

E.B. Orazgaliyeva^{1*}, M.R. Smykova², A.A. Abuzhalitova³

^{1,2}Almaty Management University, Kazakhstan;

³Narhoz University, Kazakhstan

(Email: ¹e.orazgaliyeva@almau.edu.kz, ²mraisovna@mail.ru, ³akdana.abuzhalitova@narxoz.kz)

¹<https://orcid.org/0000-0001-7030-7102>,

²<https://orcid.org/0000-0003-2373-4165>,

³<https://orcid.org/0000-0003-3390-4543>

Usability of the medical mobile application for patients: Kazakhstani case

Abstract

Object: Covid-19 pandemic was impact in all aspects of our life, especially digital health care. This study was aimed to examine the usability of the state medical mobile application called Damumed with neuromarketing tool – eye-tracking. Damumed is the main state health information system designed to facilitate the work of medical personnel, thereby improving the quality and accessibility of medical services for patients, where patients can find all medical appointments, health passport and all health-related information. This research is aimed to achieve SIG Goal of Good health and well-being for people.

Methods. Using neuromarketing instrument with unstructured interviews to identify key features of usability aspects of the medical mobile application.

Findings: Overall, 23 patients were separated into 2 age groups of young (18-24) and adults (35-44). They engaged in the study to participate both in neuromarketing research and unstructured interviews. Adults had difficulties in understanding the navigation of the app, while younger group could navigate in the app intuitively.

Conclusions. Neuromarketing studies and individual interviews clarified assessing the usability of the medical mobile application interface. Since the respondents have different background, for adults it was a bit challenging to assess the app's interface. In this respect, for older generation would a barrier to adopt this kind of information systems.

Keywords: digital medical services, medical organizations, health care, medical application, digital marketing communications.

Introduction

Since Covid-19 pandemic the State actively implementing information technologies in health care gave a considerable progress in health care, it was important to expand all sources promptly.

Analysis of the national program “Digital Kazakhstan” identified general directions of creating a unified digital circuit and introduction of innovative technologies in the system of Kazakhstan's health care, the implementation of which improved the quality of medical services (MCS) and result of it according to the data provided by the Department of Regional Health care (Digital Kazakhstan | Electronic Government of the Republic of Kazakhstan, n.d.):

- saving up to 336,5 million tenge purchase of paper on medical paper records;
- reduced number of consumables procured 252,6 million of tenge for medical images (fluorography, X-rays, mammography);
- 30% reduction in live queues due to pre-recording via electronic services;
- reduction of laboratory results by 1.8 times due to electronic services;
- 8.3% reduction in clinic visits;
- 2.8 times shorter transfer time of patients;
- 387 jobs were optimized;
- reduction of patient time in the clinic before receiving services by 50 times;
- saving of doctors' and patients' time by reducing the average time of treatment of patients in polyclinics from 25 to 15 min;
- 1.3 times less ambulance time;
- reduction of call processing time to dispatch center by 25 times.

