with magnify graph and Echo palette. Utilizing user scenarios, I could be able to see how people think with the whole process of Echo. This test started with introducing persona to understand the user who will experience Echo. An interviewee can guess or predict what purpose and expectation future users will have and after the interviewee conducted a process of empathizing with the target user through persona, I introduced Echo by scenario board (See

Figure 36).

I used the user scenario board, to introduce the features of Echo with stories such as how persona uses Echo during their journey so this will help the interviewee to understand all of the Echo function and how will be used in the life of persona. This board was printed to A2 size (420x594mm) and so that

the interviewee could see every process at once. Also, each screen was shown to the user by laptop screen to see interface design in more detail (Figure 37).

The interviewee mentioned their opinions on the function and also, they wrote their thought on the post-it. After those interviewees also carried out their preferences were given for each function. They can check preferences in a score (Table 14).

Figure 36. User scenario board

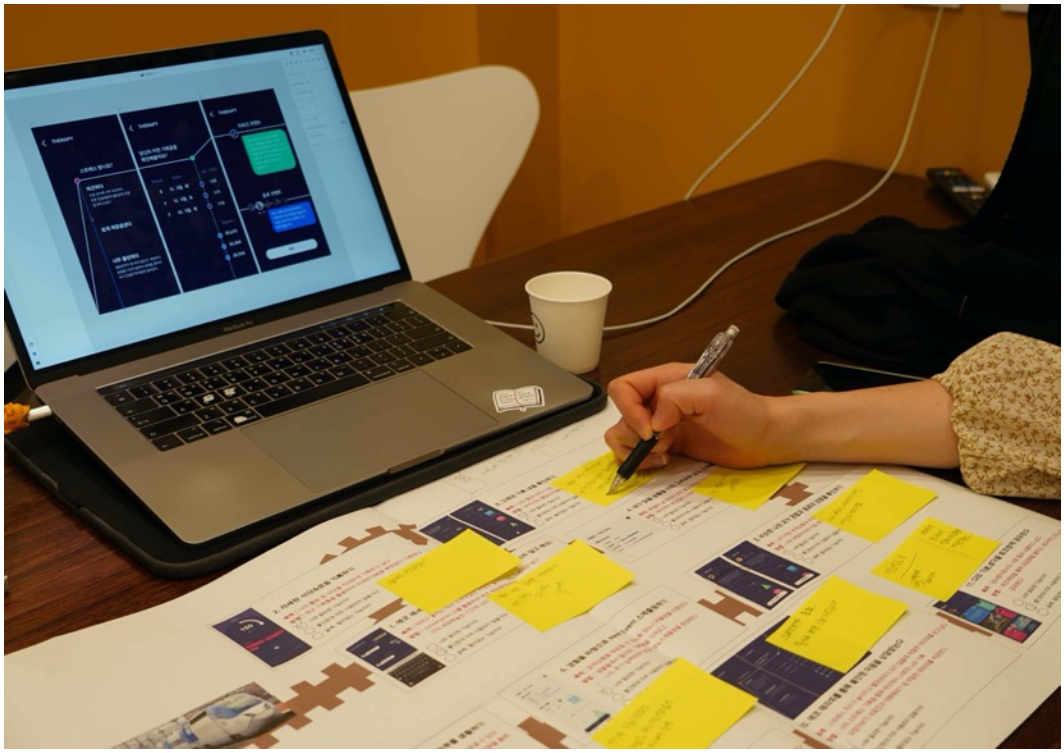


Figure 37. User scenario test environment

Table 14. The score for feature preferences

Score	Contents
1	Unnecessary Features
2	Required but unlikely to be used frequently
3	Features that are very necessary and likely to be used frequently

When the first introduction of Echo messages function was only recording some simple details, as we see the feature preferences graph it has low result. However, it gains positive response that when echo messages were also used to check the status through Therapy. (See Figure 38).

Figure 38. Feature preferences score

Echo Therapy is more like a hero comforting and motivating people. One interviewee said this message from Echo Therapy definitely will help her because she often has feelings to give up the diabetes management, she mentioned that this Echo message part of the function will enhance our participation whenever I feel down on persisting on using the Echo app (SYUS03). Moreover, other interviewees also said the same thing for Echo Therapy, they said the doctor's comment is not important here because they know what to do but the doctor frequently mentions the same thing over again and again. So they want to see their peer's experience and comments through Echo therapy intervention(SYUS01, SAUS04). The other interviewee said it's hard to tell anyone about diabetes management, but it will be cheering if she gets a peer and doctor comment from a Therapy whenever she needs. And to explain the other low scores, currently, the patient who manages diabetes the hardest does not need to schedule separately because she already sees all changes in the weekly-weekend schedule. And most patients don't think they'll do it often if there's no visible reward in the self-reflection stage after a day's schedule. As for Echo Talk, they talk about several positive-negative aspects of it and maintain a neutral score of 2 in evaluation. But at the same time, they also give the most comments talking about future improvements. Not two-way communication, only one-way communication between users, not comments, but some emoticons, etc. they were very positive about the possibility of a talk with a degree of communication. This user scenario helped me to get a lot of opinions on each step of Echo.

3.2.5. Post user research affinity diagram

The Magnify graph was identified for usability through prototyping tests. However, since the Palette function worked on obtaining ideas from users through an idea sheet, it was necessary to re-combine

ideas from users to obtain refined insights. So, I recorded all the insights from the Palette user interview by organizing sentences and working on the Affinity Diagram, where each content group to gain new insights. The Affinity diagram was conducted within the results obtained from each sheet without integrating all of the ideation sheets 1, 2, and 3. This is because it aims to provide better usability in the current flow without changing the order of functions in the Palette (Palette's flow provides anticipation for a new day and gathers information for planning their diabetes management). I made 3 categories per sheet for a better and specific way of gathering information (See Table 15, Table 16, Table 17). Those are listed at the bottom which are the First head label, Second head label, and Source code. The second head label an insight that is primary from the interviewee and the First head label is a category that is finalized from the Second head label insight and using the source codes we can easily refer to the contents in the appendix (See Table 24, Table 25, Table 26).

Table 15. Insight from the first sheet

First head label	People who are not used to planned life Kind and accurate guidance is important			
Second head label	Accurate predict where to visit and where to stay have to do. This affects overall schedule management, including my mood, busyness, eating, and activity.	Anticipate condition and prepare for the good condition through sleep management	When it comes to meal, checking not only the amount of intake but also the Risk for HBG	Unit for expecting has to be detailed and understandable
Source code	JIIS04, JIIS02, JIIS05, SAII06	SAII02, SAII01, JIIIS03	SYIS01, SAII04, SAII05, SYIS02	SYIS03, SYIS07, SAII07, JIIS01, SAII03

Table 16. Insight from the second sheet

First head label	Target users want detailed, detailed information and direct instructions on the action to be taken.		
Second head label	Finding detailed information with each session (For food: Menu name, Photo, For active: Place, For insulin: amount)	Direct teaching for taking action	
Source code	SAII01, SYIS08, SAII13, JIIS07, SYIS05	SAII11, JIIS06	
Same idea with Eco	Get my previous information	Find a user who is in the same condition as me	Checking my usual condition on a similar day

design			
Source code	SAII12	SYIS04	SAII09

Table 17. Insight from the third sheet

First head label	Depend on Alarm and Self-experience		
Same idea with Eco design	Click the timeline easily for making a detailed schedule	Setting Alarm	Bring my previous experience
Source code	SAII14	JIIS08, JIIS09	SAII15, SASSI06

And finally, from this insight, I could make 2 types of keywords to apply as UI design. It's explained below.

