



NAZARBAYEV  
UNIVERSITY



## Possibilities of Using Digital Healthcare Big Data in Kazakhstan for Real World Evidence & Countrywide Disease Surveillance

Возможности использования больших данных цифрового здравоохранения в Казахстане для доказательства реального мира и эпиднадзора за заболеваниями в масштабах страны

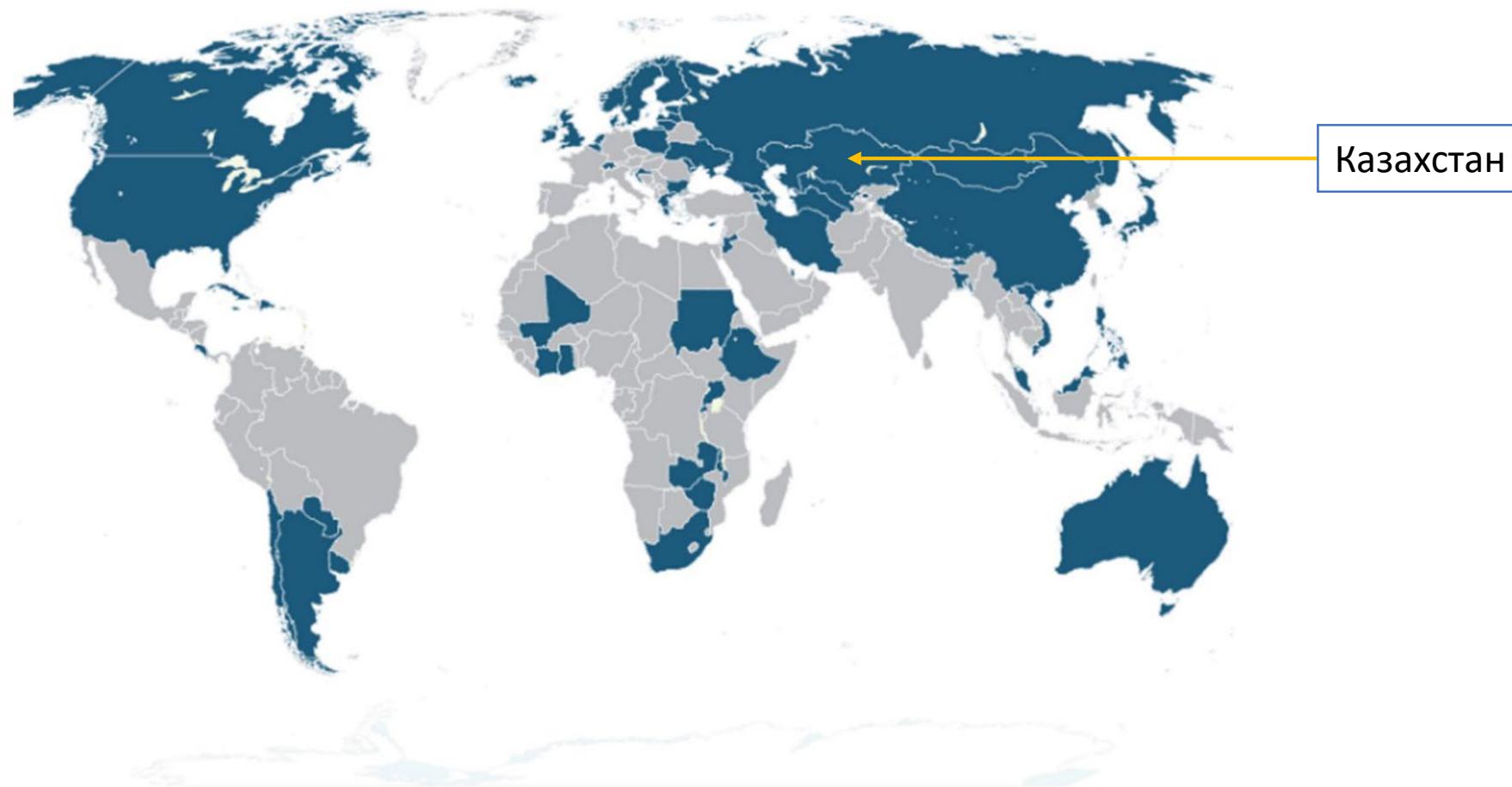
**Абдужаппар ГАЙПОВ,**

Ассоциированный Профессор Школы медицины  
АОО «Назарбаев Университет»



## Countries with national eHealth policies or strategies

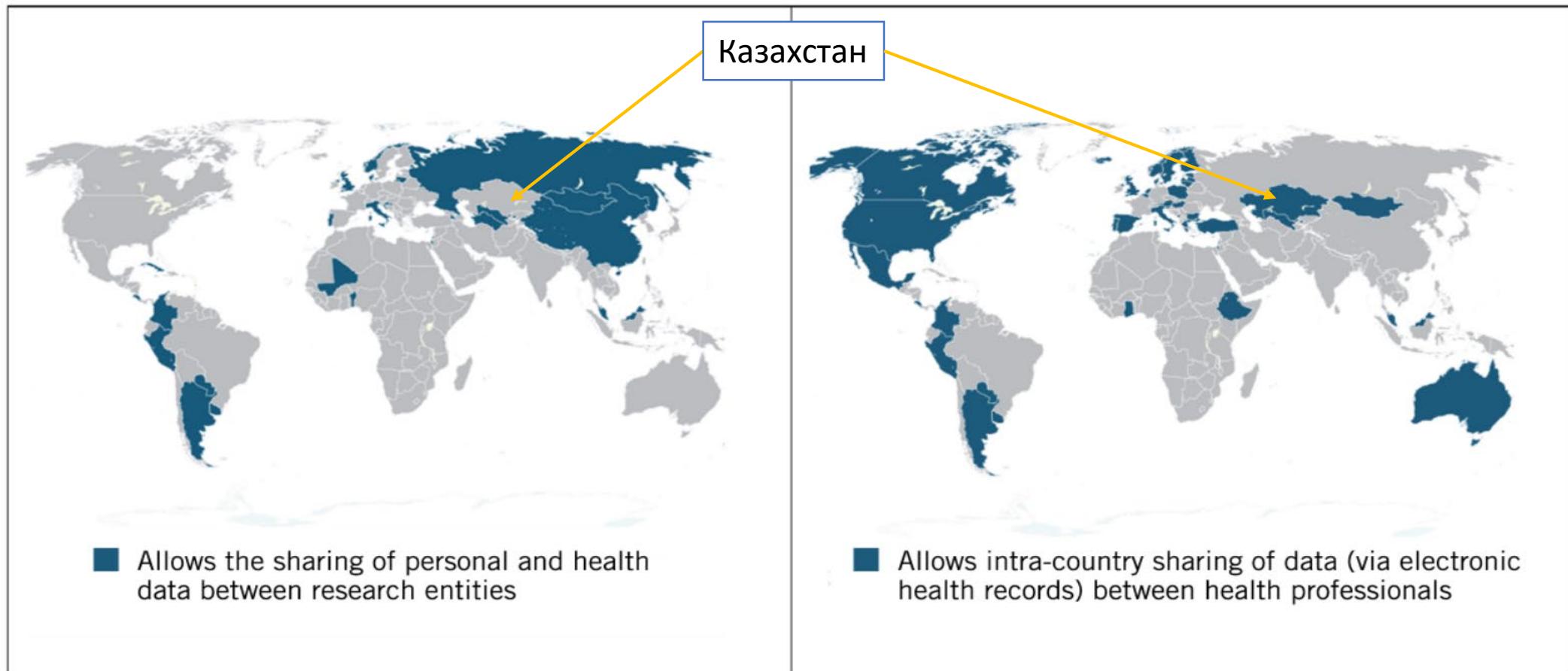
Страны с национальной политикой или стратегиями электронного здравоохранения