* Corresponding author. E-mail address: e.orazgaliyeva@almau.edu.kz

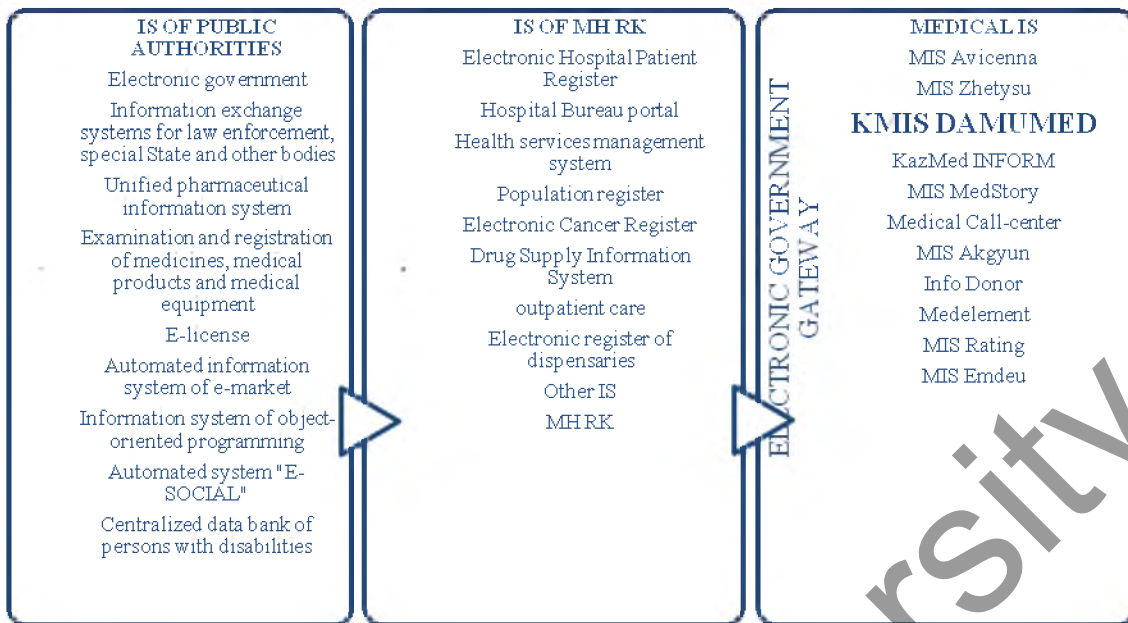


Figure 1. Integration of private medical IS, IS of public authorities with IS MH RK

Note – compiled by the authors based on the source the Digital Kazakhstan | Electronic government of the Republic of Kazakhstan. (n.d.). egov.kz. <https://egov.kz/cms/en/digital-kazakhstan>

Therefore, the Ministry of Health of the Republic of Kazakhstan (further – MH RK) is working to ensure the integration of private medical data with the Information System (further – IS) of the Ministry of Health, with a view to the prompt and correct formation of accounting and reporting documentation, monitoring and information analysis, making effective management and clinical decisions. In addition, efforts are being made to integrate other public authorities with IS for the rapid exchange of data (Fig. 1) (Digital Kazakhstan | Electronic government of the Republic of Kazakhstan. n.d.).

Literature review

The service marketing triangle is the complex of relationship between three main parties that aimed to develop, promote and build and cultivate patients’ trust. Components of the service marketing triangle in general are company, service provider and customers (Fig. 2) (Hole et al., 2018). However, in health care sector the main players would be: company – Ministry of Health, service provider – hospitals/doctors and customers – patients. In current research to stronger this relationship between above parties the main role played by medical information systems, specifically to evaluate this system’s usability.

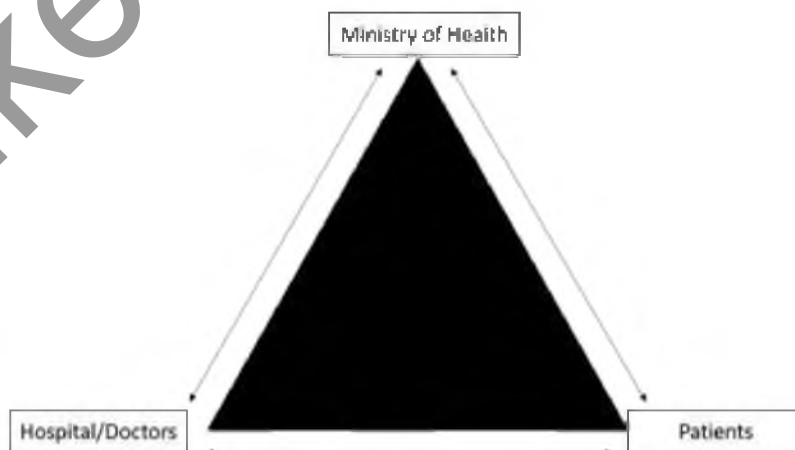


Figure 2. Service marketing triangle in health care

Note – compiled by the authors based on the source the Hole et al., 2018

In Kazakhstan currently there are overall 31 medical information systems and 14 laboratory information systems (GOV.KZ, n.d.). According to the statistics of Similarweb KMIS Damumed application (dmed.kz) is

on the first place in Health category with overall visits for the last three months 1.3 million of people (Dmed.Kz Traffic Analytics & Market Share | Similarweb, n.d.). Therefore, in the current research to measure usability KMIS Damumed application was chosen.

KMIS Damumed is software designed to automate the work of medical organizations regardless of their specialization and affiliation, whether public or commercial. The system is designed to improve the quality and accessibility of medical care by automating the work of medical personnel in all areas of activity of the medical organization. More than 1300 medical organizations cooperate with Damumed throughout Kazakhstan (Quanfin, 2020). Damumed is:

- patient-centred Medical Digital Ecosystem;
- integration with Ministry of Health portals;
- digital transformation of disease prevention, detection and control;
- electronic medical cards – paperless medicine;
- continuity between levels of care;
- increasing the efficiency of each doctor, each clinic, health industry as a whole.