1. **Detail condition check**

diabetes who have a lot of motivation for managing their disease. it was difficult to start management for them but after starting it they want to do it in a detail. Based on these insights, I was able to develop Palette's scheduling process to anticipate new days on a more detailed basis. When it comes to food, users can think about the number of carbohydrates, and when it comes to activities, users can check the amount of 20,000 steps a day, which is proposed as a standard for diabetes patients. Users can also check whether they can get a good night's sleep when it comes to stress. Finally, the previous design simply offered "freedom" for diabetes management in a day, but the label was changed to "time control" to predict how much time I can control (Figure 39).

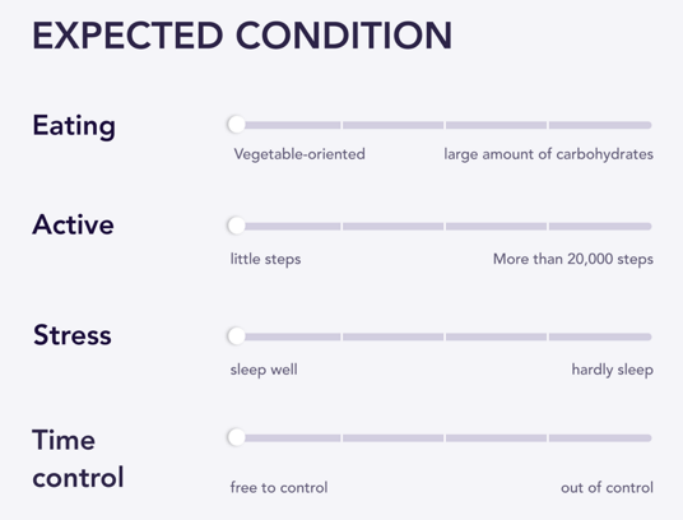


Figure 39. Figure for expecting condition

2. Elaborate searching and On-boarding screen

Most diabetics have no experience in making schedules for a healthy life. So, it's difficult to start for them to make scheduling even there is a function for scheduling. So, most of them want to have a specific guide for their management. So, we can adjust this desire by design a detailed search tool and guide page such as an on-board screen. While young diabetics have great motivation for healthy diabetes management, they can find it clumsy and awkward to manage their lives, and they want to get a lot of direct guidance. Therefore, the function for direct guidance was determined to be an accurate search for what they wanted.

4. DESIGN OUTCOMES

4.1. Echo Service Design

Echo aims to tackle diabetic problems that cause high levels of stress, particularly depression from negative recognition. Echo is a healthcare platform that records glucose levels in the blood, targets diabetes patients for managing these levels, and supports mental care by meticulously analyzing patients' sentiments through a mobile service. Echo seeks to change negative thoughts, which the patients develop while living with diabetes. As such, Echo provides an appropriate behavioral therapy to minimize the depression and stress caused by diabetic problems and improves the quality of life in different aspects of daily life.

Young diabetes patients with depression and stress further exacerbate blood sugar control by interfering with patients' self-care and encourage negative thoughts. To maintain self-care, patients can reschedule and advance their self-care based on their mutual recorded experiences. Echo aims to promote a smooth lifestyle in diabetes to maintain patients' health care from this comorbid chronic condition. Patients will be ultimately resilient in the face of mental and physical detriment. This will also motivate patients to actively engage in self-care. This virtuous cycle may boost the patient's confidence to focus on self-care.

4.1.1. Magnify Graph

Every single piece of data has a story behind it. The magnified graph depicts your daily record. The magnified graph enables the user to measure different aspects of daily life activities with increased curiosity when they check the figure of BG, not only just tracking numbers, which can be an essential lifestyle change in support of diabetes management. The magnified graph in the Echo application shows the user-relevant record transparently daily. Users can check the data between each blood glucose checkpoint by simply zoom in on the graph and realize each element that affects the blood glucose status. Also, The Magnify graph considered the direct information which affects BG, such as record time. It also shows the relationship between activity and blood sugar levels in more detail, showing how many minutes before activity took place from BGL. Moreover, when the user clicked each record, they can see the information of records, and this kind helps to manage their BG (Figure 40).

Figure 40. Design Outcome: Magnify Graph

4.1.2. Palette

Positive minds and thoughts are the driving force for diabetes management. That's why a healthy mind is as important as diabetes patients manage their diet for BGL. However, it's not easy for young diabetes patients to continue managing with positive thoughts because there is uncertainty and fear about one's BGL due to a lack of practical experience in diabetes management especially those who are first diagnosed with diabetes. So, Echo Palette is the function that starts with the need for diabetes management in young diabetics. Young patients can more specifically manage their diabetes through the Palette which is meaningful in relieving anxiety from diabetes management. First, the patients can anticipate the new day through Palette and isolate the problem on their own. In particular, patients can prepare by mark detailed figures of diet, activity, stress, and time control (Figure 41). After that, they can check previous records similar to their own and colleagues' problem situations and plan for the situation more specifically. This review experience will allow users to reference when planning new changes (Figure 42).

And based on this specific information, the patients make his or her new practice method and allows the actual plan to be implemented through the alarm (Figure 43). Moreover, Patients can frequently use the search function to obtain more specific information, even if not when creating new palettes, which can be used when patients unfamiliar with diabetes management want more detailed guidance and information (Figure 44). Also, their new solution from the event is saved as a card in the user's palette, so they can share experiences with peers. This will enhance the user's confidence while

managing their daily lifestyle activities. Diabetics can make their diabetes schedule, pick out the new issue in their life and develop solutions accordingly through Palette (Figure 45).