■ Has a national eHealth policy or strategy

## Страны, разрешающие обмен личными данными и данными о здоровье населения между научными организациями (слева) и между медицинскими работниками (справа)

**Figure 4: Countries allowing sharing of personal and health data between research entities (left) and between health professionals (right)<sup>70</sup>**



# Unified National Electronic Health System (UNEHS) Ministry of Healthcare of Kazakhstan

## Единая национальная система электронного здравоохранения (ЕНСЭЗ)

*Population registry* - регистр прикрепленного населения



*Electronic Registry of Inpatients* –  
электронный регистр стационарных больных

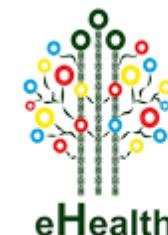


РПН

*Electronic registry of dispensary patients* –  
электронный регистр диспансерных больных



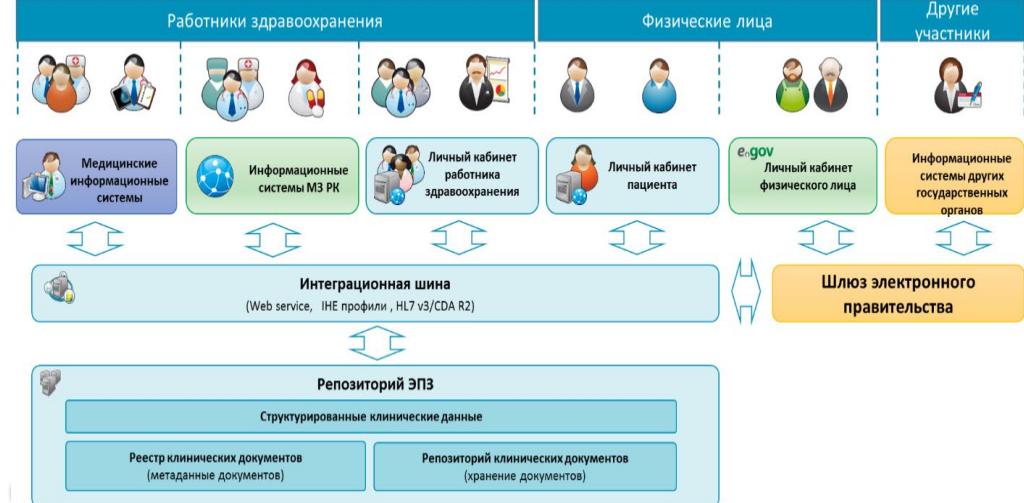
ЭРСБ



- *Other Electronic Systems* –
- *Registry of ambulatory medication prescriptions* (**ИСЛО**)
- *Unified payment system of health services* (**ЕПС**)
- *Hospitalization Bureau* - **бюро госпитализации**

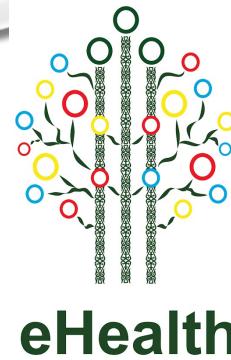
**2019:** Memorandum of understanding between NUSOM and Republican Center of Electronic Healthcare

**2020:** Service contract between NUSOM and Republican Center of Electronic Healthcare





# Grant funding from Nazarbayev University and Ministry of Education & Science



## Aggregation and utilization of the large-scale administrative health data in Kazakhstan for population health research and surveillance

2020-01 to 2022-12 | Grant  
Nazarbayev University (Nur-Sultan, KZ)  
GRANT\_NUMBER: [240919FD3913](#)

Total funding amount  
USD 143,000

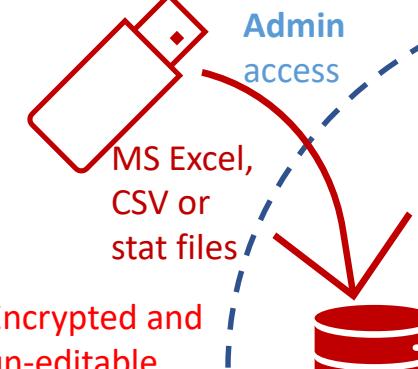
## Epidemiology and Forecasting of Infectious Diseases in Kazakhstan Using Big Healthcare Data, Mathematical Modeling and Machine Learning

2021-01 to 2023-12 | Grant  
Ministry of Education and Science of the Republic of Kazakhstan (Nur-Sultan, KZ)  
GRANT\_NUMBER: [AP09259016](#)