There are several methods being used to evaluate usability, but these methods have not been changed since 2014 (Maramba et al., 2019). Methods that could help in testing usability are similar and previously researchers have recommended other instruments for evaluation, such as eye-tracking and remote-monitoring. However, these kinds of methods were not used occasionally (Zapata et al., 2015). Among the used methods were to record number of times the app was used or specific task completion. Reasons of using these kinds of methods might be cost of instruments (for example, eye-tracking) that may lead the use of these methods expensive (Ferre et al., 2017). There might also be factors specific to different domains, thus such methods would hamper to adopt them (Maramba et al., 2019).

Lund in his work developed questionnaire to measure usability of service or a product in three dimensions: usefulness, satisfaction and ease of use that would be used to evaluate usability in health care (Lund, 2001). Jegundo and others in their highlighted that instruments such as semi-structured, interviews, observation of task completion, group discussions, or specific questionnaires were used to clearly evaluate different aspects of usability (Jegundo et al., 2020).

To measure usability there are two different approaches: formative or summative. Summative approach is used to set usability benchmark. While the aim of formative approach is to identify usability barriers and using this approach there are various formative methods taking into account user characteristics and meaning of the behaviour, for instance interviews, cognitive procedures, etc. For measuring a medical mobile application this approach would valuable to see how different user behave while using the app (Broekhuis et al., 2021).

According to the previous studies for our research formative methods were used, for interview unstructured interview were used, and for cognitive walkthroughs used neuromarketing tool – eye-tracking.

Methods

This research is aimed to achieve SIG Goal of Good health and well-being for people. The main objectives of the research reported by this article to examine usability of Damumed application by conducting unstructured interview and using neuromarketing tool in accordance with USE test (usefulness, satisfaction and ease of use, ease of learning) the following research questions were developed:

RQ1. What are the perceptions of patients about the usefulness, satisfaction, and ease of use of Damumed application?

RQ2. What types of features of Damumed interface might represent barriers to patients?

For identification of the research results below several variables were identified to formulate questions for unstructured interviews and to develop tasks for the neuromarketing research.

Eye-tracking is the equipment that made it possible to study the fixation of the gaze on individual elements of the application, which justifies the indicators interest. In our case, the eye-tracker collected data with a sample of up to 50 Hz, that is, 50 individual points of view per second for pooled groups of respondents. The eye movement process is automated, so it is a suitable tool for the qualitative of the research being conducted, as it allows researchers to tap into unconscious processes that are governed by biases and preferences. The area of interest is a tool for selecting areas of the displayed stimulus and extracting metrics specifically for those areas, it defines the area over which other metrics are calculated. In this case, the area of interest was the screen of a smartphone with an open application (Table 1).

Table 1. Questions and tasks for measuring variables

Variables	Neuromarketing task	Unstructured interview questions
(1) usefulness of the app	1. Entering the app (for first timers to register)	Have you registered in Damumed application prior? What do you think about quality and volume of relevant data?
(2) satisfaction about the app's features	2. To make an appointment therapist	What would you offer to increase awareness of the app among the population?
(3) ease of use of the app	3. To make an appointment with specialist (endocrinologist)	Do you like using this app? Why? What kind of features would you like to have in the app? Will you continue using the app? Why?
(4) ease of learning the app	4. To find medication (painkiller Ketonal)	How fast could you fill up the forms during registration? What kind of difficulties have you faced during the use of the app? What do you think about interface attractiveness?
		How fast did you complete the tasks? Do you find using the app features understandable? Would you like to see video-guides using this app?

Note – compiled by the authors

To see how different age groups encounter using the medical mobile application further detailed illustrations of each task were provided to evaluate usability. Each step was correlated with each task that was carried out (Fig. 3-6).

Log in screen

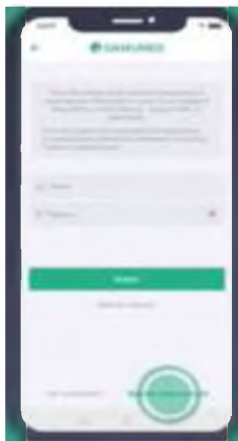


Figure 3.

Entering the app (for first timers to register)

Main screen

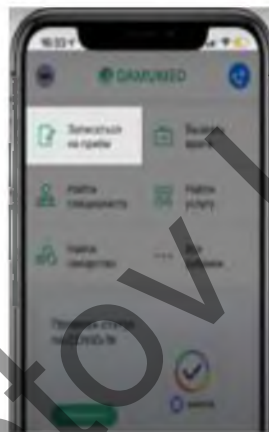


Figure 4.

