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DEVELOPMENT OF MOBILE APPLICATION FOR HEALTHY MATERNAL BEHAVIOR IN ORDER TO REDUCE FETAL MORTALITY

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Abstract

Pregnant women are not sufficiently analyzed in scientific studies, which leads to deficiencies in evidence-based treatment guidelines. There are more than two billion smartphone users in the world, which allows researchers to easily and inexpensively conduct large-scale studies using mobile applications, especially among pregnant women, whose use is extremely high, especially as an information channel. This is the first application for pregnancy research, that is, a popular application for them, for self-monitoring and training of expectant mothers. Due to the large-scale and simplified collection of data obtained through surveys, using the application, we strive to improve our understanding of the factors contributing to a healthy pregnancy, both for the mother and the developing fetus. In Kazakhstan, there are many mobile applications that provide only basic data, such as a reminder of a meeting with a doctor, a list of medical institutions, nearest pharmacies, surveys of consumers of medical services, etc. And our application is different in that pregnant women will receive useful information in addition to monitoring, as well as answers to their questions, that is, recommendations on their questions. And also this application will be sent for our country, namely for our mentality, but in the future we are considering, by improving this application, to try to launch them abroad.

Keywords: mobile application, expert system, fetal mortality, national health system, pregnant women.

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The main cause of infant mortality is conditions arising in the prenatal period, from which 270 babies (323) died in Kazakhstan in January-February, or 46.3% of the total number of deaths among infants (52.5%). The number of infants who died from congenital anomalies was 116 (113), or 19.9% (18.4%), from respiratory diseases - 68 (56), or 11.7% (9.1%), from infectious and parasitic diseases - 35 (26), or 6% (4.2%) and from accidents, poisoning and injuries - 22 (19) or 3.8% (3.1%) [1]. All these indicators are the result of the fact that during pregnancy, women fall ill with various diseases, do not reach a certain age, do not eat healthy food, endure all kinds of stress, face depression, do not engage in physical activity, do not manage their negative emotions, that all this negative sides are reflected to the child also [2, 3, 4]. The active introduction of information technologies in the healthcare sector has led to a large change in the quality of life of people. Medical costs are problematic not only in Kazakhstan but around the world. Therefore, it is necessary to apply inexpensive and effective solutions like the development of mobile medical applications. The goal of this project is to build a universal model of the system for the correct pregnancy process and with the further implementation of a mobile application. The main ideology of this work is to create a single national platform for the provision of advice and guidance during pregnancy. The main elements of the system (support system for women during pregnancy):

• Government support: health professionals, nutritionists, rules governing pregnancy

• The interest of regional and state structures in the healthcare sector in supporting socially vulnerable groups of the population.

The users of this application are all pregnant women of the Republic of Kazakhstan (this includes women who are planning a pregnancy, that is, all women in Kazakhstan over 18). According to statistics, these are 9,689,044 women. This is 52% of the total population for 2020 [5]. This application is necessary for every woman in our country so that they can give birth to a healthy baby. We strive to facilitate communication with the doctor, maintain proper and healthy nutrition for both the mother and the baby, maintain physical activity and the emotional state of the mother. Women will receive reliable recommendations, which have been confirmed by the Ministry of Health of the Republic of Kazakhstan. The most important task is to prevent all dangerous situations that can arise with a child in pregnant women.

Problem statement

Risk factors affecting infant mortality;

- Women's health. Early sexual activity, unprotected sexual relations, usually beginning in the teenage period, also increase the impact of risk factors, primarily on reproductive health, and a history of abortion.
- Child gender: boys die more often than girls. The stable excess of infant death in boys compared with girls is associated with objective reasons - the biological characteristics of the body of boys and girls, as well as behavioral reactions, which leads to greater mortality of boys from external causes.
- Maternal age: lowest infant mortality in children born to mothers 20-30 years old. The influence of the mother’s age on the level of infant mortality is expressed in the fact that it is most often observed in very young (up to 20 years) mothers. The mortality rate of children born to a woman older than 40 years is somewhat high, but until the end of the childbearing period it does not reach the same level as mothers under the age of 20 years.[6-8]

- The birth number of the child. The highest mortality of children is observed in the first-born and after 6-7 children, which is explained by the physiological characteristics of women in older age. The healthiest 4 child. The effect of the size of the interval between two subsequent births on infant mortality is expressed in the fact that the highest mortality rate is observed among children born with an interval within a year of the previous birth. With increasing intervals, the probability of death of subsequent children in the first year of life also decreases. The most favorable period between two births is two to three years.