Total funding amount  
USD 125,363

# STATUSER DATA center

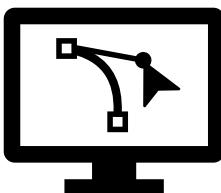
**UPLOAD**  
extracted data  
from RCEH



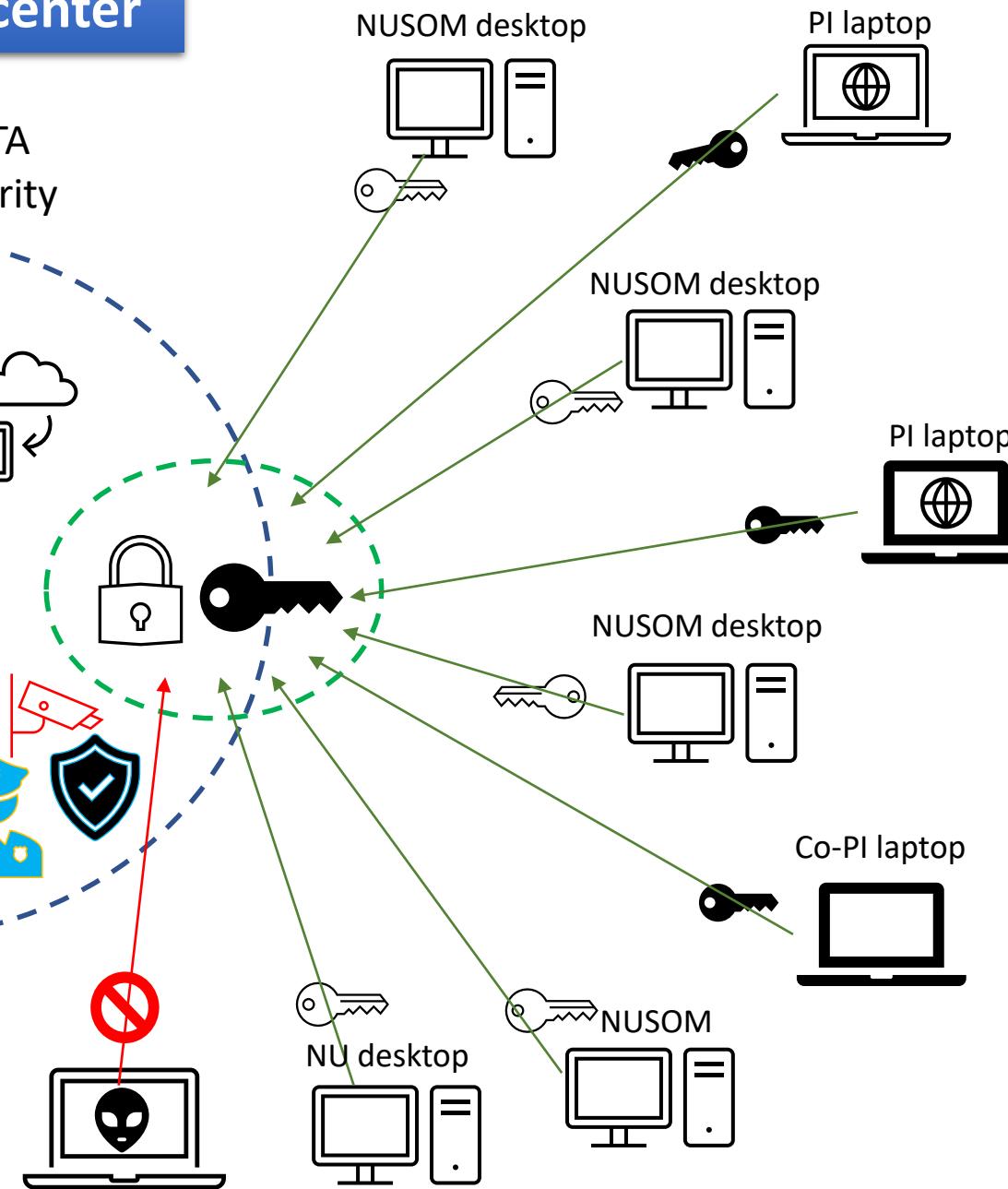
Encrypted and  
un-editable  
original files

NU Campus DATA  
storage and security

Daily BACKUP



- Windows datacenter web server
- RAM = **256 GB**
- Memory = **4TB**
- CPU = **24**
- Software: STATA, Python, OFFICE, Adobe, Graph Prism, R studio, etc.



- Special server to DATA storage (mother workstation)
- Admin controls the personal accesses
- 2 or 3 level login by personal access within the NU network
- VPN remote access for authorized PIs by personal access (3 or 4 level login)
- Recording the history of logins (time, date, name)

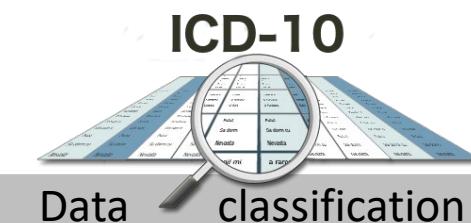
# Data management

Extracted data from RCEH by ICD-10

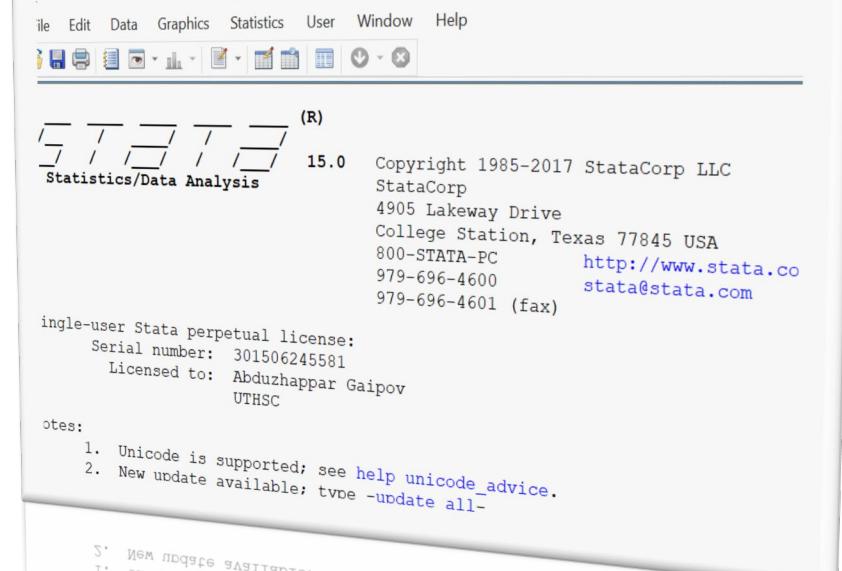
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95	404818430	1962-03-03 00:00:00.000	женский	Казахи	Среднее специаль	РЕСПУБЛИКА: Казах N18.0	NU NU	2015-05-25			
96	404819513	1954-07-19 00:00:00.000	женский	Казахи	Среднее специаль	КҮЙШИ ДИНА N18.0	NU NU	2014-05-23			
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98	404831524	1941-01-10 00:00:00.000	женский	Казахи	Среднее общее	РЕСПУБЛИКА: Казах N18.0	NU NU	2017-03-29			
99	404833445	1966-03-22 00:00:00.000	мужской	Русские	NULL	РЕСПУБЛИКА: Казах N18.0	NU NU	2017-11-09			
00	404833876	1961-01-08 00:00:00.000	женский	Украинцы	Среднее специаль	ГЛННИ	NU NU	2016-06-15			
01	404846680	1941-11-13 00:00:00.000	женский	Казахи	Не указано	РЕСПУБЛИКА: Казах N17.0	NU NU	2019-01-18			
02	404846950	1957-04-18 00:00:00.000	женский	Казахи	Выше	ГОРОД РЕСП.ЗНАЧ.: N18.0	NU NU	2018-07-28			
03	404849091	1950-11-13 00:00:00.000	женский	Казахи	Не указано	РЕСПУБЛИКА: Казах N18.0	NU NU	2014-10-30			
04	404850832	1942-05-18 00:00:00.000	женский	Казахи	Не указано	РЕСПУБЛИКА: Казах N18.0	NU NU	2014-10-30			
05	404850832	1942-05-18 00:00:00.000	мужской	Немцы	Не указано	РЕСПУБЛИКА: Казах N17.8	NU NU	2017-11-15			
06	404852714	1949-01-03 00:00:00.000	мужской	Казахи	Среднее общее	РЕСПУБЛИКА: Казах N18.0	NU NU	2018-11-22			
07	404863808	1969-09-25 00:00:00.000	мужской	Казахи	Незаконченное вы	РЕСПУБЛИКА: Казах N18.0	NU NU	2018-10-09			
08	404864272	1971-08-16 00:00:00.000	женский	Казахи	Не указано	ГОРОД РЕСП.ЗНАЧ.: N18.0	NU NU	2015-09-12			
09	404864785	1955-01-13 00:00:00.000	мужской	Русские	NULL	ЛИНИЯ: 12-я Линия N17.0	NU NU	2016-02-18			
10	404866755	1970-07-28 00:00:00.000	мужской	Казахи	Не указано	КАРМЕНОВА 76-100 N17	NU NU	2013-11-08			
11	404867645	1951-12-22 00:00:00.000	мужской	Казахи	Не указано	РЕСПУБЛИКА: Казах N17	NU NU	2015-04-16			
12	404867842	1981-05-05 00:00:00.000	женский	Казахи	Среднее общее	РЕСПУБЛИКА: Казах N18.0	NU NU	2015-04-22			
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15	404871231	1959-03-04 00:00:00.000	женский	Русские	Не указано	РЕСПУБЛИКА: Казах N17.0	NU NU	2016-11-25			
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17	404885287	1956-04-23 00:00:00.000	женский	Казахи	Среднее специаль	РЕСПУБЛИКА: Казах N18.0	NU NU	2017-03-22			
18	404900152	1961-01-01 00:00:00.000	мужской	Русские	Не указано	РЕСПУБЛИКА: Казах N17	NU NU	2013-06-27			
19	404902365	1976-01-12 00:00:00.000	женский	Немцы	Не указано	РЕСПУБЛИКА: Казах N18.0	NU NU	2016-12-22			
20	404902955	1953-06-01 00:00:00.000									