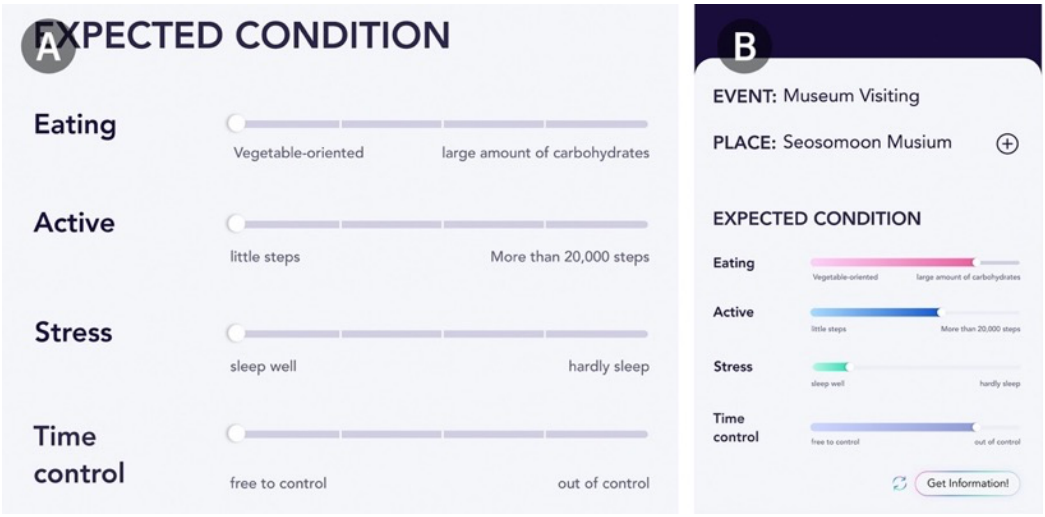


Figure 41. (A)Figure for expecting condition, (B)The first step of the palette

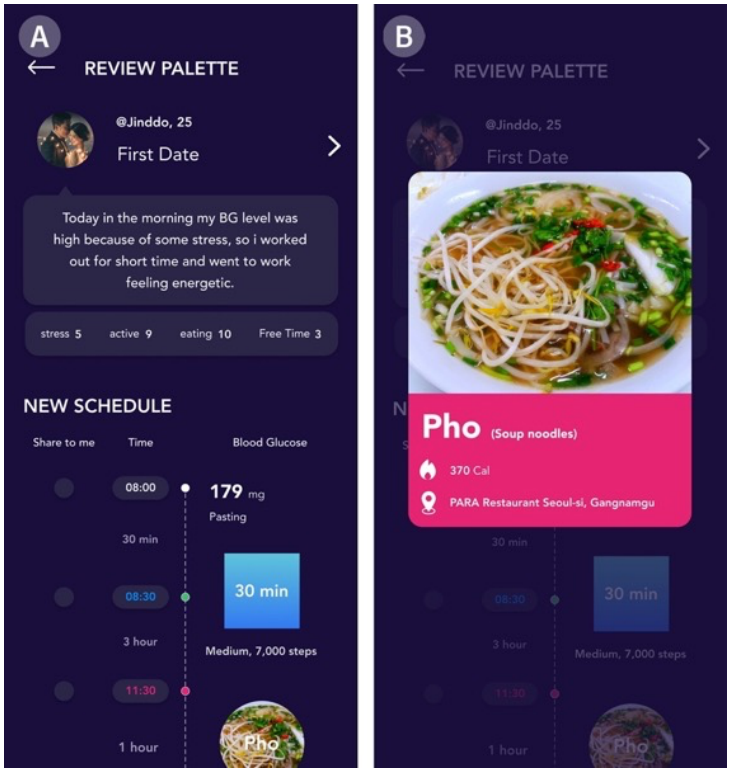


Figure 42. The second step of the palette – (A) Searching, (B) Detail information

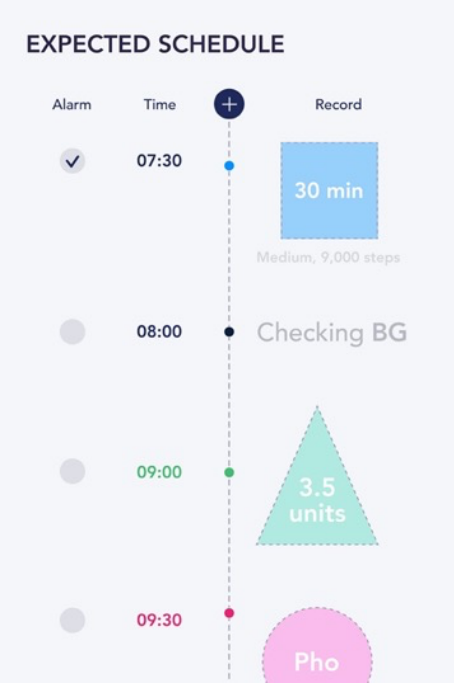


Figure 43. Last step of the palette

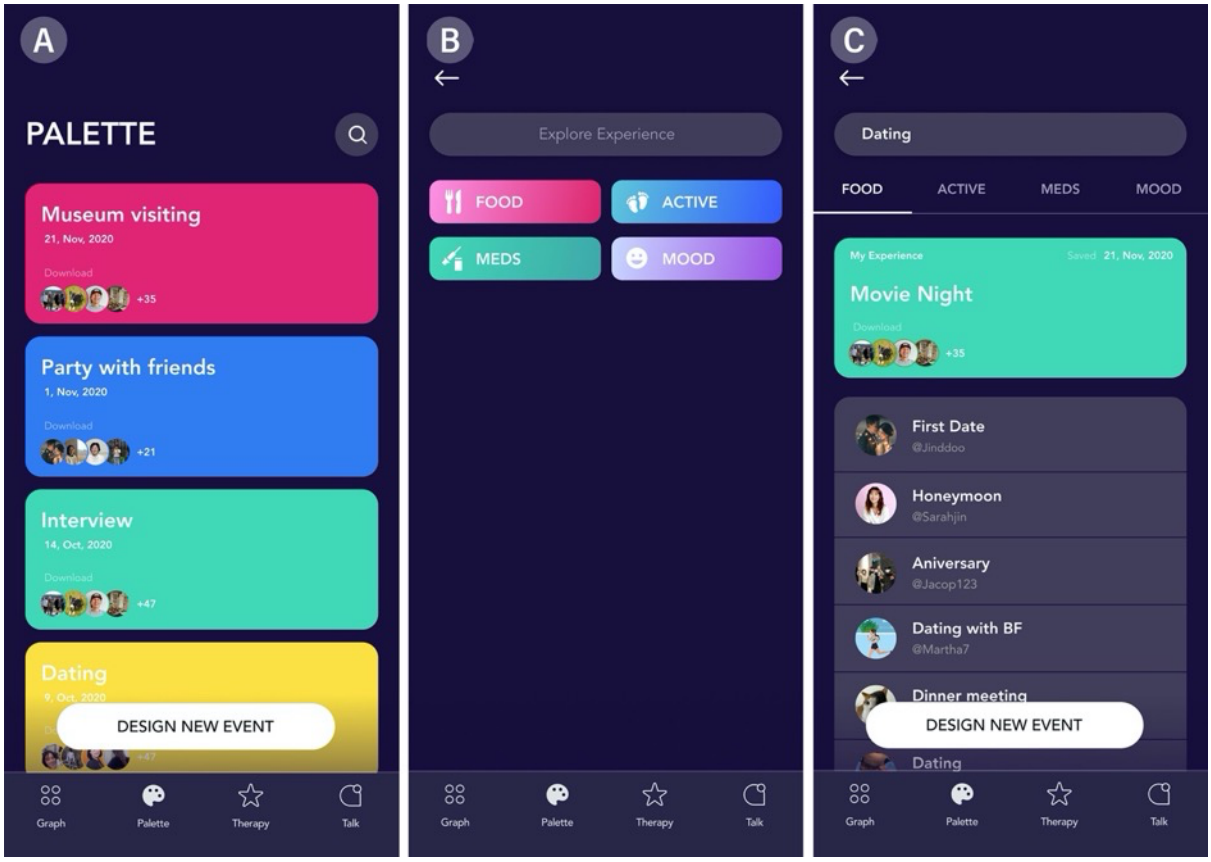


Figure 44. A) Palette main screen, B) Search screen from the main screen, C) Search result screen

