



**Digital Technologies in Education, Science and Industry 2023**



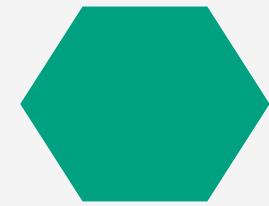
# **Design and Development of Student Digital Health Profile**

**Madina Mansurova**

Al- Farabi Kazakh National University  
Head of the Department of Artificial intelligence & Big Data

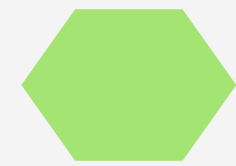


# Agenda

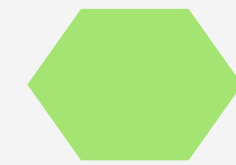


## **Design and Development of Student Digital Health Profile (SDHP)**

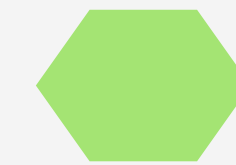
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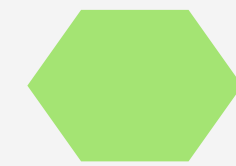
**Introduction**



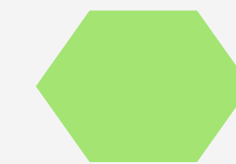
**Data sources**



**Design of SDHP System**



**Development of SDHP System**

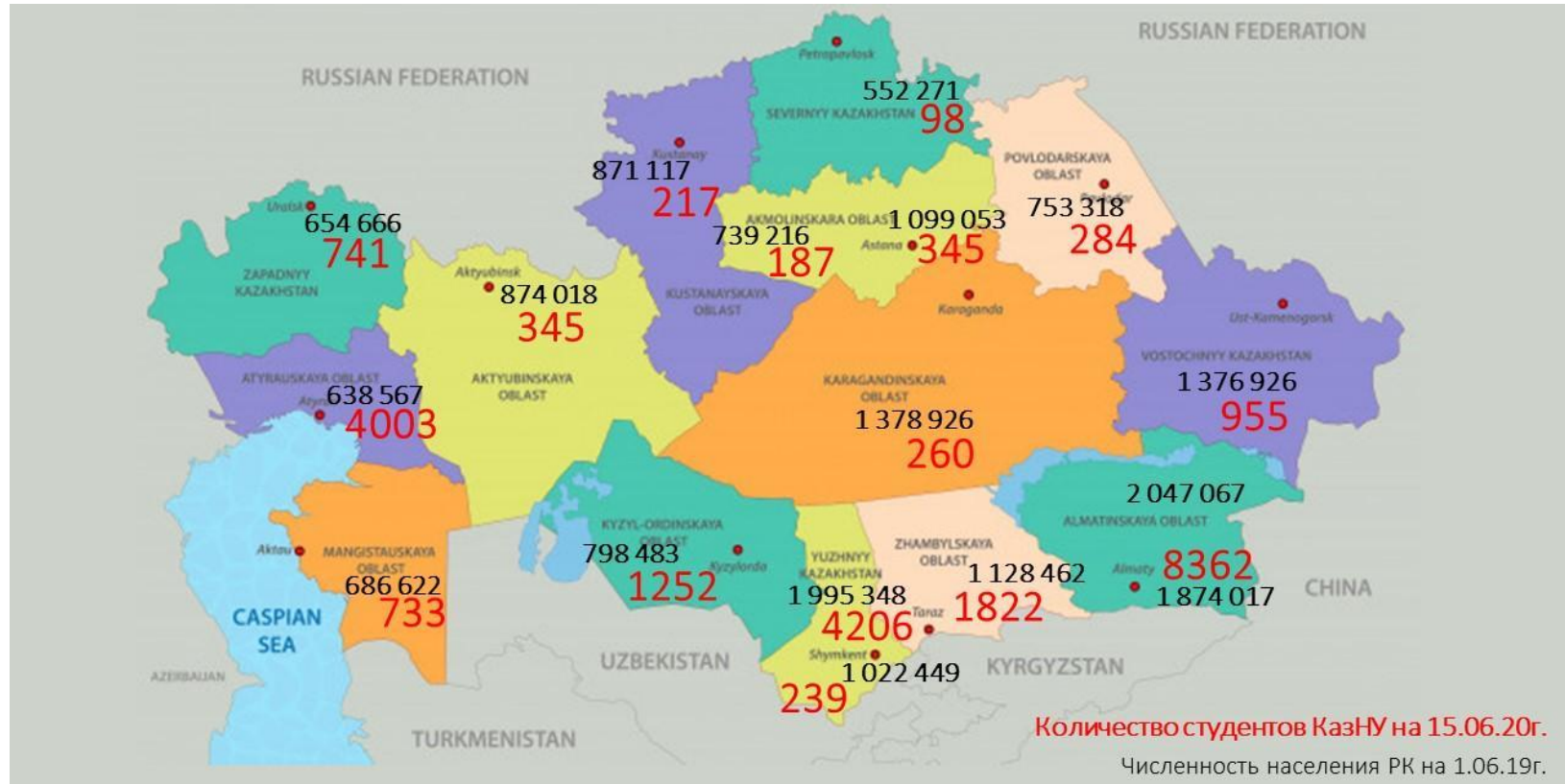


**ML for Assessment Key Factors Influencing on Quality of Student Life**

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# Introduction



Contingent of Al-Farabi KazNU students by region of residence

- The health of young people is a key factor in the intellectual, economic, and political reserve of society.
- Demographic situation in Kazakhstan: youth (age 14-29 years) make up only 19.6% of the population.
- The period of adaptation at the university is a difficult stage associated with a new environment, establishing social connections, adapting to a new regime and learning environment.

## Idea:

- Develop and provide stakeholders with intelligent decision support tools based on the collection and analysis of student health data;
- Develop of the student digital health profile;
- Transform raw information obtained from various heterogeneous sources into knowledge and recommendations that support the decision-making process.

# Examples of Digital Health Platforms

## Youth Risk Behavior Surveillance System

**View all responses for one location**

View survey results for the United States, a state, a territory or selected location. To view U.S. data, click the View U.S. Data link. To choose a specific location, make a selection in the dropdown menu or click a location on the map.

**Select Location:**

State, Local Site, Territory, or Other  [View U.S. Data](#)

**Data availability**  Data available (includes 2019)  
 Data available (does not include 2019)  
**Data updates**  Data not available

**View one question for all locations**

View results for one question for all states and locations that have data available. To choose a question, first select a Health Topic.

**Select a Health Topic:**

[Unintentional Injuries and Violence](#)

[Tobacco Use](#)

[Alcohol and Other Drug Use](#)

[Sexual Behaviors](#)

[Dietary Behaviors](#)

[Physical Activity](#)