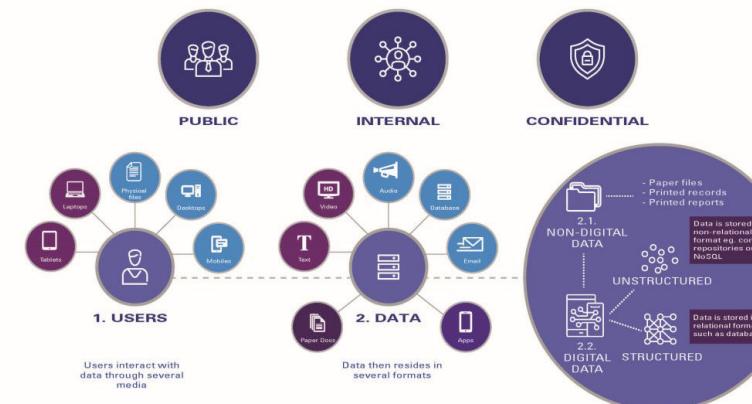
Data cleaning



Transfer data from excel to STATA



## DATA CLASSIFICATION



# Published papers

Gaipov et al. BMC Nephrology (2020) 21:407  
<https://doi.org/10.1186/s12882-020-02047-6>

BMC Nephrology

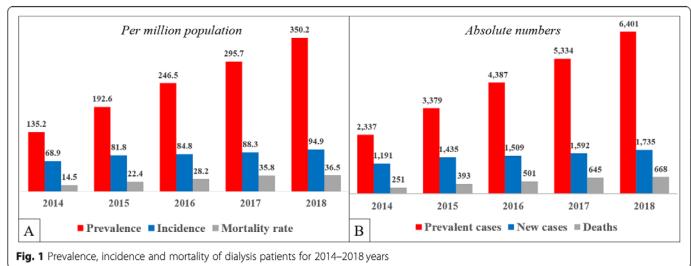
## RESEARCH ARTICLE

## Open Access

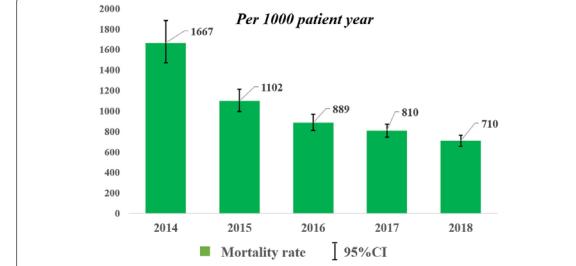
# Epidemiology of dialysis-treated end-stage renal disease patients in Kazakhstan: data from nationwide large-scale registry 2014–2018



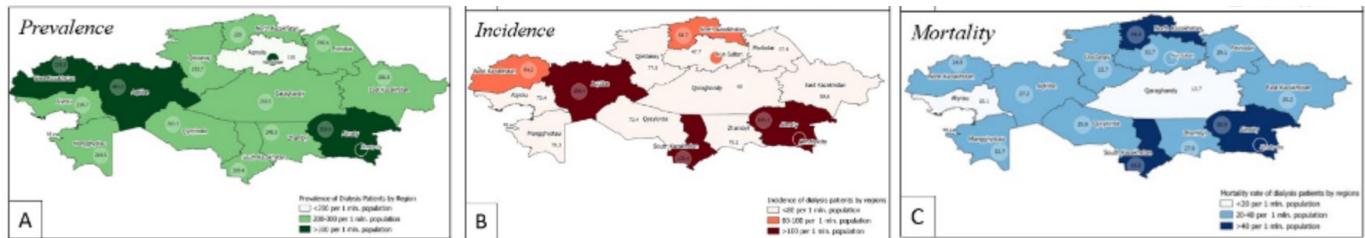
Abduzhappar Gaipov<sup>1\*</sup>, Alpamys Issanova<sup>1†</sup>, Kainar Kadyrzhanuly<sup>1</sup>, Dinara Galiyeva<sup>2</sup>, Marina Khvan<sup>1</sup>, Mohamad Alfiofan<sup>2</sup>, Miklos Z. Molnar<sup>3,4</sup> and Csaba P. Kovacs<sup>3</sup>



**Fig. 1** Prevalence, incidence and mortality of dialysis patients for 2014–2018 years



**Fig. 2** Crude mortality rate among dialysis population for 2014–2018 years



A

B

1

Gaipov et al. BMC Infectious Diseases (2021) 21:458  
<https://doi.org/10.1186/s12879-021-06154-z>