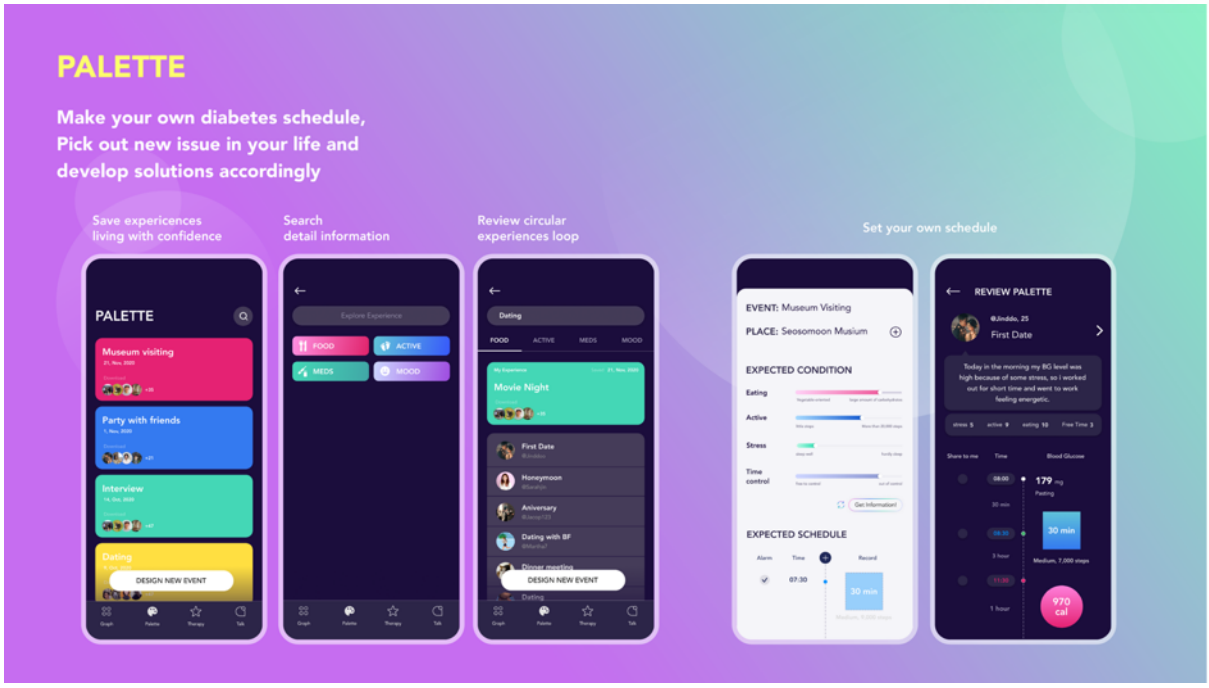


Figure 45. Palette visual board

4.1.3. Therapy and echo message

This part of the application changes negative thoughts by providing appropriate therapy. It can reduce depression and stress, but it also improves the quality of life in different aspects. The therapy function is a design based on cognitive behavior therapy, a method for correcting distorted perceptions of patients (See Figure 50).

Echo therapy starts from collecting the patient's initial data through the Echo message. Echo message is designed in conversational UI design. It sends messages to users regularly or irregularly as real friends ask for their condition. Users can record their condition in the Echo messages through simple emoticons or by clicking on the options (Figure 46). Based on these records from Echo Message, Echo Therapy is provided to users when the patient's condition is recorded as group status of users who are placed outside a certain health category. When therapy is started with the user, the patient will answer the questions provided and name their mood. This allows the therapy service to label and accurately detect the patient's condition (Figure 47). After that, the appropriate intervention of the service is given depending on the condition of the labeled patient. Therapy is the function for patients to keep analyzing their data. This is to return patients to a healthy management position through experts' suggestions and peers' comments (Figure 48). In addition, Echo messages can also be a key feature for sharing tips between users. Patients use Echo messages to comment on their own therapy for other patients. Echo obtains comments from messages to users with insights and uses them for intervention in therapy. Moreover, through Echo messages, patients can record their various data which can easily be forgotten. (Figure 49)