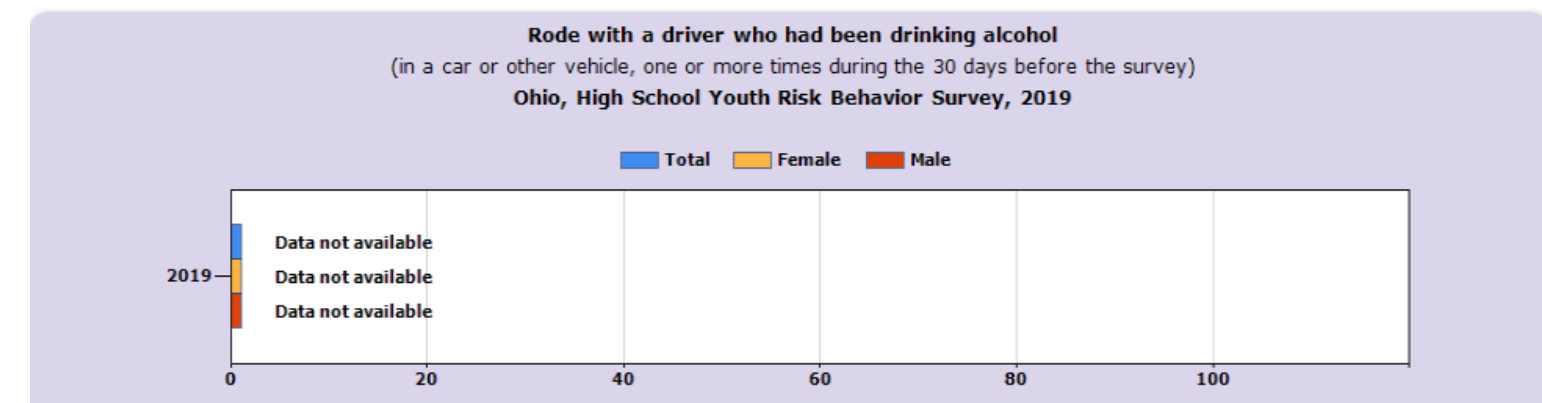
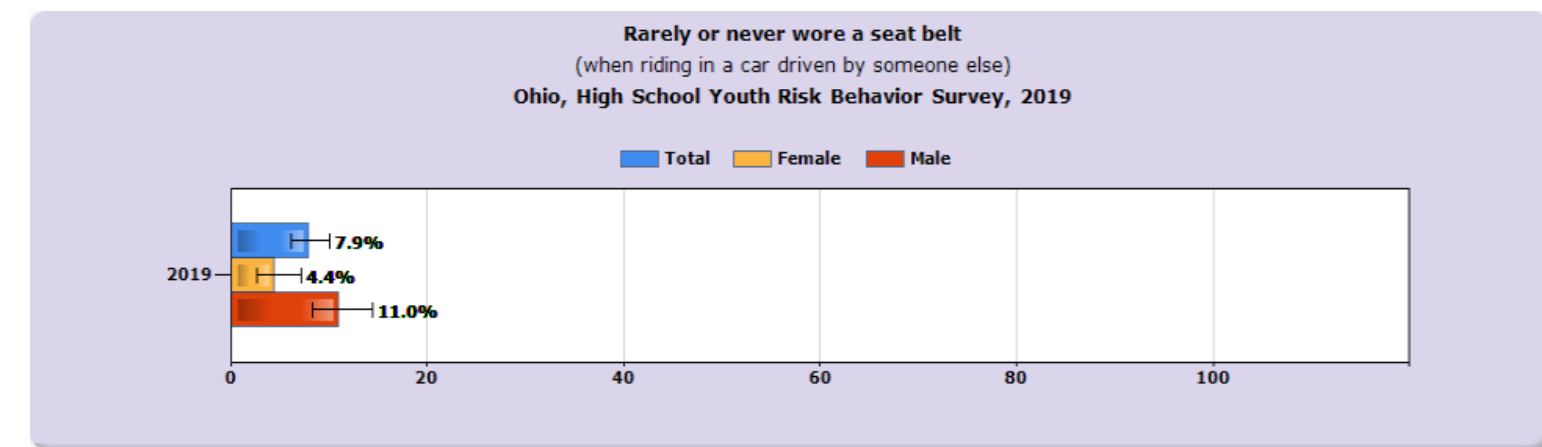
[Obesity, Overweight, and Weight Control](#)

[Other Health Topics](#)

<https://nccd.cdc.gov/YouthOnline>

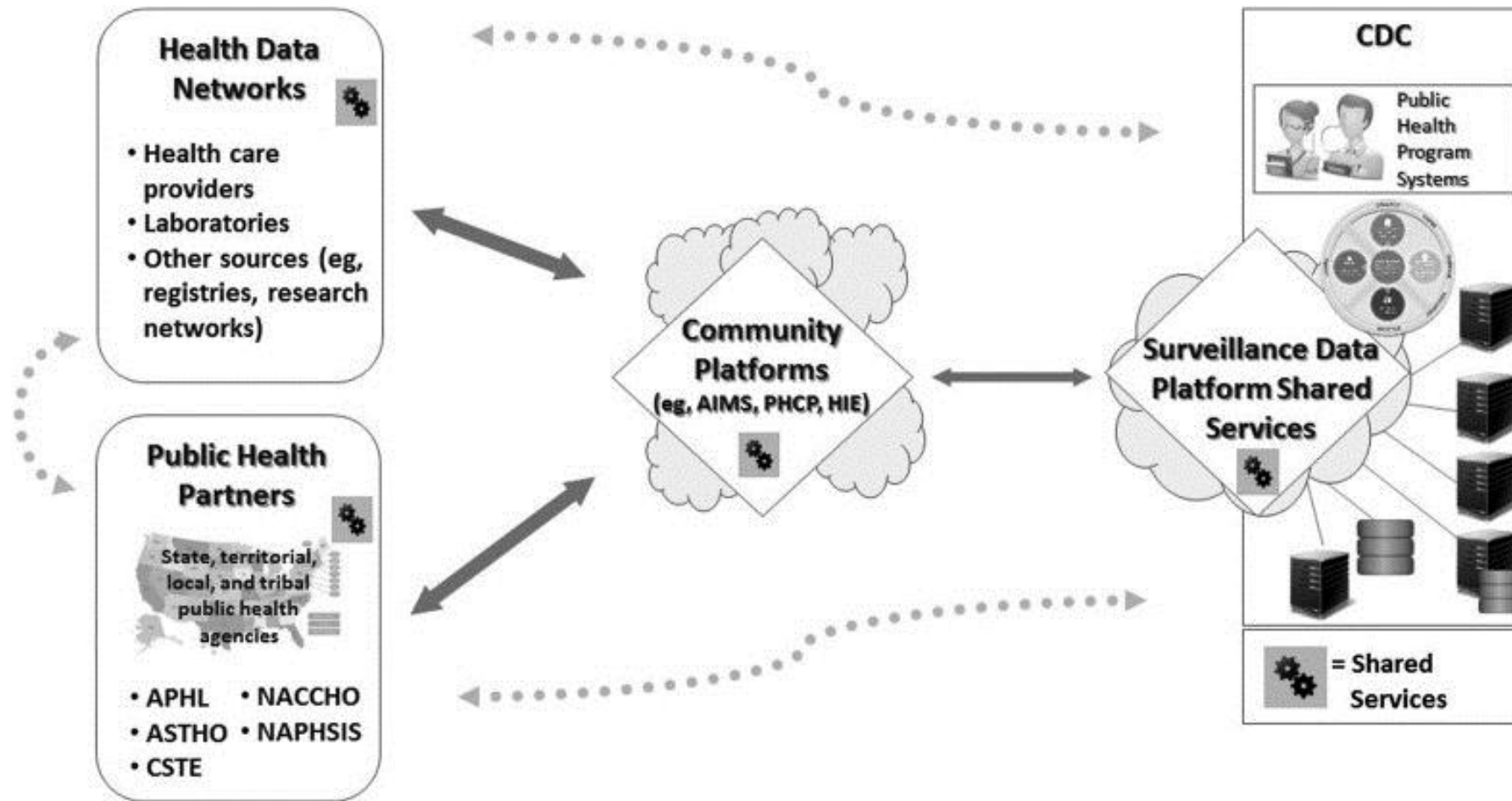
**CHOOSE TABLE CONTENT**

**Question:**  **Location:**  **Year:**





# Examples of Digital Health Platforms

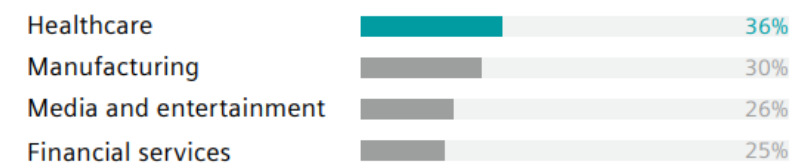


<https://www.cdc.gov/healthyschools/about.htm>

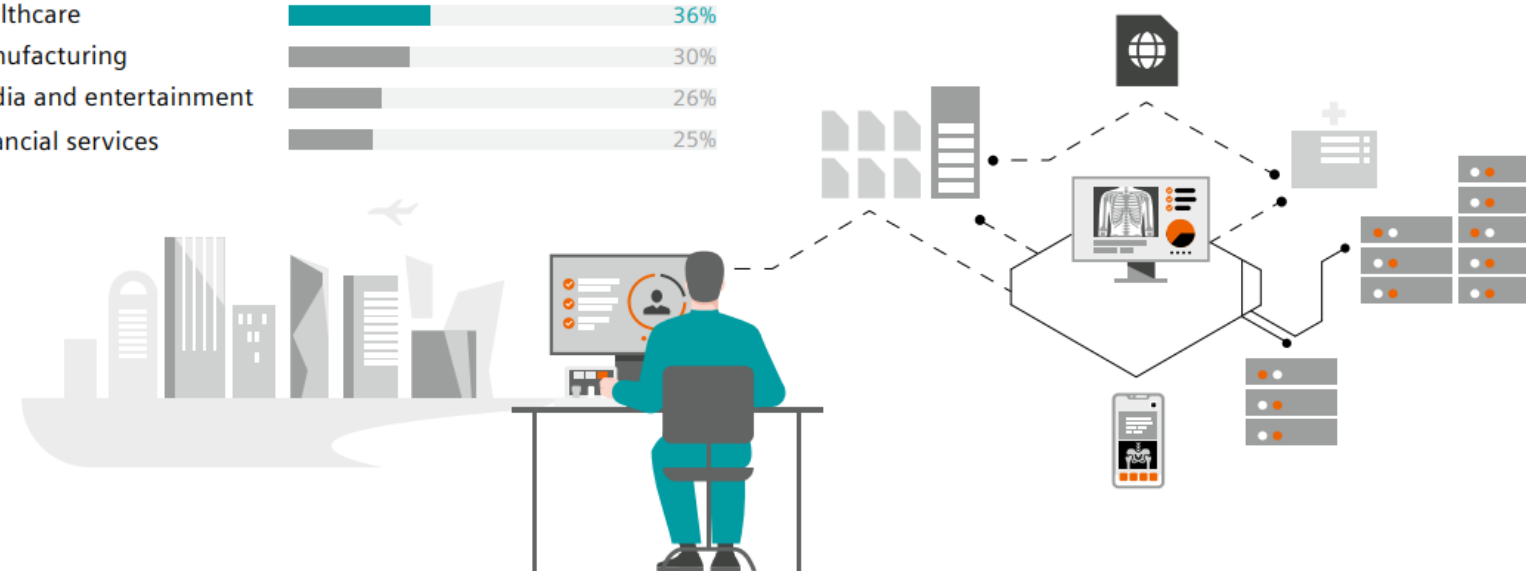


[https://www.who.int/health-topics/adolescent-health#tab=tab\\_1](https://www.who.int/health-topics/adolescent-health#tab=tab_1)