BMC Infectious Diseases

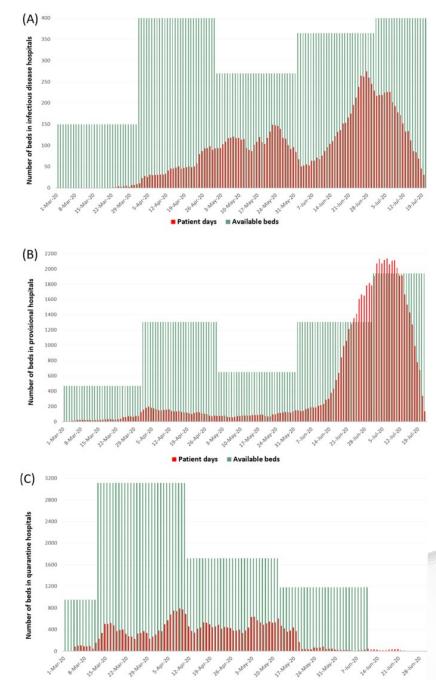
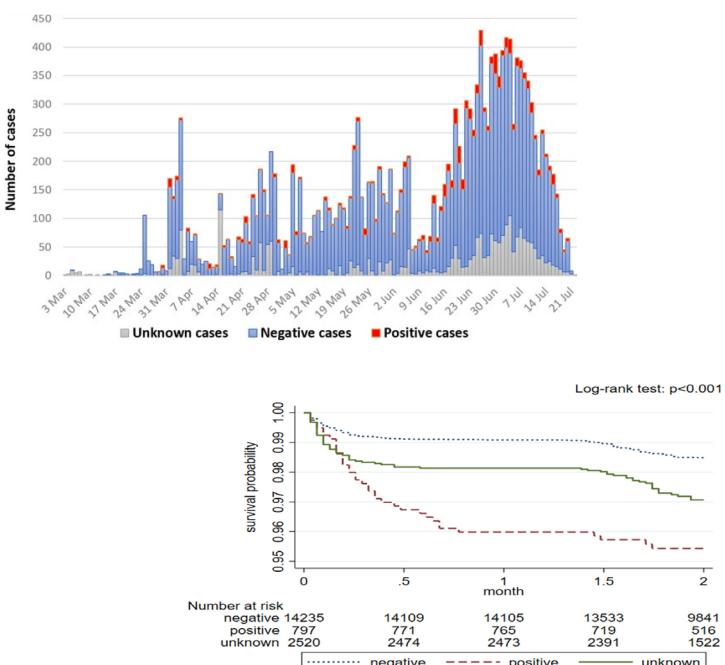
RESEARCH

**Open Access**

# SARS-CoV-2 PCR-positive and PCR-negative cases of pneumonia admitted to the hospital during the peak of COVID-19 pandemic: analysis of in-hospital and post-hospital mortality



Abduzhappar Gaipov<sup>1\*</sup>, Arnur Gusmanov<sup>1</sup>, Anara Abbay<sup>1</sup>, Yesbolat Sakkó<sup>1</sup>, Alpalymys Issanov<sup>1</sup>, Kainar Kadyrzhanuly<sup>1</sup>, Zhanar Yermakhanova<sup>2</sup>, Lazzat Aliyeva<sup>3</sup>, Ardarkashkynbayev<sup>4</sup>, Iklas Moldaliyev<sup>5</sup>, Byron Crape<sup>1</sup> and Antonio Sarria-Santamera<sup>1</sup>



# Published papers

Infection and Drug Resistance

Open Access Full Text Article

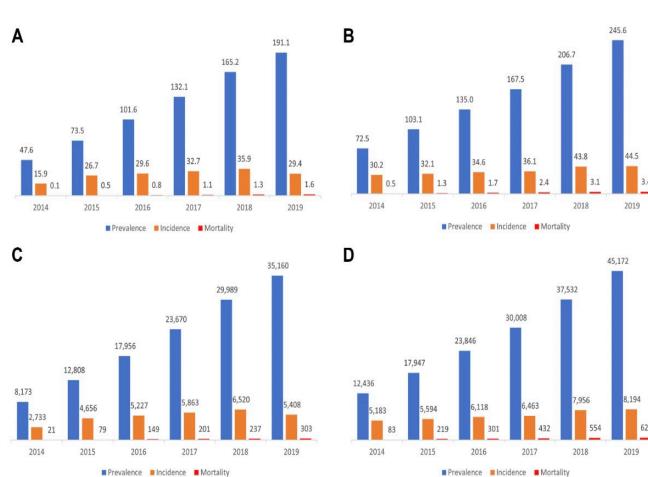
## Epidemiological Characteristics of Chronic Viral Hepatitis in Kazakhstan: Data from Unified Nationwide Electronic Healthcare System 2014–2019

Aiymkul Ashimkhanova<sup>1,\*</sup>, Dmitriy Syssoyev<sup>1,\*</sup>, Arnur Gusmanov<sup>1</sup>, Kakhman Yesmembetov<sup>2</sup>, Arina Yespotayeva<sup>3</sup>, Anara Abbay<sup>1</sup>, Aiymzhan Nurpeissova<sup>4</sup>, Antonio Sarria-Santamera<sup>1</sup>, Abduzhappar Gaipov<sup>1</sup>

Dovepress

open access to scientific and medical research

ORIGINAL RESEARCH



International Journal of Women's Health

Open Access Full Text Article

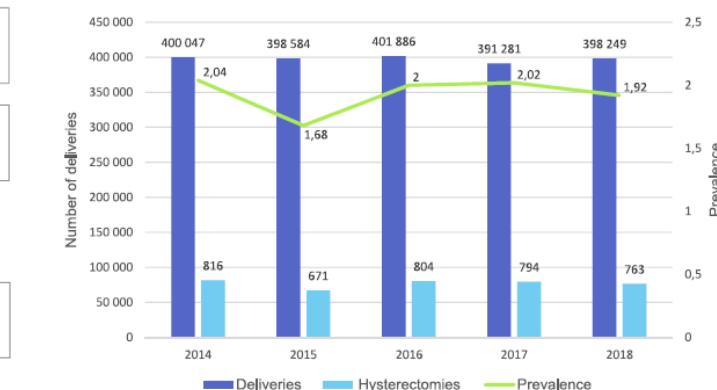
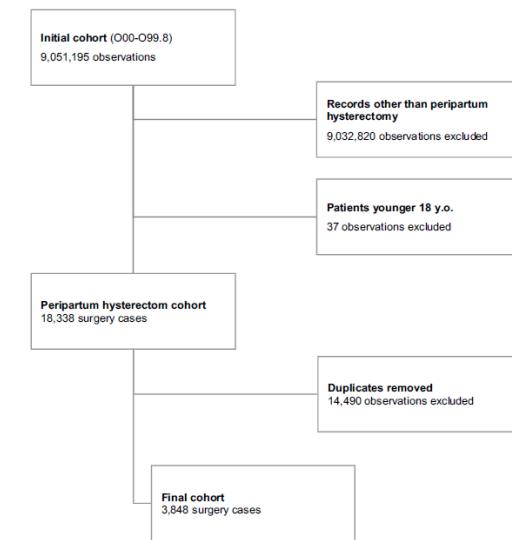
## The Prevalence, Incidence, Indications and Outcomes of Peripartum Hysterectomy in Kazakhstan: Data from Unified Nationwide Electronic Healthcare System 2014–2018