To make an appointment therapist

Making appointments

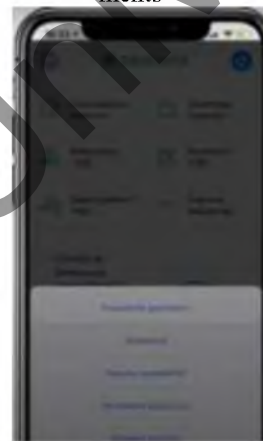


Figure 5.

To make an appointment with specialist

List of medication

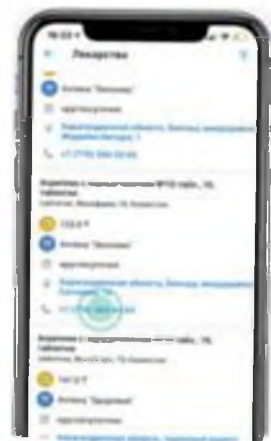


Figure 6.

To find medication

Respondents were selected according to several criteria by stratified random sampling:

- the age corresponding of the target audience of the application is from 18 years old to 44;
- respondents of both sexes, male and female;
- respondents who have information about the application, as well as uninformed people;
- respondents who had direct experience of using the application and unregistered users.

People under the age of 18 were not taken for the study, for a number of reasons, including legislative, as it was necessary to take parental permission to conduct the study, as well as the conditions for using the Damumed application.

The answers of the respondents were taken orally and recorded, the consent of the respondents was previously taken to process and store their answers and personal information for use only for research purposes (without disclosure).

Results

Most marketing research methods require a sufficient sample of respondents and have a certain level of subjectivity, which is related to the characteristics of the respondent, his objectivity and competent work of

marketers and interviewers. A study by scientists like D. Ariely and D. Berns show that respondents often talk and answer questions, not in the way they think, and may look more profitable and all this leads to unreliability of the information received and ultimately there is distortion of the study results (Ariely & Berns, 2010).

Scientists Soon S.S. and others noted that using neuromarketing equipment for experiments, get more reliable information, while evaluating the actions of consumers and their emotions, that precede the decision-making process or evaluation of the service provided (Soon et al., 2008). Given the work of researchers, the authors used neuromarketing tools for more accurate observation of the respondents.

In this study authors used stratified sampling by dividing population into age groups. This method would be effective to examine what and how problems may differ in different subgroups (Acharya et al., 2013).

According to the statistics of Similarweb the ration of gender distribution of Kazakhstani population who use Damumed application 73.49% female and 26.51% male. In explaining these indicators are respectively linked to the status of female. Most of female group of people are mothers who responsible for under-age children as it might linked to mentality of Kazakh people (Dmed.Kz Traffic Analytics & Market Share | Similarweb, n.d.).

Furthermore, as we can see on figure, the relatively big portion of app users are people from 25 to 34 years old respectively 32.17%. It means this group actively uses the app and they are not our target group. The research interest was two age groups of people who are older and younger than the age group who actively uses the app (Fig. 7) (Dmed.Kz Traffic Analytics & Market Share | Similarweb, n.d.).