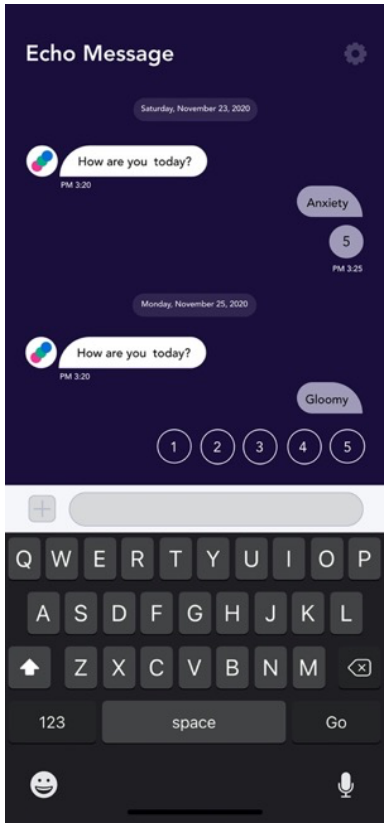


Figure 46. Echo message to collect patient status

Figure 47. Labeling patient status

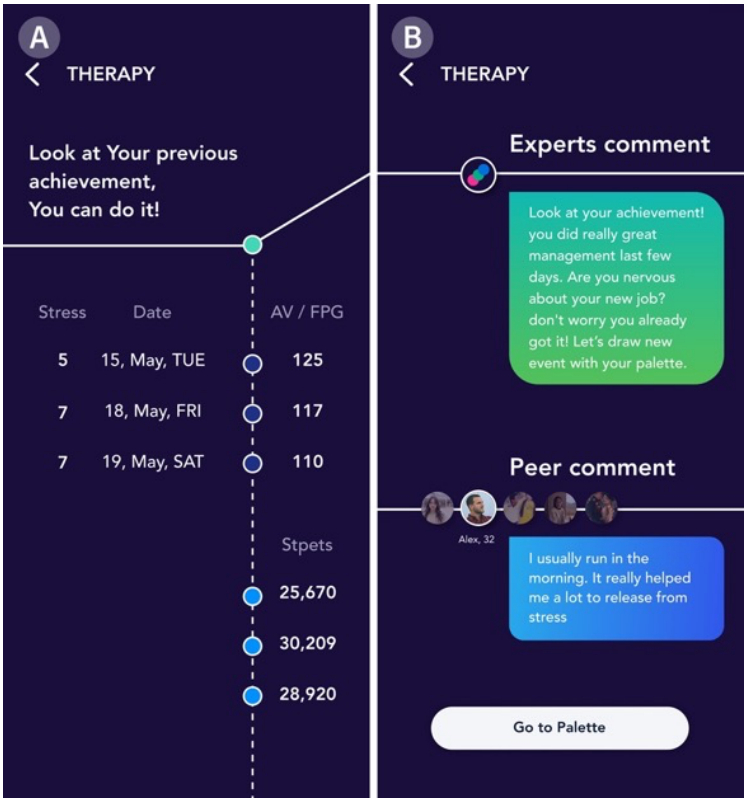


Figure 48. A,B) Therapy intervention

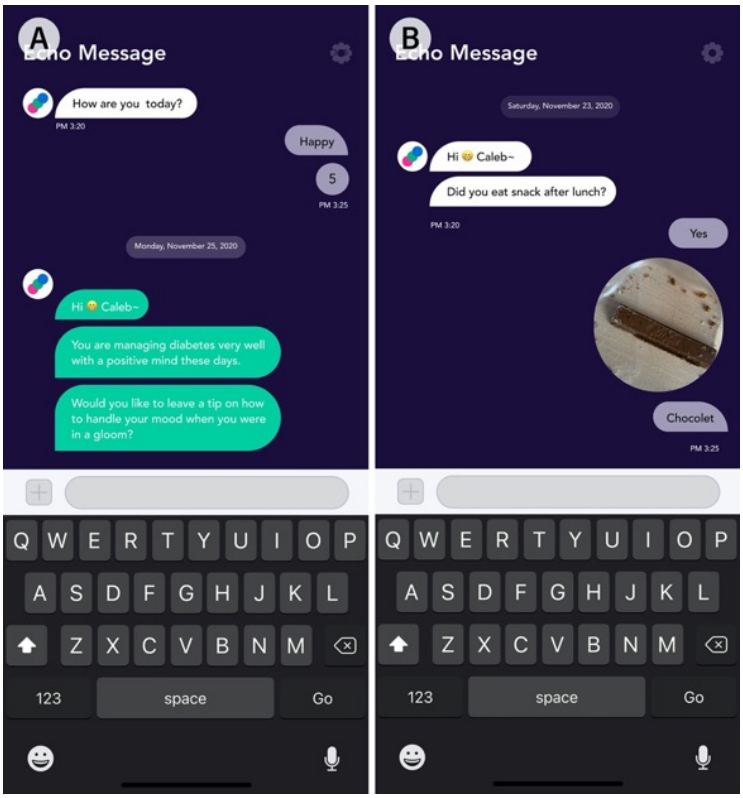


Figure 49. A)Echo message to get a user's tip B)Simple recording by Echo message

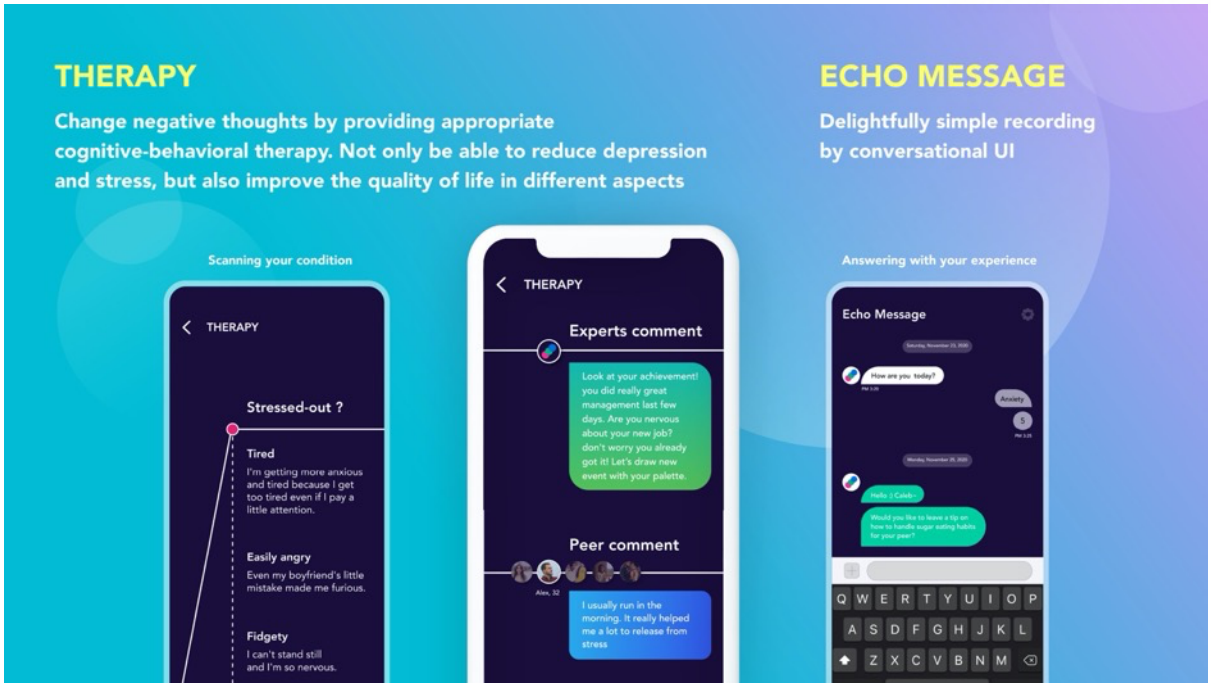


Figure 50. Design outcome: Therapy

4.1.4. Echo talk

Echo Talk is a basic community function for diabetics. One of the main features of Talk is that users can click on their profile to set basic information and preferentially check messages from another user in the intersection with the user based on their settings. Talk is characterized by sporadic content being freely shared in the feed, and the contents are volatile content that is usually communicated without being able to be saved or commented separately. Users can only communicate through the 'Like' button and the 'Heart' button. If you click on another user's profile in addition, you can check the user's basic information and stored Palette record (Figure 51). This function of Talk can enhance the patient's motivation by analyzing their activities based on self-care.