Gulzhanat Aimagambetova<sup>1,\*</sup>, Yesbolat Sakk<sup>1</sup>, Arnur Gusmanov<sup>1</sup>, Alpamys Issanov<sup>2,3</sup>, Talshyn Ukybassova<sup>4</sup>, Gauri Bapayeva<sup>4</sup>, Aizada Marat<sup>5</sup>, Aiymzhan Nurpeissova<sup>6</sup>, Abduzhappar Gaipov<sup>1</sup>

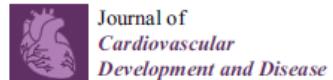
Dovepress

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ORIGINAL RESEARCH



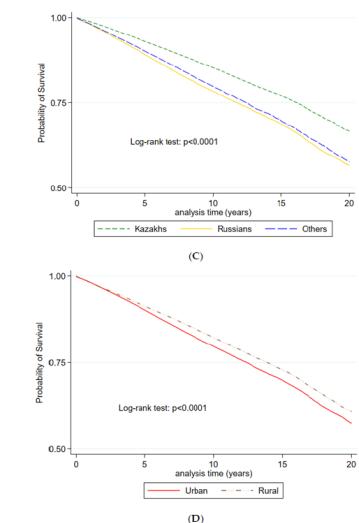
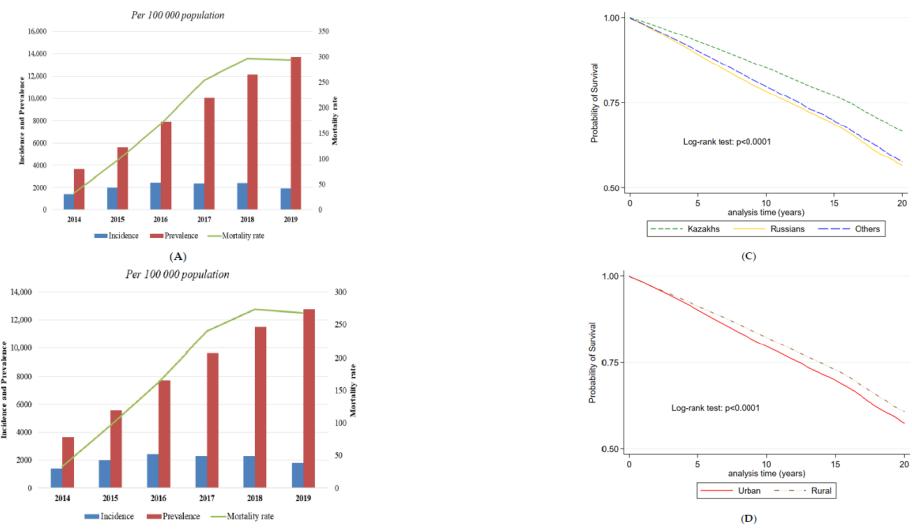
# Published papers



Article

## Epidemiology of Arterial Hypertension in Kazakhstan: Data from Unified Nationwide Electronic Healthcare System 2014–2019

Sauran Yerdessov<sup>1</sup> , Kainar Kadyrzhanuly<sup>1</sup>, Yesbolat Sakk<sup>1</sup>, Arnur Gusmanov<sup>1</sup> , Gulnur Zhakhina<sup>1</sup>, Dinara Galiyeva<sup>1</sup>, Makhabbat Bekbossynova<sup>2</sup> , Alessandro Salustri<sup>1</sup> and Abduzhappar Gaipov<sup>1,3</sup>

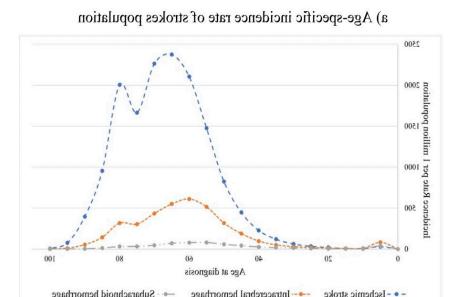


## scientific reports

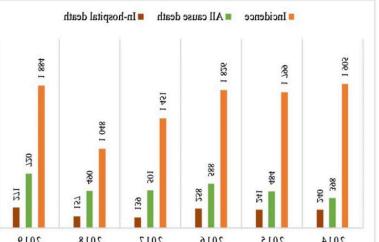
OPEN

## Incidence and mortality rates of strokes in Kazakhstan in 2014–2019

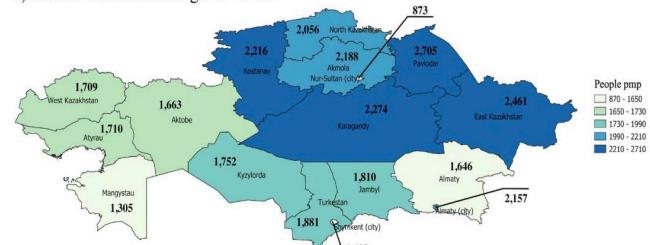
Gulnur Zhakhina<sup>1,4</sup>, Bakhytbek Zhalmagambetov<sup>1,4</sup>, Arnur Gusmanov<sup>1</sup>, Yesbolat Sakk<sup>1</sup>, Sauran Yerdessov<sup>1</sup>, Elzar Matmusaeva<sup>1</sup>, Aliya Imanova<sup>2</sup>, Byron Crape<sup>1</sup>, Antonio Sarria-Santamera<sup>1</sup> & Abduzhappar Gaipov<sup>1,3</sup>



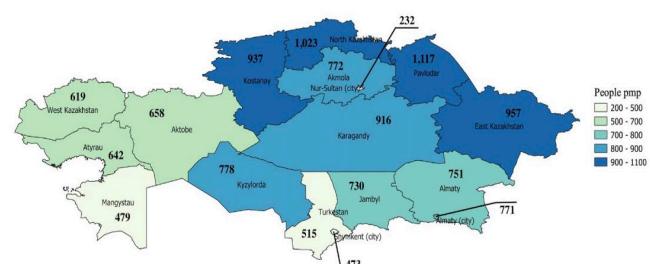
(a) Age-specific stroke incidence rate per 100,000 population



a) Incidence in different regions in 2019



b) All-cause mortality rates in different regions in 2019



# Ongoing projects

Epidemiology of measles, pertussis, influenza & chickenpox

Epidemiology of Diabetes Mellitus

Epidemiology of Tuberculosis

Epidemiology of Breast Cancer

Epidemiology of Meningitis

Epidemiology of Acute MI

Epidemiology of HIV

Up to 10 - 12 users including PI & co-PIs, RAs, MPH and MD students

## Macrovascular Complications in Patients with Diabetes Mellitus: Incidence and Impact on Survival in Kazakhstan

Preprint

File available

May 2021

 Antonio Sarría-Santamera ·  Binur Orazumbekova ·  Tilektes Maulenkul · [...] ·  Abduzhappar Gaipov

## Epidemiology of diabetes in Kazakhstan: data from unified nationwide electronic healthcare system 2014 - 2019

Galiyeva, D., Gusmanov, A., Sakkо, Y., Issanov, A., Atageldiyeva, K., Kadyrzhanuly, K., Sarria-Santamera, A., Nurpeissova, A. & Gaipov, A., Sep 1 2021, In: Diabetologia. 64, S1, p. 1-380 380 p.