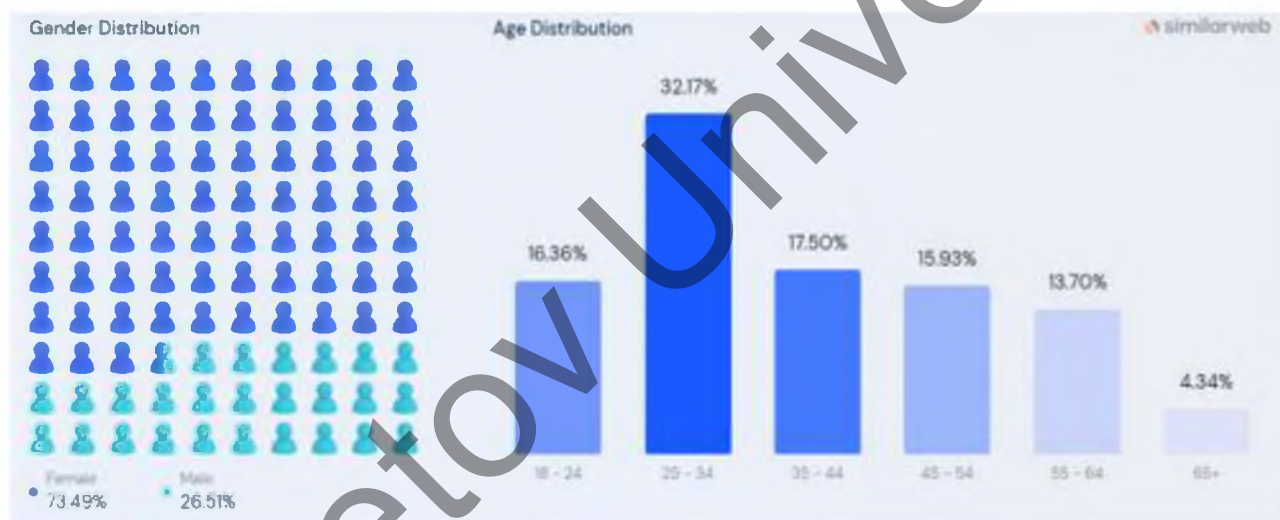


Figure 7. Damumed demographic users

Note – compiled by the authors on the basis of data from the Similarweb.Dmed.kz., <https://www.similarweb.com/website/dmed.kz>

While conducting the research respondents were divided according to age groups “young” and “adults”:

- 18 to 24 age young respondents;
- 35 to 44 age old respondents.

For the convenience of researchers, it was decided to combine the results of a study of various groups of people according to certain trends in access to the functionality of each, and taking into account changes in the course of working with equipment (human and technical factors). Thus, the following groups of results are presented. To conduct the research overall 26 respondents participated, however, results of three respondents were excluded since their video were not suitable because of error.

While conducting research with eye-tracking heatmaps were generated from aggregation of the data of each task of different age groups as it was shown below in Figures 8 and 9.

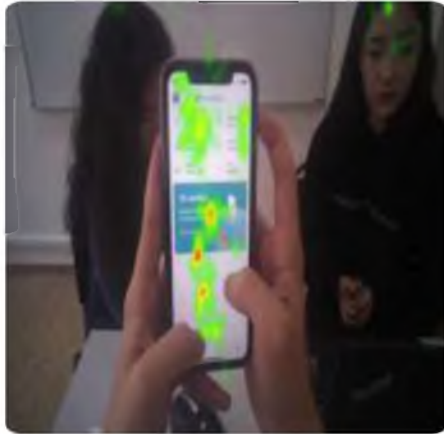


Figure 8. Results of the main screen of younger generation



Figure 9. Results of the main screen of older generation

Note – compiled by the authors on the basis of neuromarketing research

As we can see in Figure 8, the young group of respondents has a particularly paid attention to the visual, in particular to the dots at the bottom of the carousel function. Due to the fact that presidential elections were held during the study, young people might be interested in announcing the elections because of political trends. In addition, the carousel under the visual is particularly marked as the active zone of interest area. This might be due to the fact that social networks are widely popular among the younger generation. And in all social networks, carousel functions are often found, that is, a person is constantly squandering some updates, photos, advertising, so a person is waiting for further news or events.

Moderate attention is paid to the functions of making an appointment with a doctor and finding a specialist. Due to the fact that Damumed is a medical application, a young category of people is looking for opportunities to visit a doctor or find a specialist suitable for them.

However, the results of the study differ greatly in the second age group. For instance, adults do not pay much attention to the carousel, they are more interested in the function of finding a medicine and a specialist, as you can see in Figure 9.

In the second task to make an appointment with own therapist was difficult to aggregate all the results since all users had different information board about their therapist, thus part was analyzed only through their video.

The next task was to search for a specialist, for example, an endocrinologist was chosen as the specialist from the list as shown in Figure 10 and 11. When choosing and making an appointment with a doctor, respondents pay attention to the location of the specialist.



Figure 10. Results of the search for a specialist of younger generation

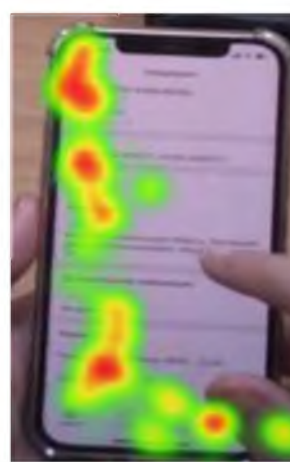


Figure 11. Results of the search for a specialist older generation

Note – compiled by the authors on the basis of neuromarketing research

The younger generation paid more attention to the contacts and address of the chosen specialist. This might be due to the fact that the location of the clinics is important for young people.

After that, the areas of interest were about the name of the clinic, the name of the doctor and the available dates of the appointment to the doctor. The reason for this might be the lack of interest and involvement of young people in healthcare in general. There is a tendency that young people prefer convenience, saving time, rather than quality and credibility. In addition, it is accepted that young people do not really understand and recognize doctors due to age and inexperience.