Average annual growth rate of data (2018–2025)<sup>6</sup>

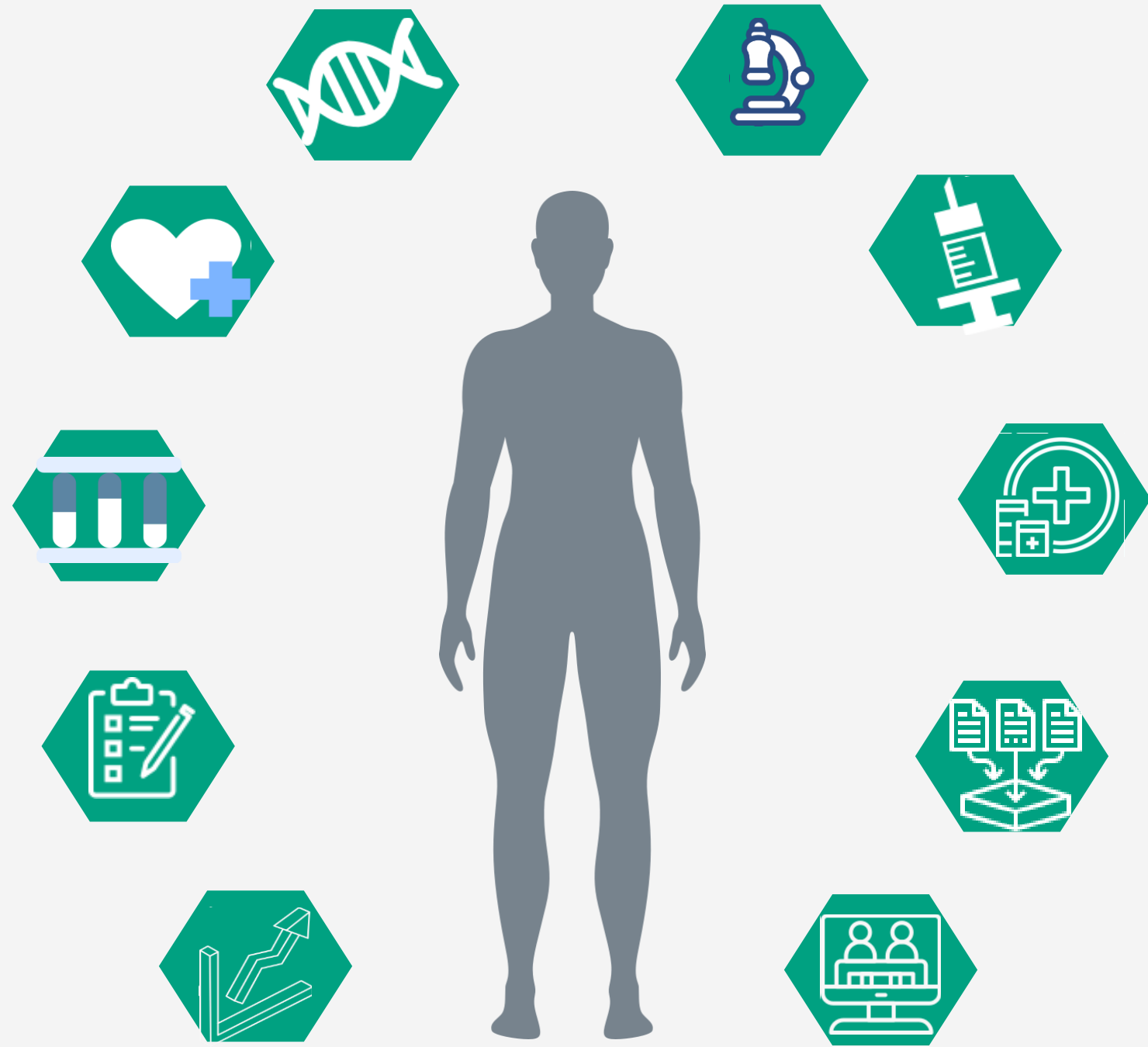


Both the volume of data and the number of locations where it is stored are growing



<https://www.siemens-healthineers.com/insights/news/digital-platforms-in-healthcare>

# Contribution of our research



- Creation of a digital **aggregator of** questionnaire data with the Data Mining of health indicators and disease risk factors based on the international classification of functioning, disability and health.
- A system for integrating data extracted from various heterogenic sources based on cloud technology.
- Digital profile of a student's health integrated with the university's LMS.
- Highlighting key indicators for assessing the student's quality of life.



# Road map to Student Healthcare



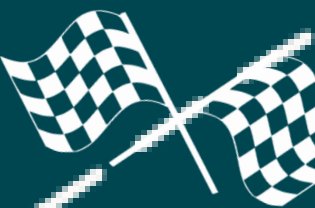
**Arrival at the university**

**Taking surveys**

**Automatic data processing and SDHP generation**

**Physical examination**

**Additional examination if abnormalities are detected**

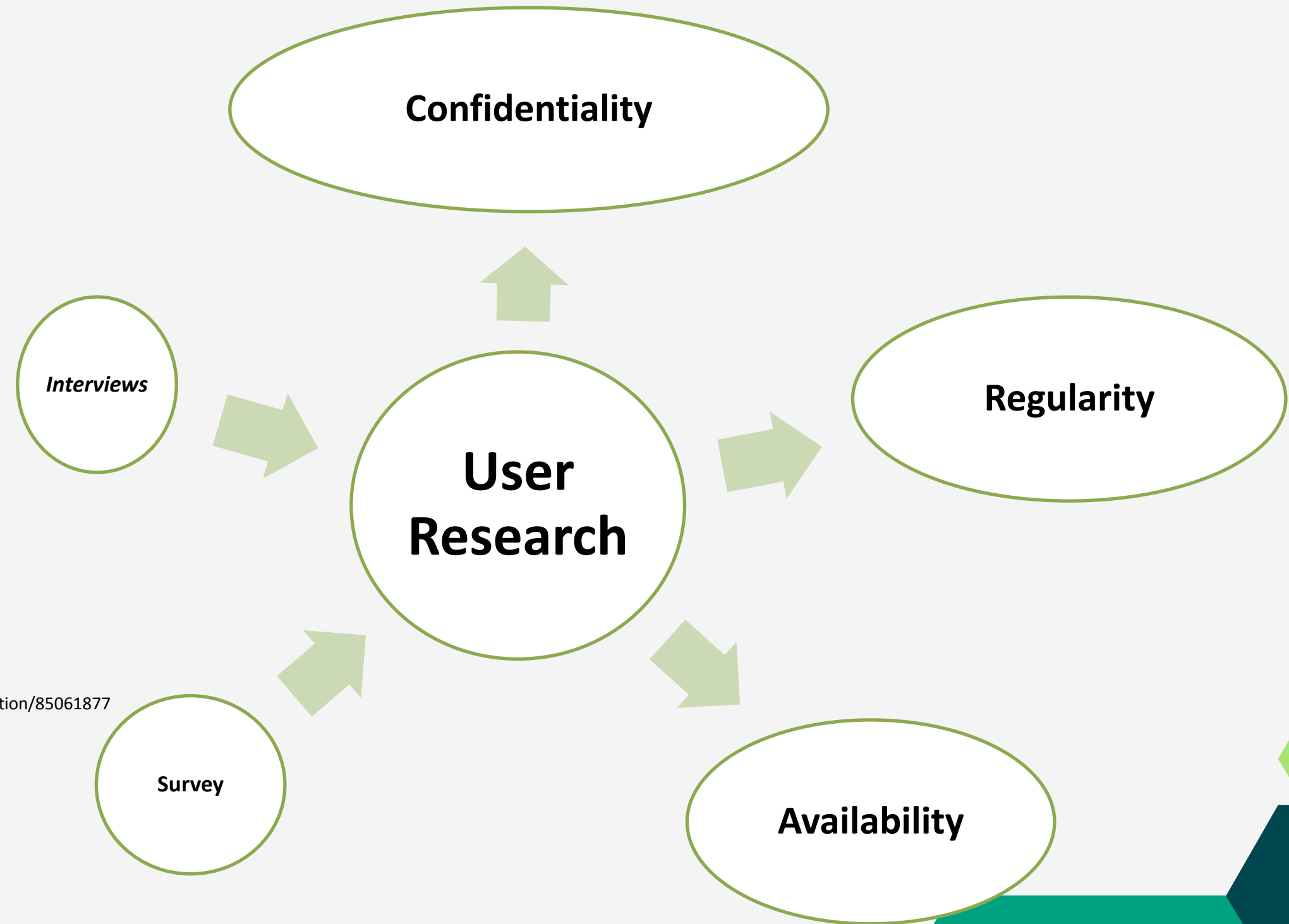




# Demand analysis



<https://health.economictimes.indiatimes.com/news/health-it/the-role-of-digital-healthcare-platforms-in-innovation/85061877>