One of the main reserves to further reduce neonatal mortality is to minimize the death of children from preventable causes. The analysis showed that the preventable causes of death were deaths at home, from birth injuries, respiratory distress syndrome, which is associated with untimely replacement therapy [9].

The cause of deaths is congenital anomalies and the so-called states of the prenatal period [10-11]. The structure of the causes of infant death in Kazakhstan [12].

- diseases of the prenatal period (hypoxia, asphyxia, birth trauma, intrauterine infection);
- congenital malformations;
- respiratory diseases;
- infectious diseases.

The following pathological processes are the main forms of non-infectious perinatal pathology [13]:

- Prematurity
- Tolerance
- Hypoxia (asphyxia) of the fetus and newborn
- Birth injury

- Pneumopathy
- Perinatal cerebrovascular accident
- Hemorrhagic disease of the newborn
- Hemolytic disease of the fetus and newborn.

Health workers should consider the age-related characteristics of the reactions of the child's body to ecopathogens. The general rule says: the younger the child, the more sensitive his body to pathogenic environmental factors. According to the respondents, in order to reduce infant mortality during the prenatal period [14]:

- family planning, the fight against abortion [15];
- maintaining a multivariate health analysis card for women of childbearing age;
- providing food for pregnant women, nursing mothers, young children (free of charge);
- prenatal diagnosis of fetal diseases, including medical genetic examination;
- providing highly specialized types of medical care for women and children.

The main organizational forms of work to preserve the health of the fetus and newborn are: nursing supervision of the pregnant woman and the further development of the infant, patronage, comprehensive and targeted preventive examinations and outpatient procedures aimed at preventing possible diseases, injuries, and timely detection of congenital and acquired pathological conditions [16-17]. Therefore, this application takes into account the current age, the presence in the history of infectious diseases, abortions, drug addiction, etc. The model considers the interaction of such factors as smoking, constant consumption of strong alcoholic beverages, sexual intercourse without barrier protection, excessive nutrition, obesity more than 20% of body weight, reduced consumption of fruits and vegetables, regular consumption of foods containing nitrates, living in an environmentally disadvantaged area, work in hazardous industries. Everyone knows

that to combat infant mortality in the country, it is necessary to attract practical doctors through the general council of obstetrician-gynecologists, neonatologists, pediatricians with the involvement of specialists in genetics, infections, immunology to jointly solve the problems of improving the health of children, girls of reproductive age, pregnant women, optimization childbirth [18]. If we take this problem into account, we can understand that, especially with regard to women's health, health tracking applications will be used by millions of women around the world and some of them are already used to study information during pregnancy [19]. These apps allow users to create profiles that include age and birth control information and keep a daily log of pregnancy-related symptoms, from beginning to end, providing a reliable source of pregnancy data. Pregnancy data collected by mobile apps for women's health is different from others and will provide reliable data and recommendations. Thus, data sets for mobile tracking pose new challenges, but also new opportunities for predicting pregnancy in a much wider population. To this end, there is an initiative to monitor the health status of pregnant women in order to prevent infant mortality.

Related work

In the process of analyzing and collecting data, 4 mobile applications frequently used by pregnant women were identified:

1) Pregnancy + is one of the popular apps. It has control over changes in weight, contractions, provides basic information during pregnancy, namely educational posts, to-do list, shopping list and calendar.

2) Pregnancy Tracker + Countdown to Baby Due Date - also has basic medical information, pregnancy calendar, contraction counter, the ability to get useful advice from other women, opportunity to share with the data, advice, information.

3) What to Expect Pregnancy Tracker is also an informative application where users can read publications of medical specialists and only in English, namely recommendations and advice for expectant mothers and fathers.

4) Contraction counter - an application that tracks contractions. There you can record the number of contractions and its time, frequency, and intensity. Helps during preparation for childbirth [20].

All of these applications mainly provide basic data that is repeated in each of them, but the uniqueness of our application is that there is a connection between the pregnant woman and the doctor, aimed at the emotional and moral state of the patient.