## POS-520 EPIDEMIOLOGY OF KIDNEY TRANSPLANTS IN KAZAKHSTAN: DATA FROM UNIFIED NATIONAL ELECTRONIC HEALTH SYSTEM 2014-2018

Khvan, M., Gusmanov, A., Sakkо, Y., Issanov, A., Kadyrzhanuly, K., Galiyeva, D. & Gaipov, A., 2021, In: Kidney International Reports. 6, 4, Supplement, p. S226-S227

## P.102: Long Term Outcomes After Fetal Pancreatic Stem Cell Transplantation in Diabetes Mellitus: Data From Unified National Electronic Health System 2014-2019

Gaipov, A., Gusmanov, A., Sakkо, Y., Issanov, A., Galiyeva, D., Alibekova, R., Kadyrzhanuly, K., Saparbayev, S., Taubaldiyeva, Z., Tuganbekova, S., Sarria-Santamera, A., Doskaliyev, Z. & Baigenzhin, A., Nov 1 2021, In: Transplantation. 105, 12S1, p. S36-S37

## POS-296 LATE DIAGNOSIS OF CKD AND ASSOCIATED SURVIVAL AFTER INITIATION OF RENAL REPLACEMENT THERAPY IN KAZAKHSTAN: ANALYSIS OF NATIONWIDE ELECTRONIC HEALTHCARE REGISTRY 2014-2020

KIM, V., Gusmanov, A., Sakkо, Y., Kim, M., Issanov, A., Assan, A., Khvan, M. & Gaipov, A., Feb 1 2022, In: Kidney International Reports. 7, 2, p. S132-S133

# Математическое моделирование прогноза

Electronic Journal of General Medicine

2020, 17(6), em256

e-ISSN: 2516-3507

<https://www.ejgm.co.uk/>

# Вспышка COVID-19 на постсоветском пространстве: моделирование наилучшего и наихудшего возможных сценариев

Original Article



## COVID-19 Outbreak in Post-Soviet States: Modeling the Best and Worst Possible Scenarios

Alpamys Issanov<sup>1†</sup>, Yerlan Amanbek<sup>2†</sup>, Anara Abbay<sup>1</sup>, Shalkar Adambekov<sup>3</sup>, Mohamad Aljofan<sup>4</sup>, Ardark Kashkynbayev<sup>2</sup>, Abduzhappar Gaipov<sup>1\*</sup>