Adults, in turn, concentrate on the name of the specialist and the name of the clinic. This is explained by the fact that adults would take care of their health more and they are more aware of reputable hospitals and specialists (Wildenbos et al., 2019). According to the results the location of the clinic is the least important factor they took into account. As it can be seen in heatmaps, younger generation gaze are more spontaneous, rather older generation, who are more focused.

Further, on Figures 12 and 13 are shown the results of respondents while choosing medication.

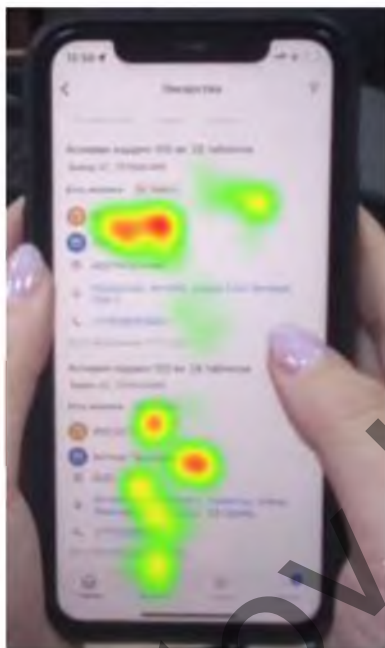


Figure 12. Results of the choosing-medication of younger generation

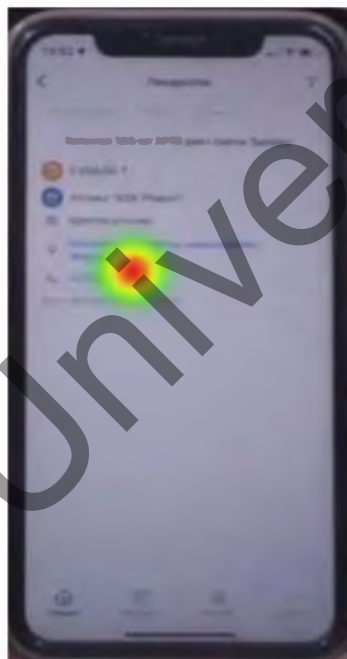


Figure 13. Results of the choosing-medication of older generation

Note – compiled by the authors on the basis of neuromarketing research

It follows from the analysis that the majority of respondents from the adult category, for the most part, paid attention to the quality of medication and their composition. While the young category paid more attention to the cost of medicines, rather than the quality and composition of the product. This causes adults to take more care of their health than young people. In the figure can be seen that the youngsters were focused at the price.

During the study, various indicators were studied. With the help of the equipment, the eye movement of the subjects was monitored, followed, the speed of perception and the quality of assimilation of information, the convenience of the interface for the user, distractions, as well as the ergonomics of the mobile application.

The neuromarketing study helped to identify the needs and motivations that underlie different age groups.

Discussions

Users who registered for the first time noted difficulties during registration. In addition to the Individual Identification Number (further – IIN), additional data is required in the application. The IIN contains all the

personal data of a person. According to the authors, these barriers reduce the level of use of the Damumed mobile application.

During the survey, respondents found incorrectly entered personal data. Such as, residential address. When calling a doctor, the correct address of the patient is of great importance. In our opinion, users should be able to adjust and update their personal data.

The majority of respondents expressed a desire to supplement the application with an online consultation function, which could make the application even more convenient. There is a need to integrate telemedicine into the Damumed system to improve the quality of life of the population.

Table 2. Interview analysis

Categories	Compilation of answers	Impact
(1) usefulness	Registration requires a lot of information. There are difficulties with registration.	Lose interest or refuse registration. When used, they see opportunities and prospects for improving the quality of life, but there is no contentment.
	Incorrect personal data. Incomplete and false data. Most users have different completeness of the completed data (test results, medical history, etc.).	Be able to adjust and update personal data. Timely filling in information on attached patients by medical institutions.
	There is not enough promotion, advertising of the Damumed mobile application.	It is necessary to send information about Damumed by various messengers. Poor information about this application in medical institutions.
(2) satisfaction	Unanimous approval of the application. Helps to save time and finances. The presence of various functions regarding health.	Opportunities integration of all medical services into one application to improve the quality of life of the population.
	The possibility of confidential medical online consultations is not presented.	Development of telemedicine.
	Unanimous approval. Getting digital medical services in one click.	Ensuring the high-quality functioning of digital medical services through a single state platform.
(3) ease of use	Problems with the system of booking visits to the doctor, with locating the nearest clinic. The language features of the app have drawbacks.	Elimination of errors in the operation of the application. Refinement of the interface in various language formats.
	The visual content of the app is accessible and easy to use. There is no accessibility button for people with disabilities.	The 18-24 age group was intuitively oriented when performing tasks. For them, the application interface is logical and easy to use. The 35-44 age group performed the assigned tasks longer.
(4) ease of learning	In general, it is clear that there were some difficulties.	Adaptation in the age group 18-24 (young) took less time than in the age group 35-44 (adults).
	It would be nice to have video-guides how to use the application.	The 35-44 age group (adults) had more video guide needs than the 18-24 age group (young).