# Data Sources

Опросник - приложение ASP.N

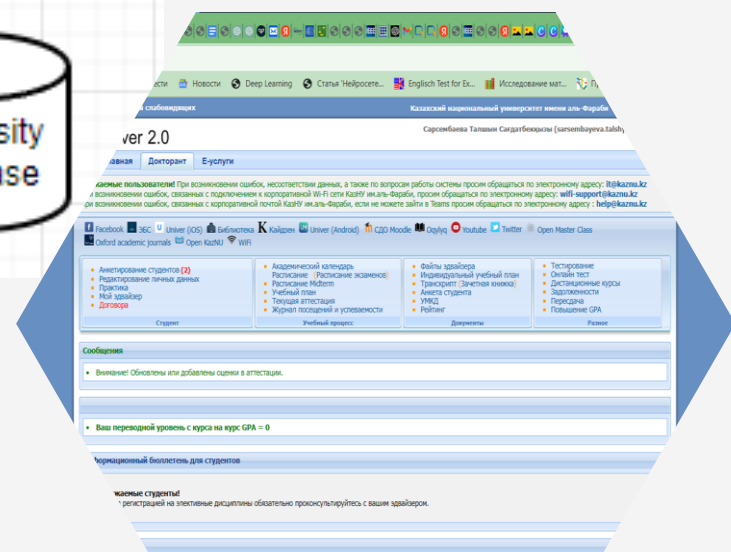
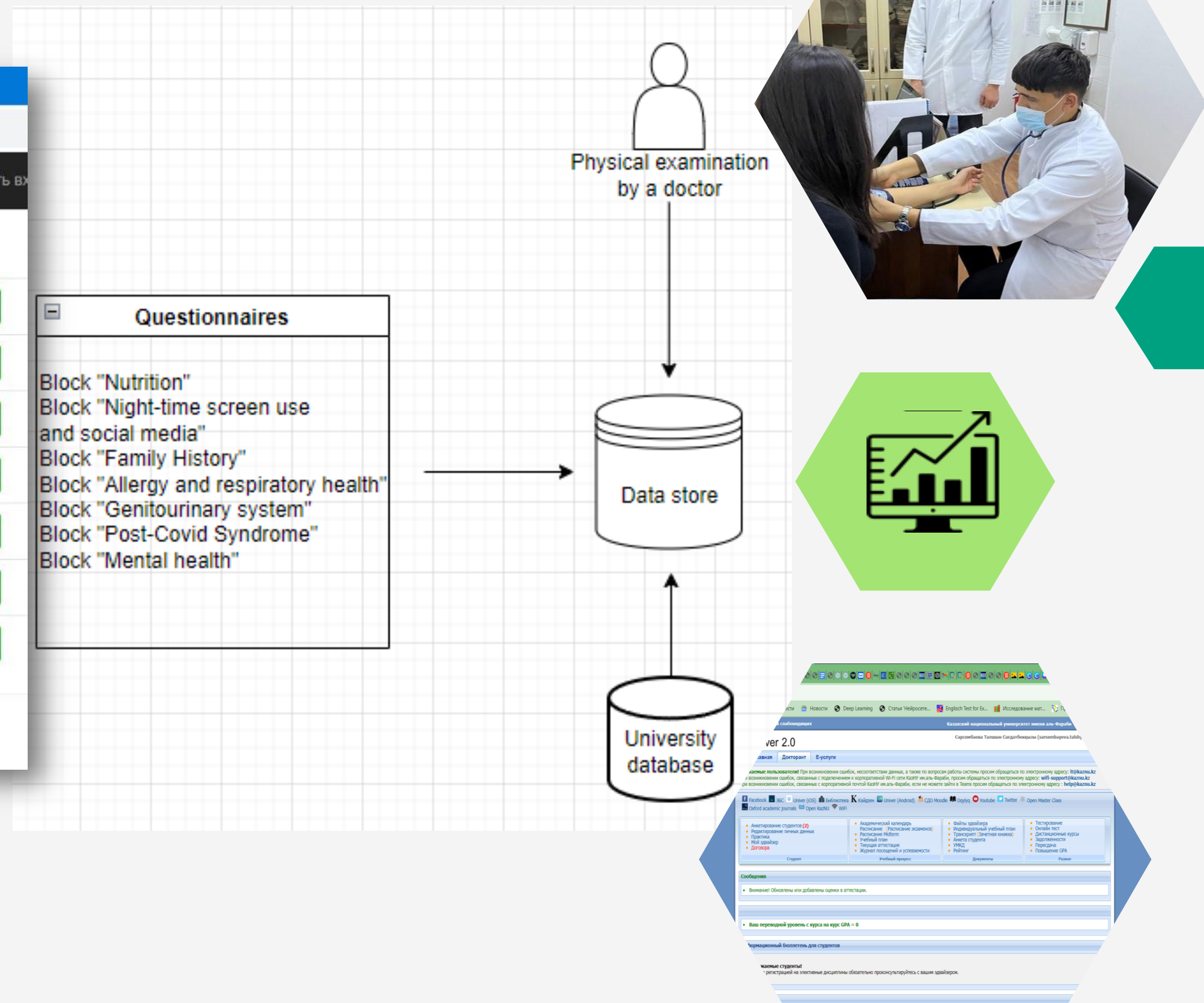
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## Опросник

Постковидный синдром	Осталось 367 дней	<a href="#">Пройти опросник</a>
Психическое здоровье	Осталось 246 дней	<a href="#">Пройти опросник</a>
Мочеполовая система	Осталось 135 дней	<a href="#">Пройти опросник</a>
Аллергия и респираторное здоровье	Осталось 154 дней	<a href="#">Пройти опросник</a>
Семейный анамнез	Осталось 48 дней	<a href="#">Пройти опросник</a>
Использование экранов в ночное время и социальные сети	Осталось 101 дней	<a href="#">Пройти опросник</a>
Питание	Осталось 26 дней	<a href="#">Пройти опросник</a>

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# Questionnaires

	name or direction of the questionnaire	description
1	"Nutrition" block	This questionnaire contains questions regarding the eating habits of students. It allows you to assess how healthy and balanced nutrition students prefer, including the level of consumption of fast food , fresh fruits and vegetables, as well as the importance of drinking water and PN.
2	Block "Night-time screen use and social media"	This questionnaire focuses on students' nighttime screen use (e.g., smartphones, tablets, computers) and their social media activity. Such a survey will help determine how common the behavior is, whether addiction is present, and how it may affect sleep and mental health.
3	Block "Family History"	Contains questions regarding hereditary factors and diseases in students' families.
4	Block "Allergy and respiratory health"	This questionnaire contains questions related to their state of the respiratory system, the presence of allergies and breathing problems. This will allow us to assess the prevalence of respiratory diseases and allergies among respondents.
5	Block "Genitourinary system"	It will identify possible problems associated with the bladder, kidneys and other organs.
6	Block "Post-Covid Syndrome"	This questionnaire contains questions regarding possible consequences and symptoms after suffering from COVID-19. It will help understand how people cope with post-Covid syndrome and whether it affects their overall health
7	Block "Mental health"	This block includes questions related to the general mental health of students, as well as symptoms of anxiety and depression. It also includes the GAD-7 scale and the Beck scale , which assess the level of anxiety and severity of depressive symptoms.



## Data Privacy, Security and Confidentiality

- Protection of Student Health Information
- Compliance with Regulations



## Validation of the Questionnaire

Carrying out survey with focus groups for improvement of questionnaire and correction of questions




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Тел: +7 (727) 2211612. Телеракс: +7 (727) 3773453.