Proposed model

Tasks were set for the main elements of the system, such as:

1) encouragement of medical workers and healthcare workers for the allotted time and consultation, which contribute to the preservation of the life and emotional state of pregnant women;
2) the use of modern IT-tools for the development of a consulting and reference system available to everyone online;
3) the use of IT-tools for the implementation of global tasks in the field of healthcare, including indicators of social motivation;
4) notification and proper consultation of pregnant women, as well as psychological support and monitoring of their condition;
5) training of new specialists on the basis of practice thanks to this system, which makes it possible to analyze the history during pregnancy.

The application simplifies communication with the doctor, makes it possible to maintain proper and healthy nutrition for both the mother and the baby, to maintain physical activity and the

emotional state of the mother. Women will receive reliable recommendations, which have been confirmed by the Ministry of Health of the Republic of Kazakhstan. And also have the main following functionality:

- Chat with a doctor + speech recognition is a function that performs the work of a messenger, namely, the connection between a patient and a doctor. A woman can ask any questions about pregnancy that interest her in russian or kazakh.
- Geolocation - Tracking the patient's geolocation data to save time in an emergency.
- An emergency call is a direct call to a doctor, which also includes an emergency notification of a pregnant woman's family and friends.
- Medical record - a questionnaire and a patient's medical record, which stores the patient's personal data (name, surname, patronymic, IIN, telephone number, residence address, contact details of relatives, 3x4 photo, information about the patient's condition - information from the medical card from the clinic).
- FAQ - frequently asked questions and answers to them• Pregnancy calendar - detailed information about the development of the baby for each period of pregnancy.
- Intellectual Assistant - for voice search of an answer.

Methodology

Table 1

Methodology table

Research type	Qualitative, original data, experimental
Sources	arxiv.org, pubmed
Research methods	surveys, experiments
Practicalities	maternity hospital, pregnant women, statistics

Research type will be qualitative, cause we will work with a large amount of information, in order to describe any situation in the period of pregnancy, also we will collect original data, it means we will use data that were approved by the Ministry of Health of the Republic of Kazakhstan (Table 1). And another type is experimental, cause we will directly interact with pregnant women, take a survey about all cases from them, hear their wishes and test the application in all stages from the demo version to full readiness. Sources were conducted from various resources (arxiv.org, pubmed) found by using keywords in my direction. (mobile application, pregnant women, health, pregnancy process, medicine, pregnancy support program, recommendations of experts and doctors, expert systems).

Experimental results

The existing applications were analyzed, different functionalities were tested, the advantages and disadvantages of each of them were highlighted. The structure of the mobile application was formed and statistical analysis was carried out, that is, the classification of the main directions integrated into mobile applications and systems [21]. The main functions of existing mobile applications were highlighted and a table was compiled according to their results, which were divided into two categories: Kazakhstan applications and foreign applications. Questions for pregnant women were compiled in order to conduct a social survey among them. The survey was compiled using a research project carried out by WHO in the global network of medical institutions [22]. This system will include a home page with various sections: authorization (for both doctors and patients), services, about us, contacts, correspondence, patient card, etc. After authorization, each part will have the opportunity to enter their data, such as age, weight, name, blood type and other important aspects in order to regularly fill in their data. At that time, the mobile application will include various data such as a pregnancy calendar, contact with

the doctor, helpful advice and recommendations, physical activity, current health status, emergency calls, etc.

Conclusion

The research is being carried out to build a full-fledged universal model of the system. We define the main parameters, application and system functions, advantages for creating a new system model and then the implementation of a mobile application.

The main idea of this system is to provide effective and best services for pregnant women, realizing the information received so that doctors can use this data and give a quick and effective solution. After all, doctors can examine their patient regardless of time and place. And most importantly, quick work of the patient with the doctor using the current data and the current status of the pregnant woman.

To date, research is being carried out to build a full-fledged universal model of the system. We define the main parameters, advantages for creating a new system model and then the implementation of a mobile application. This study is not yet completed and is at the stage of implementation of the main stages.