Note – compiled by the authors on the research

Also, as can be seen from Table 2 it is necessary to pay attention to the age groups of users as an important aspect of improving the quality of digital medical services of the Damumed system for more effective use of the mobile application.

To organize the systematic dissemination of information about Damumed application and about its capabilities, as well as to ensure accessibility among various groups of the population.

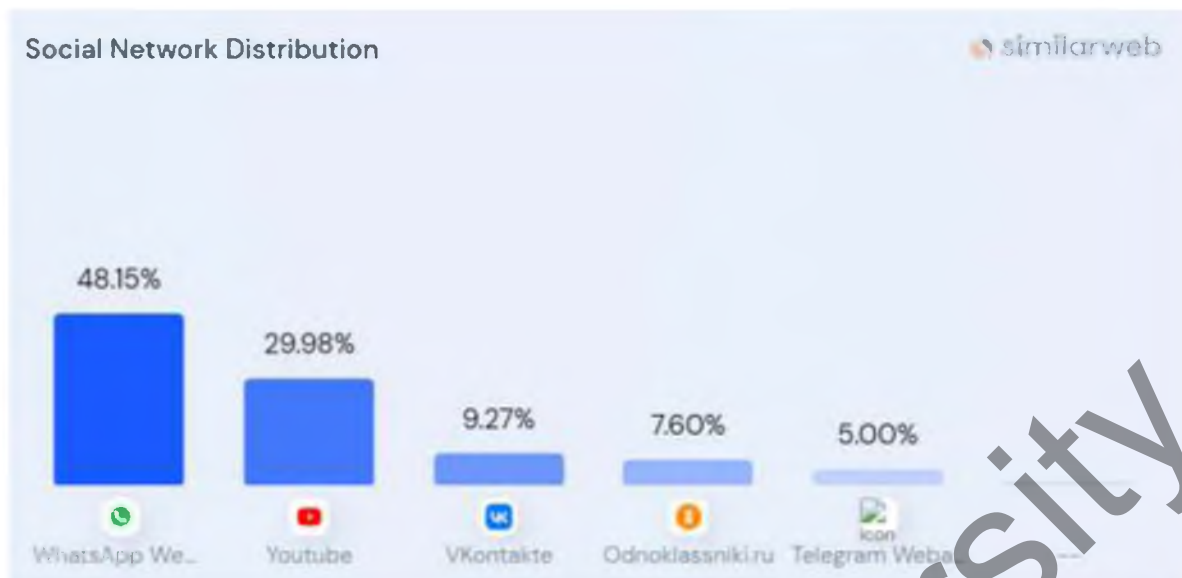


Figure 14. Social network distribution of Damumed

Note – compiled by the authors on the basis of data from the Similarweb.Dmed.kz., <https://www.similarweb.com/website/dmed.kz>

Therefore, social media promotion would be the most effective to cover all population. Social media traffic of Damumed distributed to the following hierarchy: WhatsApp Webapp, Youtube and VKontakte. Also, interaction with the users through Telegram Webapp may open new perspectives as it was shown in Figure 14 (Dmed.Kz Traffic Analytics & Market Share | Similarweb, n.d.).

Conclusions

For the first time in Kazakhstan neuromarketing tool eye-tracking was used to assess the usability of the medical application.

Within the framework of service marketing triangle hospitals as a service provider should consider the following aspects for simplification and more efficiently perform the service.

- on Damumed’s website were several different services that they supposed to provide, in reality some of the features did not work. Thus, it would be more effective if the mobile application could reflect the actual existed services;
- since some of the users struggled using due to the font of the mobile application, enlargement features would be beneficial considering all age groups;
- educating users about the use of the mobile application is important, to increase awareness different social channels to different age groups should be engaged;
- to manage own personal medical information;
- to integrate telemedicine into the Damumed system.