050040, г. Алматы, пр. аль-Фараби, 71.  
Тел: +7 (727) 2211612. Телеракс: +7 (727) 3773453.  
Қазақстан Республикасының Ғылым және Ғылым министрлігі, денсаулық сақтау қорғаныс жүйесі  
"әл-Фараби" атындағы Қазақ ұлттық университеті  
республикалық мемлекеттік қоспаны  
«Қоғамдық денсаулық сақтау жоғары мектебі»  
Этикалық комитет

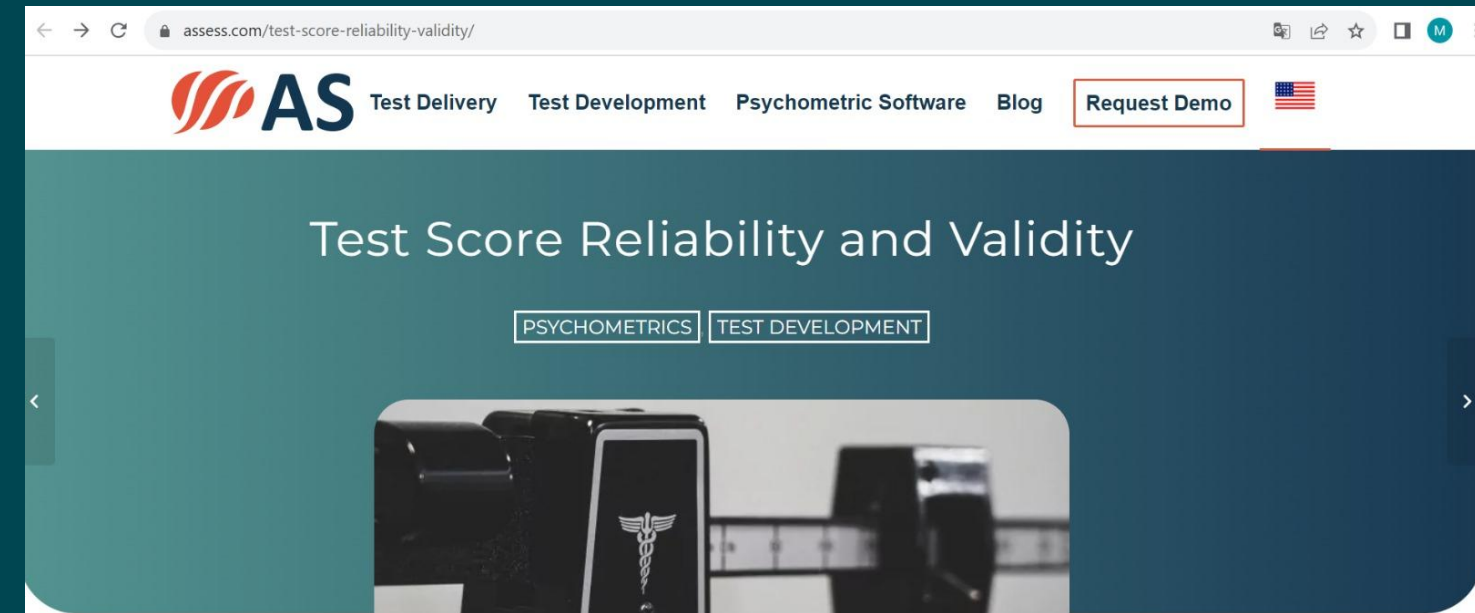
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№ 257414

**Локальный Этический Комитет  
факультета медицины и здравоохранения  
Казахского Национального университета имени аль-Фараби**

Одобрение Локального Этического Комитета факультета медицины и здравоохранения (IRB00010790 al-Farabi Kazakh National University IRB #1)  
Протокол № IRB – A148  
Название исследовательского проекта: «Разработка интеллектуальной информационно-аналитической системы оценки состояния здоровья студентов Казахстана»  
Дата одобрения: 20.08.2020 г.  
Дата истечения одобрения: 19.08.2021 г. (с последующим продлением)  
20 августа 2020 года на онлайн- заседании ЛЭК ФМЗ был рассмотрен и одобрен исследовательский проект «Разработка интеллектуальной информационно-аналитической системы оценки состояния здоровья студентов Казахстана», подготовленный кафедрой фундаментальной медицины Высшей Школы медицины факультета медицины и здравоохранения Казахского Национального университета имени аль-Фараби.  
Исследователи обязаны информировать Локальный Этический Комитет о любых предполагаемых изменениях в протоколе заранее и предоставлять необходимые документы в ЛЭК для рассмотрения, за исключением тех случаев, когда подобные изменения необходимы для немедленного предотвращения вреда для участников исследования. Также, о любых серьезных и неожиданных неблагоприятных событиях или других осложнениях, представляющих риск для субъектов исследования, должно быть доложено Локальному Этическому Комитету в кратчайшие сроки.  
Заявки на продление одобрения должны подаваться за 30 дней до даты истечения срока утверждения данного исследования.

Председатель ЛЭК ФМЗ  Г.М. Усатаева

01191

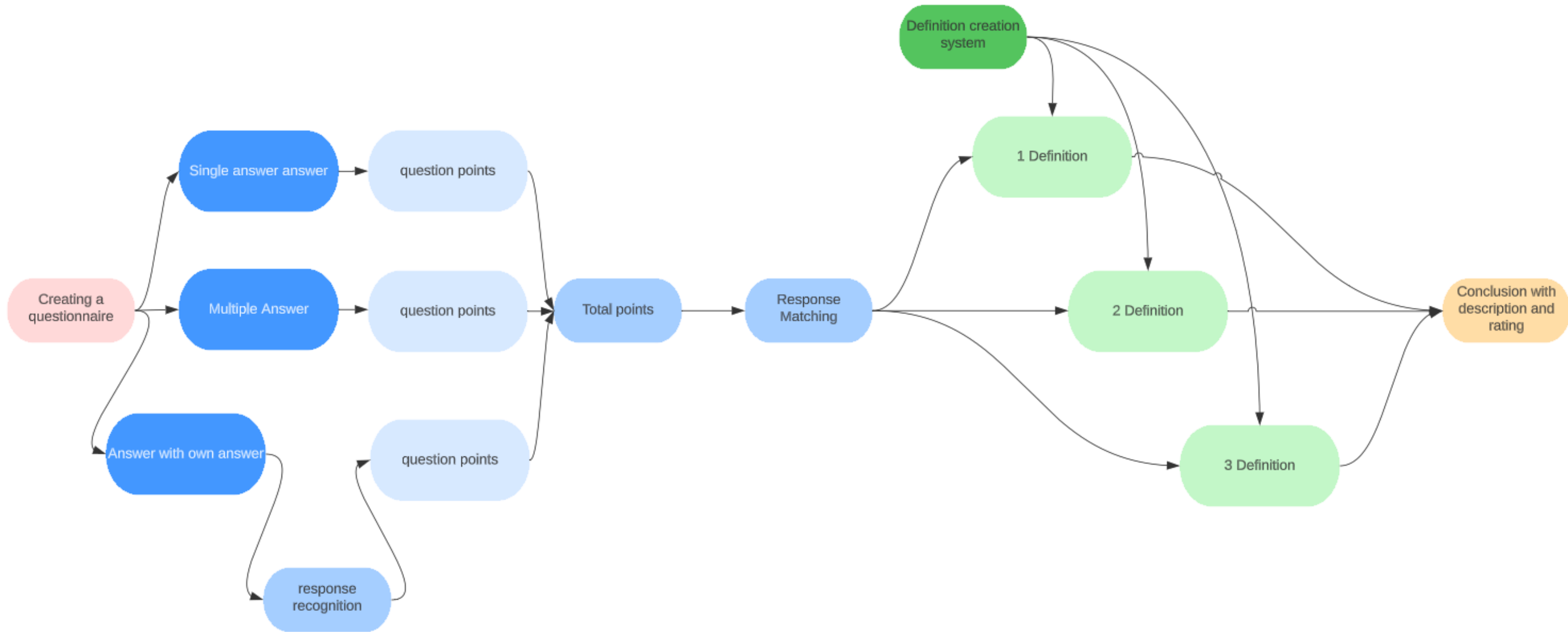


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<https://assess.com/predictive-validity>  
<https://assess.com/content-validity-in-assessment/>