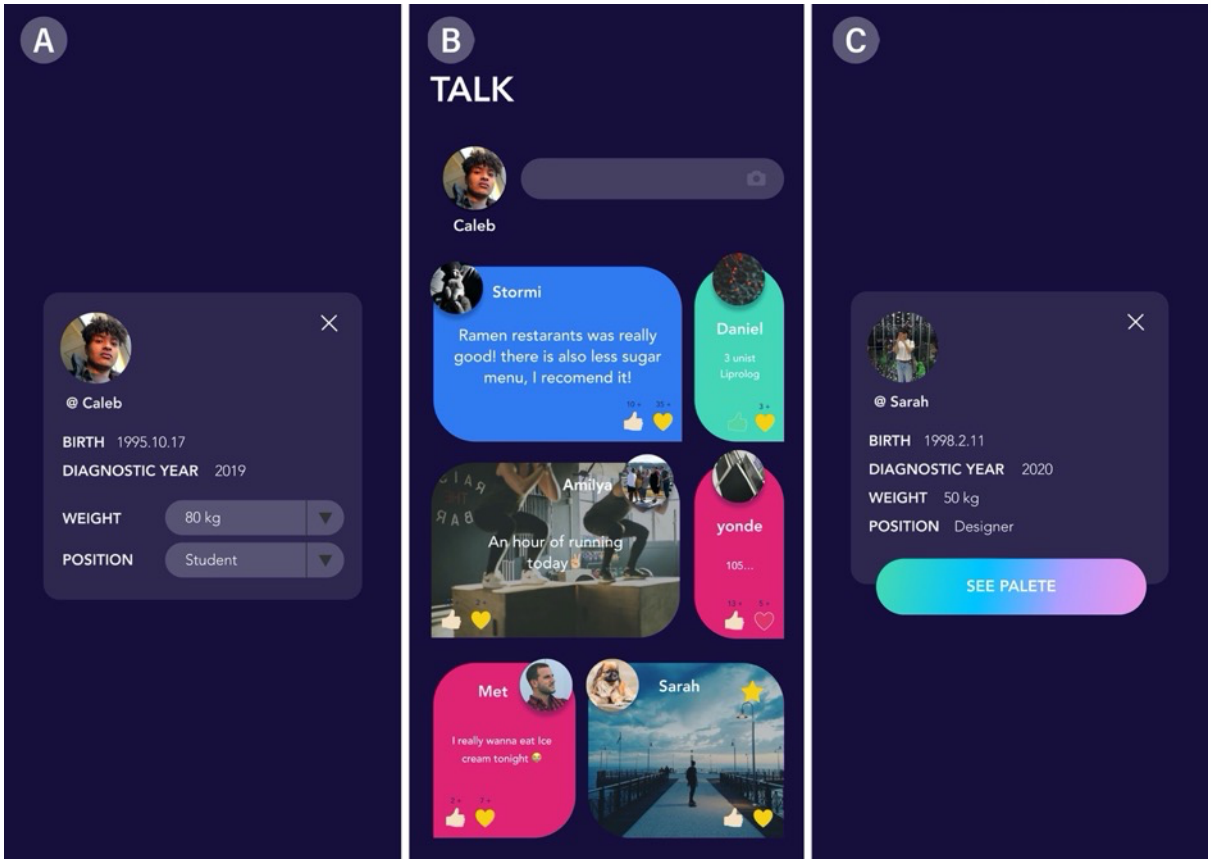


Figure 51. Echo Talk – A)My Profile, B)Talk Feed, C)Friend Profile

5. DISCUSSION

5.1. Summary and Contributions

Diabetes patients, especially those in their 20s-30s are significantly increased due to improper intake habits and changes in living conditions. Most of these young patients are diagnosed with high psychological distress that resultantly worsens their health outcomes with poor blood glucose control. The existing diabetes applications mainly utilize insulin care to tackle diabetic problems. On the other hand, the Echo service application focuses on patients' lifestyles by providing a mobile application service. The application aims to enhance the diabetes management process with growing diabetics' confidence and motivation for self-management. This study showed that Echo service design enables careful suggestions and provides a guide for patients to manage their daily lifestyle patterns. The design derives the core features and user interface sketch through desk research and preliminary user study. Subsequently, the Echo service was verified through post user research to obtain detailed user feedback and ideas for each function in the design Echo service application.

The design process determined digital service functions called magnify graph, palette, therapy, and talk. These are practical tools for diabetes management. In particular, 1) the magnify graph aims to help patients to learn their condition by checking their records and allows them to participate in recording their data and analysis apart from tracking the data, 2) the palette is a tool for making a habit of regularly managing diabetes. With this function, the service can engage patients to join their management as experts immersively in self-care. Also, the palette allows patients to redefine their problems by reviewing their shared experiences actively, 3) the Echo's therapy platform, which provides well-known cognitive behavioral therapy content for diabetic problems to minimize depression and stress and improve quality of life in different aspects of daily life, and 4) the talk, which is a community channel designed only for diabetes to check other patients' diabetes conditions. The primary function of Echo is the application to manage diabetic's lifestyle.

This study derived functions through research practice that can help people with diabetes for a healthy lifestyle. Overall, the service has identified that it can boost patients' participation in diabetes management. The research practice and its outcomes also endorsed its place in diabetes educational facilities because at the onset of this study, during the 'pre-task in the post user research, the interviewees shared their opinions that this setup is an opportunity to rethink how usually we managed diabetes by planning a daily basis diabetes management plan. This shows that it is challenging to make diabetes management themselves, thus diabetes educational facilities could learn how to teach their patients daily diabetes management by following the Palette feature in the Echo service application.

The service application offers diabetes management while providing positive impacts on young diabetics' mental health. This study affirms that service with diabetes management and mental health management is hard to find in the market. Therefore, it is conceivable that the proposed Echo service application provides a platform for patients to modify their negative actions against diabetes management and boosts positive habits for self-oriented care .

5.2. Limitations

As mentioned earlier in the characteristics of young diabetics, young diabetics do not know their illness. These characteristics put social constraints on them to participate in interviews or other social setups. In addition, the social problems caused by the COVID-19 also have many restrictions to have face-to-face meetings. In particular, tests using the ideation sheet during post user research aimed to create a site where more diverse experiences could be shared by gathering diabetics together in a place but the plan has not been implemented due to the characteristics of diabetes patients who are reluctant to reveal their identity and the social situation in which multiple people are not allowed to gather due to the pandemic situation.

We expected from real prototyping tests that users can discover what is hindered in reaching their goals. In real Echo tests, we fabricate prototyping of Magnify graphs, allowing us to observe how users proceed in expanding the graph to find its effect on BG. However, the prototype was not developed together with Echo's minimum value, Palette, and Therapy, so there is a limitation that each function was connected, and the user's journey was not observed, and each function was tested. In this process, if full prototyping was created for MVP, it would be possible to observe the MVP's entire process, especially when users produce their Palette, such as how to verify their Graph information.

This study is based on a practical project so I do not have deep historical research or enough information about diabetes research. For example, diabetes patients often manage other chronic diseases caused by broken lifestyles managing, such as high blood pressure and hyperlipidemia. However, the function which is related to the other chronic disease was not considered in Echo. In particular, if blood pressure recorded in the Magnify Graph is also indicated, it will greatly help patients identify the causes of hyperglycemia and broken lifestyle and learn by themselves.

5.3. Future Actions

Future studies should continue to arrange meetings with people related to diabetes management to listen to their opinions about managing diabetics. For example, I had a short conversation with doctors who were in the department of preventive medicine. They had an interesting response to the Echo, and they further added that the particular function of Palette is a good option for preventing their work. So, I recommended to other studies that meet more people so that future study can getter more exciting ideas. Furthermore, future studies may proceed to develop the complete prototype for the

MVP test to explore how real users communicate in the Echo so that we can find the more interesting points in their exchange of experiences. Finally, I suggest that future studies consider other chronic diseases which easily finds in people with diabetes. It is posited that how users can record their blood pressure and show their data association on the graph. This consideration may promote enhanced outcomes when they check their record in the Magnify graph diabetics and it can also relate to their BGL with their other data, such as blood pressure.

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APPENDIX

Preliminary User Research: Interview

Patients KM

Date: May 18, 2020

Place: Meeting room in the café, Jeolla-do

Table 18. Pre user research interview: KM

Code	Interview Insight
KMI01	The stress of diabetes diagnosis itself is really big. Despite the early detection and prevention of complications, the stress of diabetes alone is a lot.
KMI02	Sleep long is difficult because going to the bathroom often
KMI03	The doctor talks too much in numbers. He doesn't seem to know my mind because he is not involved. At first, I just followed what he said, but when it doesn't work, distrust arises
KMI04	In a short period time, I talked a lot with a young diabetic patient who I happened to meet at the hospital. I felt sorry and sorry. He was also interested in me. I think we could have more conversation because we shared things
KMI05	It's better to talk enough to people around me and open up my illness. I felt protected after opening up my condition about the disease. Before the opening, people used to hide and manage diabetes, but now I'm showing people syringe in a funny way
KMI06	I want to tell to young diabetic not to be frustrated
KMI07	Diabetes ping pong is the most difficult. If you have low BG, you keep eating it, and if you have high BG, it's also hard
KMI08	I feel a great deal of the need to improve living patterns
KMI09	Diabetes patients have needs but are difficult to get started. But it would be very helpful if I received a message from patients in similar situation that would be a stimulus when I needed it
KMI10	Diabetes sharing BGL is not burdensome at all
KMI11	I want to know what kind of lifestyle a patients of his or her got their BGL

KMI12	I usually god diabetes information for the book. At the time of the diagnosis I found information here and there but it was not credible because it was not the real patient's experience what I hear in person
KMI13	Communicate with patients in a similar condition to mine and exchange practical information and form a community
KMI14	There is a great deal of information about diabetes. There are so many that I don't know what information to look at.
KMI15	Diabetes management itself is stressful. He tries to deal with it alone and puts management behind him.