The findings of the study showed that the utilizing both eye-tracking and unstructured interviews are much more effective and gives clearer picture of existing problems and barriers, identified user’s expectations while using the application. Therefore, this article reports an observational study using a multi-method approach, which also includes the USE testing, to determine the perceptions of different age groups about the usefulness, satisfaction, and ease of use of the mobile application.

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Пациенттер үшін медициналық мобильді қосымшаны пайдалану ыңғайлылығы: қазақстандық кейс

Аңдатпа:

Мақсаты: COVID-19 пандемиясы біздің өміріміздің барлық салаларына, әсіресе цифрлық денсаулық сақтау саласына әсер етті. Зерттеудің мақсаты нейромаркетинг құралы *eye-tracking* көмегімен Damumed мемлекеттік медициналық мобильді қосымшасының қолайлылығын зерттеу. Damumed — бұл медициналық персоналдың жұмысын жеңілдетуге арналған денсаулық сақтаудың негізгі мемлекеттік ақпараттық жүйесі, осылайша пациенттер барлық дәрігерлердің қабылдауына жазыла алады, денсаулық паспортын және денсаулыққа қатысты барлық ақпаратты таба алады, яғни медициналық қызметтердің сапасы мен қолжетімділігін арттырады. Аталған зерттеу адамдардың денсаулығы мен әл-ауқатының басты мақсатына жетуге бағытталған.

Әдісі: Медициналық мобильді қосымшаның ыңғайлылығының негізгі ерекшеліктерін анықтау үшін сұхбат және нейромаркетинг құралы пайдаланылды.

Қорытынды: Жалпы алғанда 23 респондент жас ерекшелігіне қарай екі топқа бөлінді: жастар (18-24 жас) және ересектер (35-44 жас). Олар нейромаркетингтік зерттеулерге де, сұхбатқа да қатысты. Ересектер мобильді қосымша бойынша навигацияны түсінуде қиындықтарға тап болды, ал жастар қосымшаны интуитивті түрде қолдана алды.

Тұжырымдама: Нейромаркетингтік зерттеулер мен жеке сұхбаттар медициналық мобильді қосымшаның интерфейсінің ыңғайлылығын бағалауды нақтылады. Респонденттердің жұмыс тәжірибесі әртүрлі болғандықтан, ересектерге қосымшаның интерфейсін бағалау қиынға соқты. Осыған байланысты аға буын мұндай ақпараттық жүйелерді енгізуге кедергі болар еді.

Кілт сөздер: цифрлық денсаулық сақтау қызметтері, денсаулық сақтау ұйымдары, денсаулық сақтау, медициналық қосымша, цифрлық маркетингтік коммуникациялар.

Э.Б. Оразгалиева, М.Р. Смыкова, А.А. Абужалитова

Удобство использования медицинского мобильного приложения для пациентов: Казахстанский кейс

Аннотация:

Цель. Пандемия COVID–19 оказала влияние на все аспекты нашей жизни, особенно на цифровое здравоохранение. Целью этого исследования было изучение удобства использования государственного медицинского мобильного приложения *Damumed* с инструментом нейромаркетинга — *eye-tracking*. *Damumed* — это основная государственная информационная система здравоохранения, предназначенная для облегчения работы медицинского персонала, тем самым повышая качество и доступность медицинских услуг для пациентов, где пациенты могут найти все записи на прием к врачу, паспорт здоровья и всю информацию, связанную со здоровьем. Это исследование направлено на достижение главной цели — хорошего здоровья и благополучия людей.

Методы: Использование инструмента нейромаркетинга с неструктурированными интервью для выявления ключевых особенностей юзабилити медицинского мобильного приложения.

Результаты: В целом, 23 респондента были разделены на две возрастные группы: молодые (18–24 года) и взрослые (35–44 года). Они включились в исследование, чтобы принять участие как в нейромаркетинговых исследованиях, так и в интервью. Взрослые испытывали трудности с пониманием навигации по приложению, в то время как молодые могли ориентироваться в приложении интуитивно.

Выводы: Нейромаркетинговые исследования и индивидуальные интервью прояснили оценку удобства использования интерфейса медицинского мобильного приложения. Поскольку респонденты имеют разный опыт работы, взрослым было немного сложно оценить интерфейс приложения. В этом отношении для старшего поколения было бы препятствием внедрять такого рода информационные системы.

Ключевые слова: цифровые медицинские услуги, медицинские организации, здравоохранение, медицинское приложение, цифровые маркетинговые коммуникации.

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