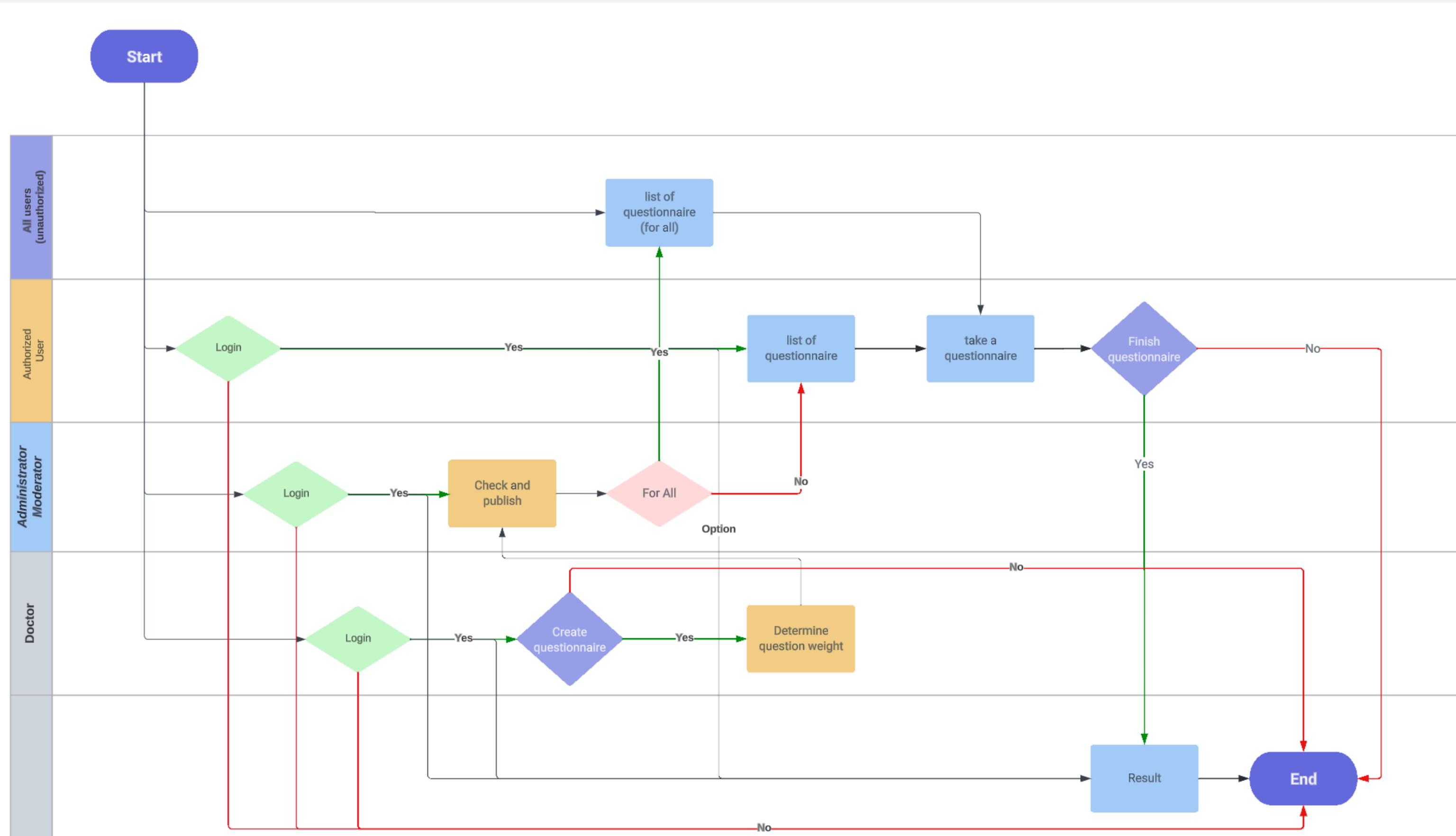


# Structure of modules for data collection





# Work structure for creating and receiving responses to downloaded questionnaires





# Activity interface with questionnaires

## Список вопросов в опроснике "Питание"

[Зодать новый вопрос](#) | [Вернуться в список опросников](#)

ID	Вопрос на русском	Вопрос на русском	Вопрос на русском	Тип вопроса	Heavy
8	Во сколько вы ужинаете?	Сіз қайуақытта кешкі ас ішесіз?			
7	Что входит в ваши перекусы?	Сіздің тағамдарыңызға не кіреді?			
6	Как часто в течение дня вы делаете перекусы?	Күні бойы сіз тіскебасарларды қаншалықты жиі жасайсыз?			
5	Что входит в ваш обед?	Сіздің түскі асыңызға не кіреді?			
4	Как часто вы обедаете?	Сіз қаншалықты жиі түскі ас ішесіз?	Сіз қаншалықты жиі түскі ас		
3	Что входит в ваш завтрак?	Сіздің таңғы асыңызға не кіреді?	What is included in your break		

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### Questionnaire

Asthma control test, ACT	You can pass at any time	Complete the questionnaire
Risk of diabetes and obesity	You can pass at any time	Sign in to submit
NIGHT SCREEN USE AND SOCIAL MEDIA	You can pass at any time	Sign in to submit
Nutrition	You can pass at any time	Complete the questionnaire

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### Do you have any special food preferences?

- I eliminate animal products from my diet.
- I eliminate dairy products from my diet.
- I exclude fish and fish products from my diet.
- I eliminate poultry from my diet.
- I eliminate gluten from my diet.
- No, I don't have any particular dietary preferences.

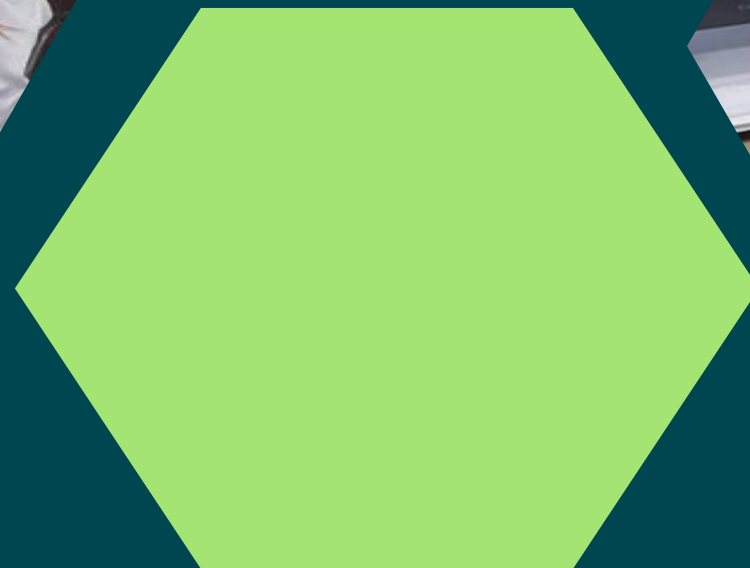
Answer

Back

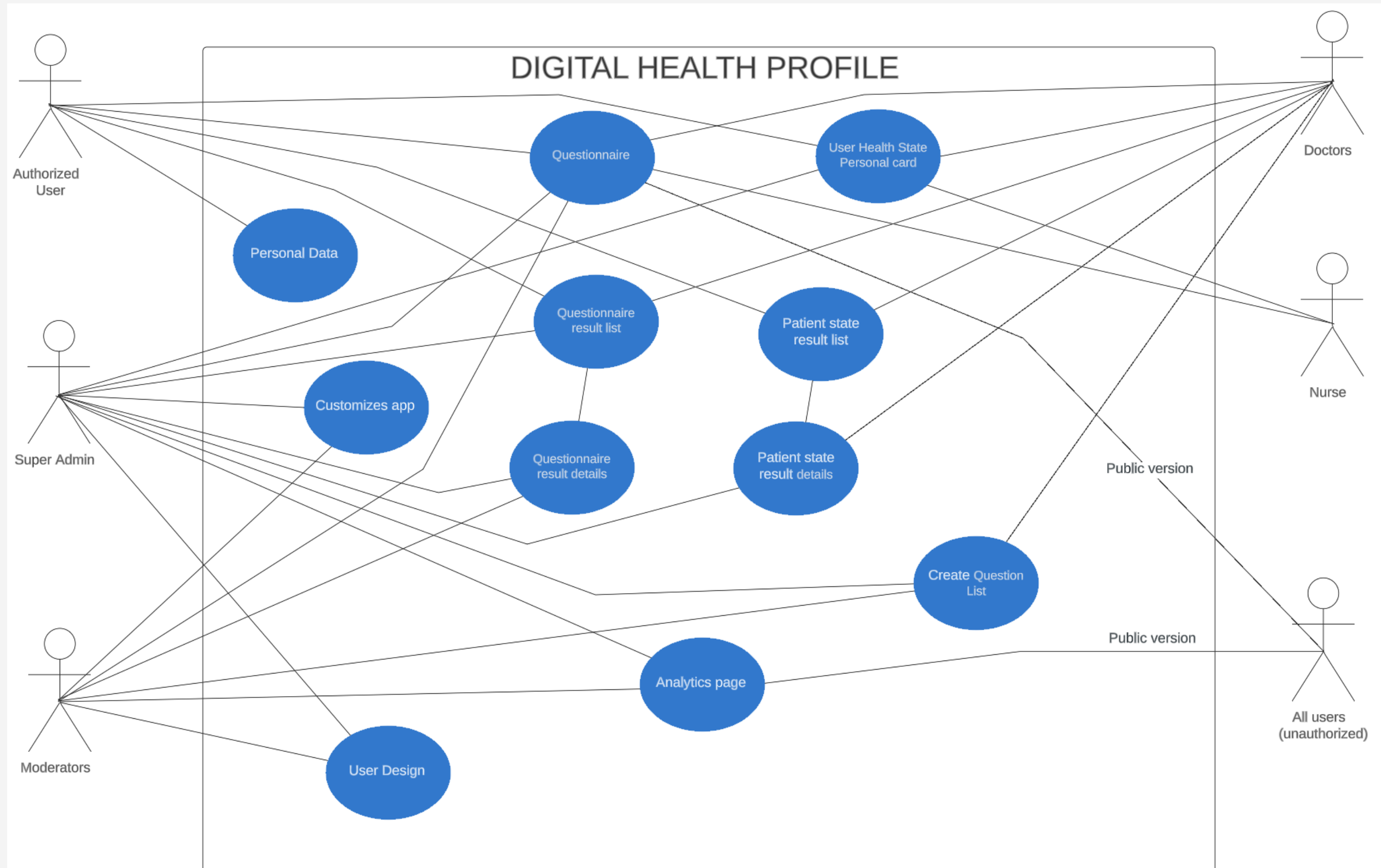
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# Physical examination