Affinity Diagram

Table 19. Diabetes patients want to communicate with each other through the community

Code	Contents	From
	Young diabetics can't reveal the pain around them	On-line observe
KMI15	Diabetes management itself is stressful. He tries to deal with it alone and puts management behind him.	Interview
	Lifestyle needs to be improved after diagnosis of diabetes.	On-line observe
	Exercise, diet management, and insulin measurement require improvement in lifestyles that have not been done before, and this itself is highly stressful	On-line observe
	Young diabetics are at a loss because they don't even know where to start	On-line observe
	Diabetes patients can continue health care with steady care and immediate motivation	New insight from affinity diagram
	Immediate motivation when you need it most	New insight from affinity diagram
KMI09	Diabetes patients have needs but are difficult to get started. But it would be very helpful if I received a message from patients in similar situation that would be a stimulus when I needed it	Interview
	If diabetics look at people's behavior through the story log, they can exchange immediate motivation.	New insight from affinity diagram

	Interesting and easy interaction for getting motivation instantly	New insight from affinity diagram
	Recommended group activity for achieve your Goal	New insight from affinity diagram
KMI13	Communicate with patients in a similar condition to mine and exchange practical information and form a community	Interview
	Use the "Cheer Up" button to support your colleagues who manage with you.	Idea Generation Workshop
	Based on data set by phosphorus, related groups can be recommended and active	New insight from affinity diagram

Table 20. Diabetes care professionals can be self-care professionals.

Code	**Contents**	From
	Treat well-managed patients as masters and seek to improve awareness of diabetes	New insight
KMI14	There is a great deal of information about diabetes. There are so many that I don't know what information to look at.	Interview
	Through my graph, I can summarize the level of diabetes after eating.	New insight
	I can put my comment on each figure.	New insight
	I can share my comments with people through the service.	New insight
	simple vertical scroll graph for Deliver large amounts of information	New insight
	Check blood sugar/diet/exercise together and easily determine the cause of my current condition. Diabetes care that can be done easily.	New insight
	Many diabetics of the same age and condition as me can see my reviews of red bean porridge.	Oline-observe
	The advantages of sharing among patients are that they can see specific information, but the disadvantage is that the reviews do not exactly apply to everyone.	Oline-observe
	Access to Healthy life habit, where you input yourself, get your own enlightenment.	New insight

	Designing a solution in a way that allows the patient to find it on their own, rather than letting the app know it directly	New insight
KMI08	Service to answer, "What lifestyle do I need to change to be good at blood sugar management?"	Interview
	Through participatory care, get environmental factors that can only come from patients.	Related-work
	Approach in a way that boosts the self-esteem of diabetics.	New insight
	Participatory medical care: to generate one's own data and to have authority and responsibility for the results;	Related-work
	Improving awareness on a high-quality level to think that diabetes management is self-care.	New insight
	Zoom in between blood sugar and blood sugar, and you'll see my records (insulin, food, exercise.	New insight
	Like, "Ah! This 'food' is what this 'behavior' brings in this blood sugar," so that you can learn on your own.	New insight

Table 21. The service allows diabetics to share their diabetes care tips.

Code	**Contents**	From
	Greater motivation from patients who are in a similar condition to mine	Online-observe
	I can check my comments in each blood glucose	New insight
	Tip connection enough to overcome when low blood sugar levels	New insight
	If numbers outside the normal range continue to come out - suggest directions to return to the normal range rather than alarm indications such as hazard	New insight
	Designed to see other people's tips on my bad blood sugar. : ex) Twenty users with 150 blood sugar levels lowered their blood sugar levels through a 30-min walk! Please check the tip	New insight
	Passing tips on current BG figures	New insight
	Getting current answers from past records of yourself/other users	New insight

	In anticipation of future figures from the present state, attached advice	New insight
	View tips from multiple people by category	New insight

Table 22. Cognitive behavior therapy-based services can help relieve depression in diabetes management

Code	Contents	From
	Cognitive restructuring approach: let me check my record in the Graph and write down my thoughts and feelings about it.	New insight
	Proceed to the Dispute question	Related-work
	The app asks questions to counterargu	New insight
	Diary of the Day (Time to Turn Yourself)	New insight
	Today's graph review is available after 9 p.m. (One-line daily review at a set time)	New insight
	Review the counterpart's content (controduce arguments together)	New insight
	The link between thoughts, feelings and actions needs to be carefully examined	Related-work
	Write down the reason why I ate unnecessary food and the right time to replace it	New insight
	Combining with Friend Feedback	New insight

Table 23. Diabetes patients can relieve anxiety and form healthy lifestyles from specific diabetes management plans.

Code	Contents	From
	Plans should be drawn up to prevent problems.	New insight
	Diabetics need to be practice to solve their problem	Related-work

Post User Research: Interview

Patients SY

Date: April 1, 2021

Place: Meeting room in the café, Ulsan

Table 24. Post user research interview: SY

Code	Interview Insight	
SYIS01	Expect the day eating pattern is the best important thing	First-Sheet
SYIS02	It would be clear to have the red/yellow/green lights anticipate the dangers of the meal it self	First-Sheet
SYIS03	The drag component is good for stress,active,freedom but food intake need to be more specific level to expectation	First-Sheet
SYIS04	Getting information from other user who are same with me Age, Weight, kind of Diabetes	Second-sheet
SYIS05	When it comes to show meal the picture of food is better than calory. Becaus when we see picture we can easily see how Vege, Carbohydreates, Proteins are composed in the food	Third-sheet
SYIS06	Manage Diabetes can't keep do it by my self. So pear patients are really important.	Second-sheet
SYIS07	Drag component is good for checking Active, but It would be better if there were certain criteria according to the degree	First-Sheet
SYIS08	If there is special day record from other people, It would be better to see how they eat the outside menu.	Second-sheet
SYP01	First image of Magnify graph is good and simple	Prototype Test
SYP02	If there is monthly boold glucose report it would be better. It will be easy to share with doctor	Prototype Test
SYUS01	For Therapy function, Peer comment will be really helpful than doctor comment wich is just saying same thing what I prepared	User Story
SYUS02	For Echo message, It would be better to check my condition detaily by typing more than just click the stress number.	User Story
SYUS03	Specially because of peer comment ,the teraphy function will be really helpful to me when I don't want to care of diabetes	User Story