References

1. Численность населения Казахстана на 1 марта достигла 18,67 млн человек, 16.04.2020, Ахметбеков Асхат, https://rus.azattyq-ruhy.kz/society/8072-chislennost-naseleniia-kazakhstana-na-1-marta-dostigla-18-67-mln-chelovek.
2. Dunson D.B., Baird D.D., Colombo B. (2004). Increased Infertility With Age in Men and Women. *Obstetrics & Gynecology*, 51-56.
3. Greil A.L. (1997). Infertility and psychological distress: a critical review of the literature. *Social Science & Medicine*, 1679–1704.
4. Liu B., Shi Sh., Wu Y., Thomas D., Symul L., Pierson E., Leskovec J. (2018). Predicting pregnancy using large-scale data from a women's health tracking mobile application, *The World Wide Web Conference*, 2999-3005.
5. О демографической ситуации за январь-март 2021 года, 15.05.2021, К. Рысбаев, https://stat.gov.kz/news/ESTAT416608.
6. Hantsoo L., Criniti S., Khan A., Moseley M., Kincler N., Faherty L. J., Epperson C.N., Ian M. Bennett. (2018). Mobile application for monitoring and management of depressed mood in a vulnerable pregnant population. *Psychiatr Serv.*, 104–107.
7. Faherty L.J., Hantsoo L., Appleby D., Sammel M.D., Bennett I.M., Wiebe D.J. (2017). Movement patterns in women at risk for prenatal depression: use of a mood-monitoring mobile application in pregnancy. *J Am Med Inform Assoc.*, 746–753.
8. Daly L.M., Horey D., Middleton P.F., Boyle F.M., Flenady V.(2017). The effect of mobile application interventions on influencing healthy maternal behavior and improving prenatal health outcomes: a systematic review protocol. *Syst Rev*, 6-26.
9. Andreev E.M., Kvasha E.A., Kharkov T.L. (2016). Mortality and longevity. // Population of Russia. *Book house "University"*, 39-79.
10. Kennedy B., Kerns E., Chan Y.R., Chaparro B.S., Fouquet S.D. (2019). Safeuristics! Do Heuristic Evaluation Violation Severity Ratings Correlate with Patient Safety Severity Ratings for a Native Electronic Health Record Mobile Application? *Appl Clin Inform*, 210–218.
11. von Dadelszen P., Magee L.A., Payne B.A.,Dunsmuir D.T., Drebit S., Dumont G.A., Miller S., Norman J., Pyne-Mercier L., Shennan A.H., Donnay F., Bhutta Z.A., Ansermino J.M. (2015). Moving beyond silos: How do we provide distributed personalized medicine to

pregnant women everywhere at scale? Insights from PRE-EMPT. *Int J Gynaecol Obstet*, S10-S15.

12. Isaev D.S. (2004). Methodology of managing medical and social prophylaxis of infant mortality. *Alma-Ata*, p.266.
13. Medovikov P.S. (1916). Causes of child mortality. *Petrograd*, 30-31.
14. Vinogradova I.V., Samoilova A.V. (2011). Reduction of neonatal mortality as a result of organizational activities of the obstetric care and childhood service. *Health. Chuvashia*, 15-20.
15. Snyder K., Dinkel D. (2019). Mental and physical support (MAPS) for moms: preliminary findings from a prenatal health support program. *Integr Med Res*, 8–14.
16. Liu B., Shi Sh., Wu Y., Thomas D., Symul L., Pierson E., Leskovec J. (2019). Predicting pregnancy using large-scale data from a women's health tracking mobile application. *Proc Int World Wide Web Conf.*, 2999–3005.
17. Miyamoto M., Pau L.F. (2018). Can female fertility management mobile apps be sustainable and contribute to female health care? *Harnessing the power of patient generated data; Analysis of the organizations active in this e-Health segment*,1-71.
18. Baranov A.A. (2007). Mortality of the child population. *Child mortality rate in Russia*, p.328.
19. Zhihan L., Chirivella J., Gagliardo P. (2016). Preprint: Bigdata Oriented Multimedia Mobile Health Applications., [arXiv:1603.06243]
20. Лучшие приложения для беременных, 17.04.2020, Наталья Торжанова, https://ru.ccm.net/faq/6133-lucshie-prilozhenija-dla-beremennih.
21. Raghupathi, W., Raghupathi, V.(2013). An overview of health analytics. *J Health Med Informat*.
22. Global survey on maternal and perinatal health, https://www.who.int/reproductivehealth/topics/maternal_perinatal/globalsurvey.