# UML use case diagram of Student Digital Health Profile







# Student Digital Health Profile

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## DIGITAL HEALTH PROFILE

An electronic document containing information about the health of a particular person. It may include health data, medical history, laboratory and instrumental test results, medications and dosages, and other data that may be useful in providing medical care.

### Health data integration

The digital health profile system integrates data from various sources such as e-health, medical devices and mobile applications. This allows you to have a complete and up-to-date view of your health on one platform.

### Ease of communication with medical professionals

The ability to use telemedicine platforms allows you to quickly contact doctors and get advice or a second opinion on medical issues, especially if access to specialists is limited.

### Saving time and resources

The digital health profile system simplifies health management processes, avoiding repeated examinations and unnecessary visits to doctors. This helps save time and reduce medical costs.

**A digital health profile makes it** easier to monitor health, make treatment more personalized, improve care coordination, and reduce errors in diagnosis and treatment. However, when using such technologies, it is necessary to ensure the protection of personal data and respect for the privacy of patients.

The digital health profile system promises to revolutionize healthcare by making it more accessible, efficient and personalized. It enables people to take an active part in managing their health and provides new opportunities for disease prevention and treatment.

**The benefits of a digital health profile system** certainly exist and can attract many users. Here are some key benefits:

1. Convenience and accessibility: You can access your digital health profile anytime, anywhere through your computer or mobile device. This allows you to control your health indicators and monitor your condition without the need to visit doctors.
2. Personalized care: Through data analysis and the use of artificial intelligence, the digital health profile system can provide personalized recommendations for healthy lifestyle, nutrition and treatment. This helps to achieve more effective results and improve overall health.
3. Preventive care: Tracking various health indicators allows you to identify problems and risks of diseases at an early stage. This contributes to a more effective application of preventive measures and reduces the likelihood of developing serious diseases.
4. Emergency and chronic disease monitoring: For people with chronic diseases or risk conditions, the digital health profile system can provide monitoring and emergency alerts in case of problems.

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WhatsApp x Details - приложение ASP.NET x +

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300 потрясающих... Создание собствен... Дипломный проек... T рерайт антиплагиат а

Hinfo.kz Информация Специалисты Опросник Аналитика Контакт

## gauhar.isaeva18@gmail.com

### Ваши персональные данные

Вы с нами с июн. 12.2023

Дата	Gaukhar
Фамилия	Issayeva
Отчество	Kanatkyzy
Имя пользователя	gauhar.isaeva18@gmail.com
Рост (см)	161
Вес (кг)	55
Индекс массы тела	0
ИИН	0
Дата создания	12.06.2023 1:00:38
День рождения	18.04.2002
Гражданство	citizenship
Пол	2
Семейное положение	1
Факультет	
Личный тел. номер	
Адрес проживания в настоящее время	ал-Фараби 71/28
Имеется ли доп. работа	<input type="checkbox"/>
Группа инвалидности	no
Есть ли у вас хроническое заболевание?	<input type="checkbox"/>

Назад Редактировать данные Сменить пароль



# ML for Assessment Key Factors Influencing on Quality of Student Life (I)



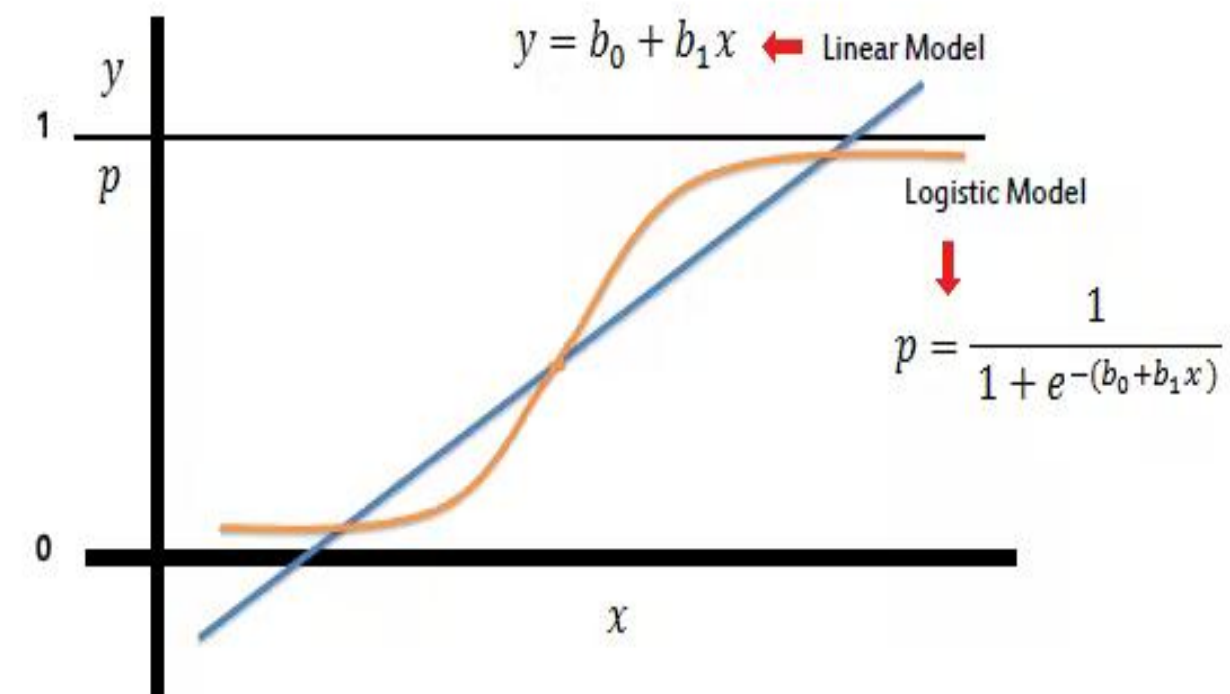
To quantify the overall well-being of students, we developed an aggregated "Student Well-being Score". This score was calculated using the responses to the questions encompassing both physical and mental health indicators. The questions ranged from psychological feelings such as anxiety, worry, irritability, fear, and feelings of failure or guilt to perceptions of self-image, ease of work, and interpersonal interest. Physical symptoms and conditions such as sleep quality, tiredness, appetite and weight changes, as well as health concerns, were also considered.

## Data Preprocessing and Cleaning

- Integration of separate data sets into a single dataset, representing each student with a unique row, and each question or characteristic with a unique column.
- Identify columns with missing values using standard data analysis tools. Using imputation methods to handle missing values.
- Convert responses to numeric format using one-hot and label encoding methods for compatibility with analytical tools.
- Outlier detection and processing: Using boxplot and Z-score methods to identify outliers. Correct or retain outliers depending on the nature of the data.
- Bringing numerical data to a common scale to prevent any feature from unduly influencing analytical models.
- Removing duplicate entries to ensure each student response is unique.
- Anonymize responses to sensitive questions, ensure data security, and use only aggregated, anonymized data in analysis.

## Assessment of the Influencing on Selected Factors

- Application of machine learning (logistic regression) to determine the influencing factors on the quality of life of students.
- Iterative selection of main factors (k ranging from 20 to 140) using ANOVA F-value to assess their association with the target variable.



# ML for Assessment Key Factors Influencing on Quality of Student Life (II)



$$Y = b_0 + b_1x_1 + b_2x_2 + \dots + b_nx_n$$

- $b_0$  - shift coefficient ( intercept), which represents the value of the dependent variable when all independent variables are equal to zero
- $b_1, b_2, \dots, b_n$  - regression coefficients that determine the weight or importance of each independent variable
- independent variables (features) used to predict the dependent variable
- $x_1, x_2, \dots, x_n$  - the dependent variable (target variable) for which we predict values.