Patients JI

Date : April, 12, 2021

Place : Meeting room in study café, Osan

Table 25. Post User Research Interview : JI

Code	Interview Insight	
JIP01	There is so many kind of health care app so it's difficult to choose for using it self. Because I wanted to tracking my blood glucose and manage intake etc but I should use a lot o	Prototype Test
JIP02	There is limit to manage my diabetes with health care app in the app store. I have to use two or three app to do both of things (tracking diabetes, manage health)	Prototype Test
JIP03	She couldn't think about cliking figure of blood glucose because she thought it's graph so it has only number at here. After she know the function she really satisfied to see other contetns (active, meal)	Prototype Test
JIP04	The time difference between eating and blood glucose has to be clearly designed. Because even if it's the same blood glucose level, it has a huge different meaning between levels immediately after meal and levels from hours after a meal.	Prototype Test
JIIS01	First I will think about how much I will active on the day	First-Sheet
JIIS02	Preparing or checking the place to check blood glucose is important	First-Sheet
JIIS03	It is important to think ahead of the hustl and bustle for checking blood glucose	First-Sheet
JIIS04	When I will check blood glucose has to be prepared	First-Sheet
JIIS05	I have to think about whether the food I'm going to eat is a food that needs attention	First-Sheet
JIIS06	The amount of insulin to get is different by my blood glucose level so I want to know I much of insuline should I take	Second-sheet
JIIS07	If I set the insuline chart first, I think I can use it when I search my information	Second-sheet
JIIS08	Setting the time to take a Insuline is best important	Third-sheet
JIIS09	Alarm is really needful idea but I don't think I can make schedule in a detail	Third-sheet

JIIS10	The setting about insuline is best important so it has to be detailed design like, set the kind of insulin, amount, time ect	Third-sheet
JIUS01	If the message coming when I busy I will not check it	User Story
JIUS02	Find exercise what is good for me is also important	User Story
JIUS03	I think Scheduling also good for self-diagnosis	User Story
JIUS04	Review my day is really important but difficult to do it.	User Story
JIUS05	Checking people who use my impormation is good idea	User Story
JIUS06	I can't say my diabetes problem to anyone but I can say my feeling to app is really good and if I could get answer from the other patients is also awesome	User Story
JIUS07	direct chat make people tired	User Story

Patients SA

Date : April, 13, 2021

Place : Meeting room in study café, Chuncheon

Table 26. Post User Research Interview : SA

Code	Interview Insight	
SASSI01	For me the fake hypoglycemia was hard but I followed my rule. BG levels are normal, but if I feel hypoglycemia, I ate candy	Interview
SASSI02	She called people who had long-term diabetes care 'Master'	Interview
SASSI03	Most of people in diabetes online café are 40-50's so I couldn't get many kind of information	Interview
SASSI04	I check my BG really because I am so curious my BG level after eating something	Interview
SASSI05	I posted my information on the diabetes online group but I was stoped it cus people who are in different environment don't like my caring	Interview
SASSI06	I get a information from people, age is not important. It's more important whether the balance is the same as mine	Interview
SAII01	The sleep condition is really affect a lot to BGL it's because of strees	First - sheet
SAII02	Active and Stress most affect to BGL	First - sheet

SAII03	The active Unit (Km, minit..) it's difficult to people who don't exercise before. so the amount of step is better to show them. Diabetics know that they have to work 10,000 step for a day	First - sheet
SAII04	check if I will eat all three meals on the day or not	First - sheet
SAII05	O/X format will be good for meal intake like, whether totalk intake calories are more than 1800, whether a carbohydrate-oriented meal is more than one meal.	First - sheet
SAII06	The freedom need to be check, sometimes I could followe my schedule because of office environment	First - sheet
SAII07	Each section need to have level to check. And example.	First - sheet
SAII09	If I see my usually condition and style of meal intake will be also helpful	Second-sheet
SAII10	I want to get detail impormation with each section (active, meal, insuline..)	Second-sheet
SAII11	If there is direct teaching will be also good like, Walk for some minit	Second-sheet
SAII12	Showing my previous experience is really good because I also check my experience often to take a good action	Second-sheet
SAII13	Calory doesn't has show people. Only picture and name of food is enough. People don't know with calory.	Second-sheet
SAII14	If the menu will be different with normal day, I will put a lot of exercise in between hours so I want to touch all the time line with button	Third-sheet
SAII15	Bring my previous experience is really good Idea	Third-sheet
SAP01	I took picture of my meal, and use it when I see the diabetes note. If there hyperglycemia, I check what I ate on the hyperglycemia day. So this function I really like	Prototype Test
SAP02	I want to more detail information of meal	Prototype Test
SAP04	I can see the information at a glance it's really good	Prototype Test
SAP05	If the figures outside my goal BG range will be shown in a different	Prototype

	color (like red) will be good	Test
SAP06	If I got Hyperglycemia and hypoglycemia it's recored with dangerous sign. And I want to get a simple impormation to correct the BG level	Prototype Test
SAUS01	Echo message is good, I think answer my feeling with emoticon better than level (number)	User Story
SAUS02	It would be perfet if it could be linked to a BG meter	User Story
SAUS03	I will review with only my special day	User Story
SAUS04	The doctor comment is not important. I can guess it'will be same word always.	User Story
SAUS05	Peer comment is really good Idea. The way of comment is really good it's totally different with chatting	User Story
SAUS06	The teraphy flow is really good for me. Asking my condition and checking my previous data and get a comfort from peer is really good flow.	User Story
SAUS07	I want to see profile of people in the Echo chat. Insulin intake information and physical information	User Story

ACKNOWLEDGEMENT

First and foremost, I want to confess my highest gratitude to my almighty Lord God. You are worthy of all the acknowledgments. I express my deep gratitude to professor Hwang Kim, who is an advisor professor through him I received various experiences and skills, I was able to expand my potential as a designer and develop my power to think deeply. The professor's support and trust for me gave me the strength to stand up and run whenever I faced difficulties.

I would also like to express my gratitude to professor Doo-Young Jung and professor Seung-Ho Park Lee for reviewing this thesis. Although there were a lot of shortcomings because of good feedback and sincere advice to the end helped me to achieve better results. I also sincerely appreciate the feedback offered by professor Hui-Sung Lee, who helped me during my last semester of graduate school, and I am very grateful for Tufail Muhammad postdoctoral researcher, to spend his time and energy on assisting me on this thesis, without his guidance and persistent help this thesis would not have been possible.

In addition, I would particularly like to thank the four interviewees who shared their diabetes management experiences through interviews. They constantly supported and sent me ideas even after the interview.

I would like to thank my “OF NOW” laboratory members and UNIST colleagues for being a family and making me feel like I am always home. In particular, I also want to mention my gratitude to my peers Ji-Young Lee, who spend long nights in writing and working with me, Hye-Min Choi and Byeong-Kuk Kwak thank you for your endless warm encouragement and support, Do-Kyung Kim, I am thankful for your constructive comments for Echo project and I would like to say thank you to all the CDE colleagues, Sung-won Jang, Min-hyuk Lee, and Woo-in Jang who have been great supportive peers.

Last but not least, I would like to express my deepest appreciation to my beloved family, Mrs. Gyung-Hue Kim, Mr. Sang-Rok Jin, You-Jeong Jin, Han-Cheol Bae, and Sil Jin thank you for always being with me and giving me guidance. Special thanks to Caleb Dagualem Melese, for always thinking about my thoughts and being on my side.

This paper was supported by a Korea Institute for Advancement of Technology (KIAT) grant funded by the Korea Government (MOTIE) (P0012725, The competency Development Program for Industry Specialists)