$Y$  In our case, quality of life can be assessed by:

$$\begin{aligned} Y = & 3.08E - 01 \cdot x_1 + 1.28E - 01 \cdot x_2 + 6.40E - 02 \cdot x_3 - 9.06E \\ & - 04 \cdot x_4 + 8.99E - 01 \cdot x_5 + 3.84E - 01 \cdot x_6 + 3.32E - 01 \\ & \cdot x_7 + 2.86E - 01 \cdot x_8 + 8.47E - 02 \cdot x_9 + 5.42E - 01 \cdot x_{10} \\ & + 6.73E - 01 \cdot x_{11} - 3.51E - 01 \cdot x_{12} - 1.42E - 01 \cdot x_{13} \\ & + 4.39E - 01 \cdot x_{14} - 1.78E - 02 \cdot x_{15} + 9.88E - 01 \cdot x_{16} \\ & - 1.05E + 00 \cdot x_{17} + 2.47E - 01 \cdot x_{18} + 5.18E - 01 \cdot x_{19} \\ & + 1.73E - 01 \cdot x_{20} - 5.44E - 01 \cdot x_{21} - 5.85E - 02 \cdot x_{22} \\ & - 1.47E - 01 \cdot x_{23} - 2.49E - 01 \cdot x_{24} + 7.47E - 01 \cdot x_{25} \\ & + 1.09E + 00 \cdot x_{26} + 5.71E - 01 \cdot x_{27} - 5.69E - 02 \cdot x_{28} \end{aligned}$$

These coefficients determine the importance and direction of influence of each independent variable on the dependent variable.

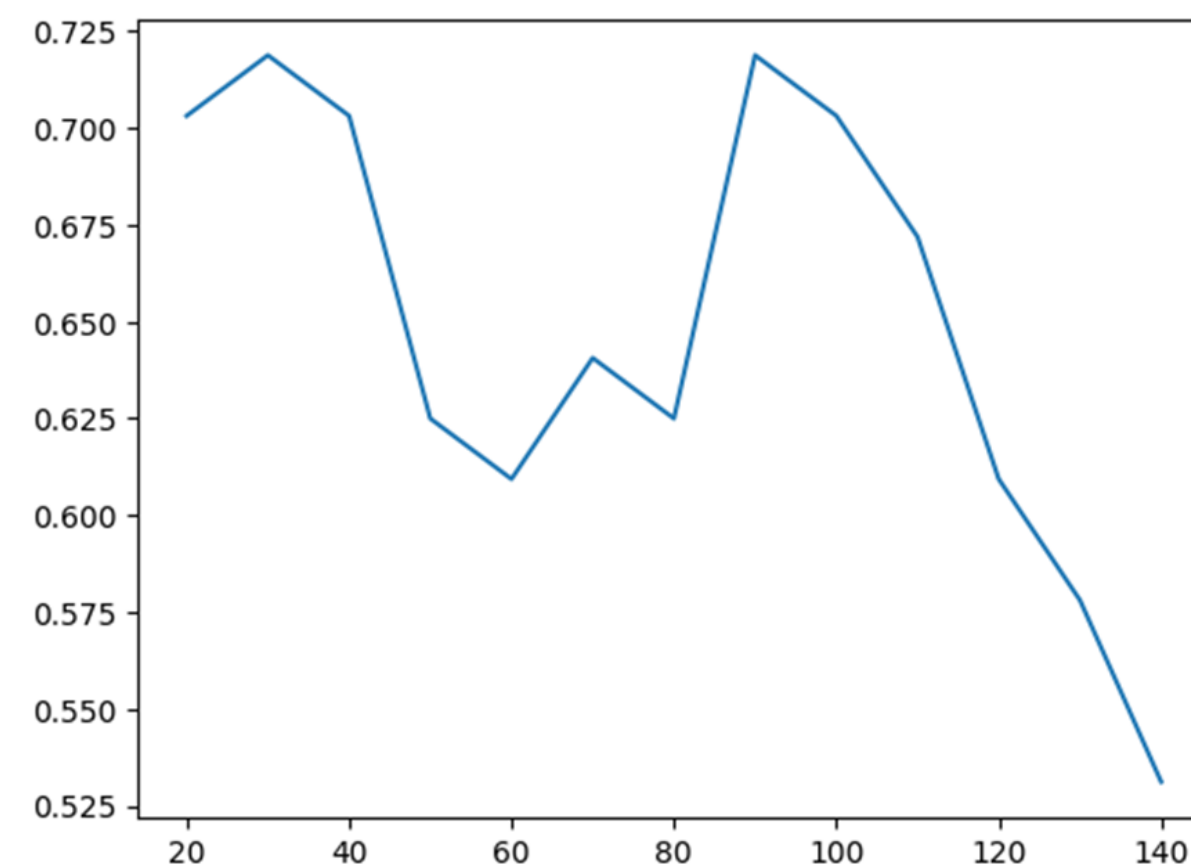


# Key Factors Influencing on Quality of Student Life

Coefficient(  $b_n$  ) Question (  $X_n$  )

- 3.08E-01 How many ml of sugary carbonated drinks do you consume per day?
- 1.28E-01 How often do you eat food prepared outside the home?'
- 6.40E-02 Do you eat red meat (beef, horse, lamb)?
- 9.06E-04 What do you do if someone smokes in the premises of a hospital, clinic, dormitory, university?
- 8.99E-01 How often do you go to the dentist for a preventive checkup?'
- 3.84E-01 How often do you change your toothbrush?'
- 3.32E-01 Do you eat fish (tuna, cod, herring, perch, carp, zander, trout, salmon, sturgeon)?,
- 2.86E-01 How many times a day do you brush your teeth?'
- 8.47E-02 How do you feel about alcohol?,
- 5.42E-01 How many days of the week do you usually eat fresh vegetables and herbs?'
- 6.73E-01 Do you have any special food preferences?'
- 3.51E-01 Disability group (if applicable)\n'
- 1.42E-01 How often do you eat during the day?'
- 4.39E-01 Do you have a chronic illness?\n'
- 1.78E-02 How often do you use energy drinks (Red Bull, Dizzi , Adrenalin, Gorilla, etc.) during the day?,
- 9.88E-01 How salty is your regular food?'
- 1.05E+00 What's in your lunch?'
- 2.47E-01 Do you have extra work? Write if there is additional work',
- 5.18E-01 How often do you eat lunch?','What is included in your breakfast?'
- 1.73E-01 How many days of the week do you usually eat fresh fruit?'
- 5.44E-01 Do you use iodized salt when cooking at home?,
- 5.85E-02 How do you feel about smoking?','What goes into your meals?'
- 1.47E-01 Have you ever had food poisoning?\n! If there is poisoning, describe in what conditions (for example, a student dormitory)!'
- 2.49E-01 What time do you have dinner?'
- 7.47E-01 Do you feel pain in your upper abdomen?'
- 1.09E+00 How often do you eat breakfast?'
- 5.71E-01 How many liters of clean water do you drink per day? (excluding soups, tea, coffee, sugar drinks)'
- 5.69E-02 Is there a temper?'

At the first stage, 544 students from different faculties of Al-Farabi Kazakh National University completed a survey. Participation was voluntary, data confidentiality was provided.



Accuracy of the logistic regression model for various numbers of features

- Positive coefficients of the logistic regression model for each question indicate a relationship between a high level of response to the question and an increased likelihood of a positive outcome, negative coefficients indicate the opposite.
- The analysis showed that the 27 factors most influencing the quality of life of students are related to eating habits and lifestyle. Proper nutrition significantly affects the physical and psychological state of students.





# Key Features

## Store and Track Medical

### Records

The students can securely store and track their medical records within the digital health profile. This feature allows them to easily access important health information, such as vaccination records and previous medical diagnoses, whenever needed .



## Schedule Appointments

The digital health profile enables students to schedule appointments with healthcare providers directly through the platform. This feature streamlines the appointment booking process, making it more convenient and efficient for students to access the care they need .



## Receive Notifications

Students receive notifications through the digital health profile system to stay informed about upcoming appointments, reminders, and important health updates. This feature helps students stay proactive in managing their health and ensures they never miss important healthcare-related information.





# Key Benefits

## Sustainability

Lays the foundation for a healthier and more sustainable society in the future.

## Youth is the future of the nation

Healthy students can become more productive members of society in the future.

## More Data for Research

Medical researchers can use this data to identify trends in student health, identify risks, and develop more effective treatments.

- Healthy students usually have better concentration and learning ability
- The digital profile allows students to track their health indicators, which promotes proactive health care.
- The system can be configured to monitor the spread of diseases among students and promptly take the necessary measures to prevent the spread.



# THANK YOU FOR YOUR ATTENTION!



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