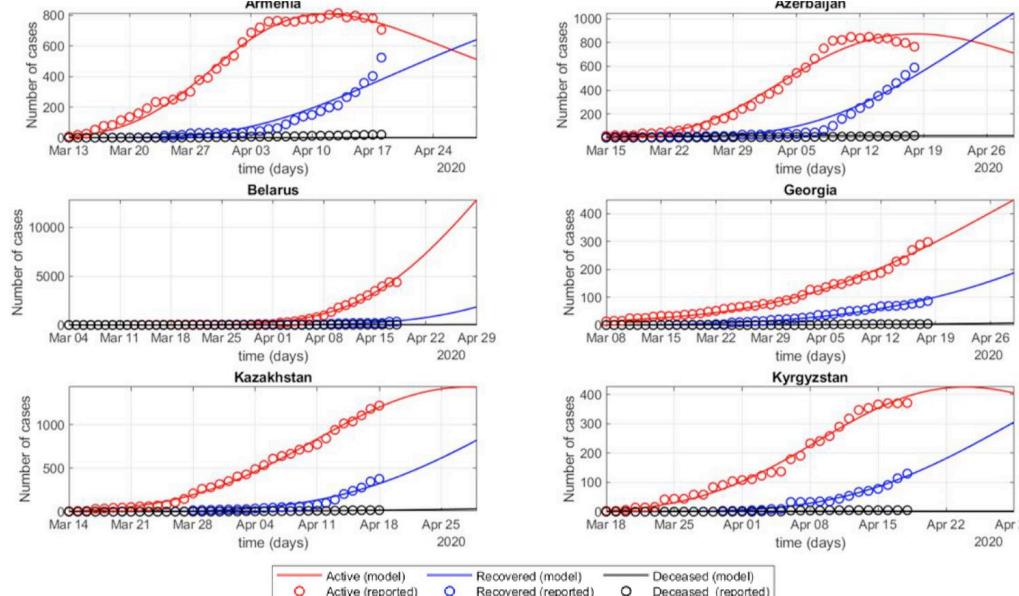


Figure 2. Modeling of COVID-19 outbreak prediction for 10 days

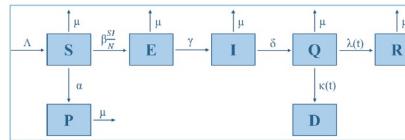


Figure 1. Algorithm of SPEIQR model

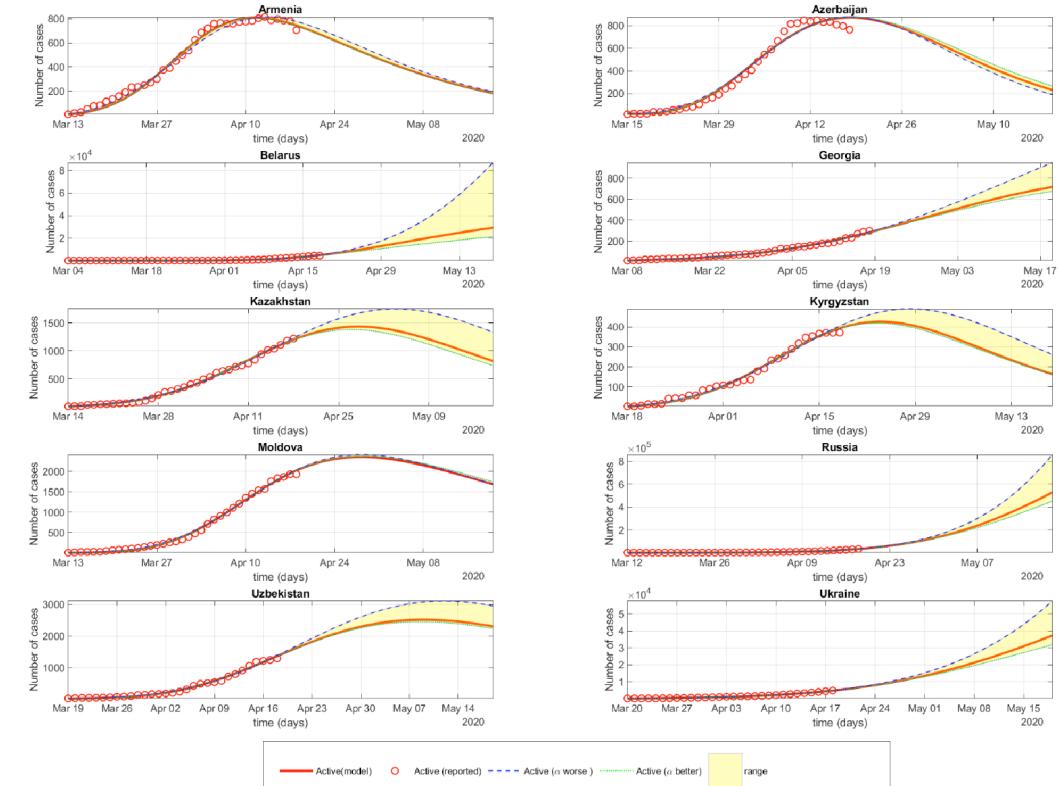
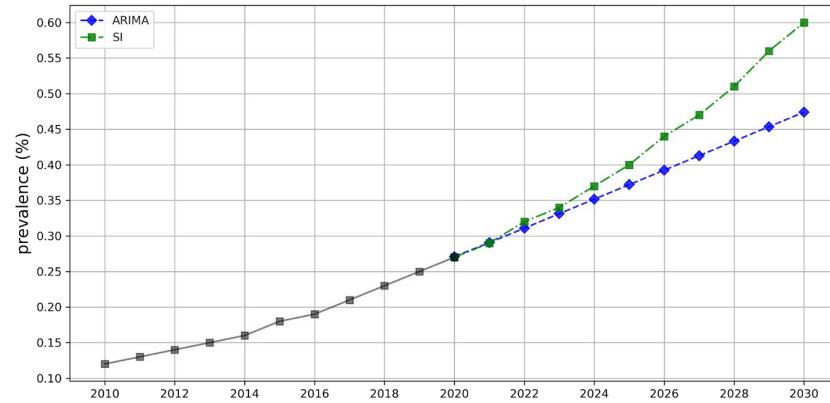


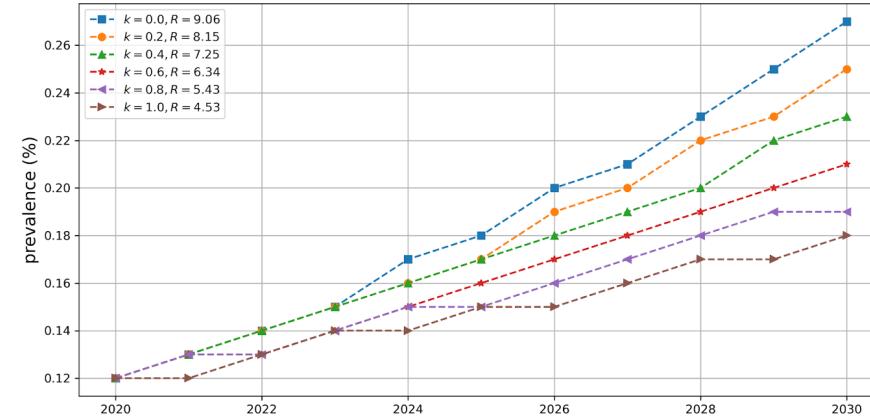
Figure 3. Better and worse spread scenarios of COVID-19 outbreak for 30 days

## Математическое моделирование прогноза

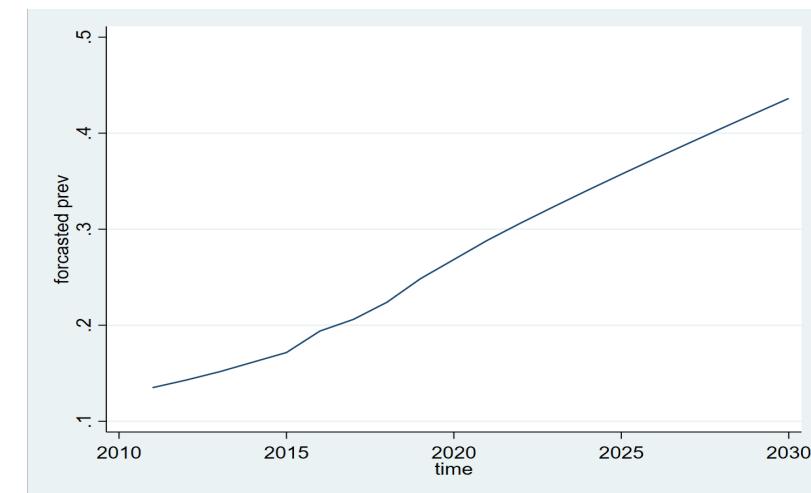
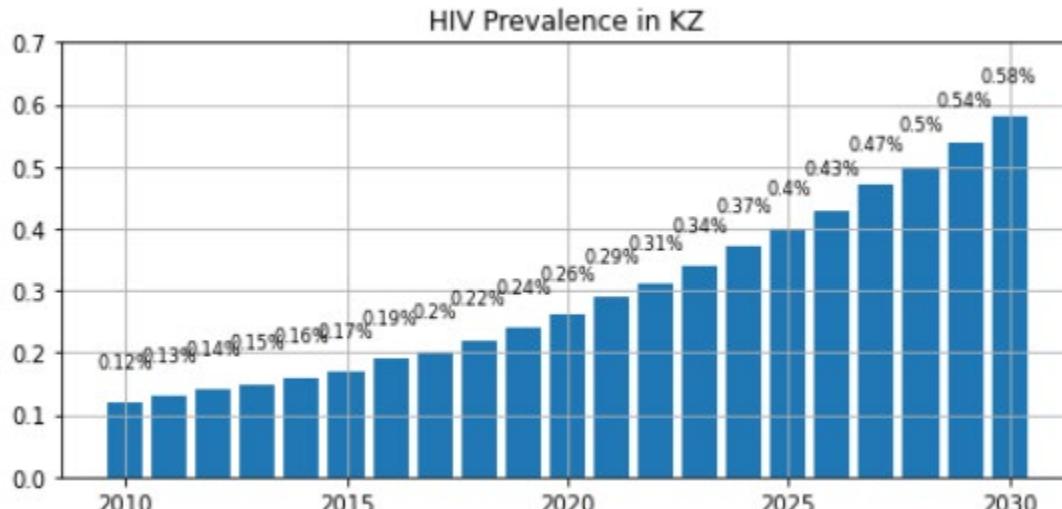
# Сравнительный прогноз распространенности и заболеваемости ВИЧ в Казахстане с использованием математических и статистических методов



HIV prevalence forecasting by ARIMA and SI models



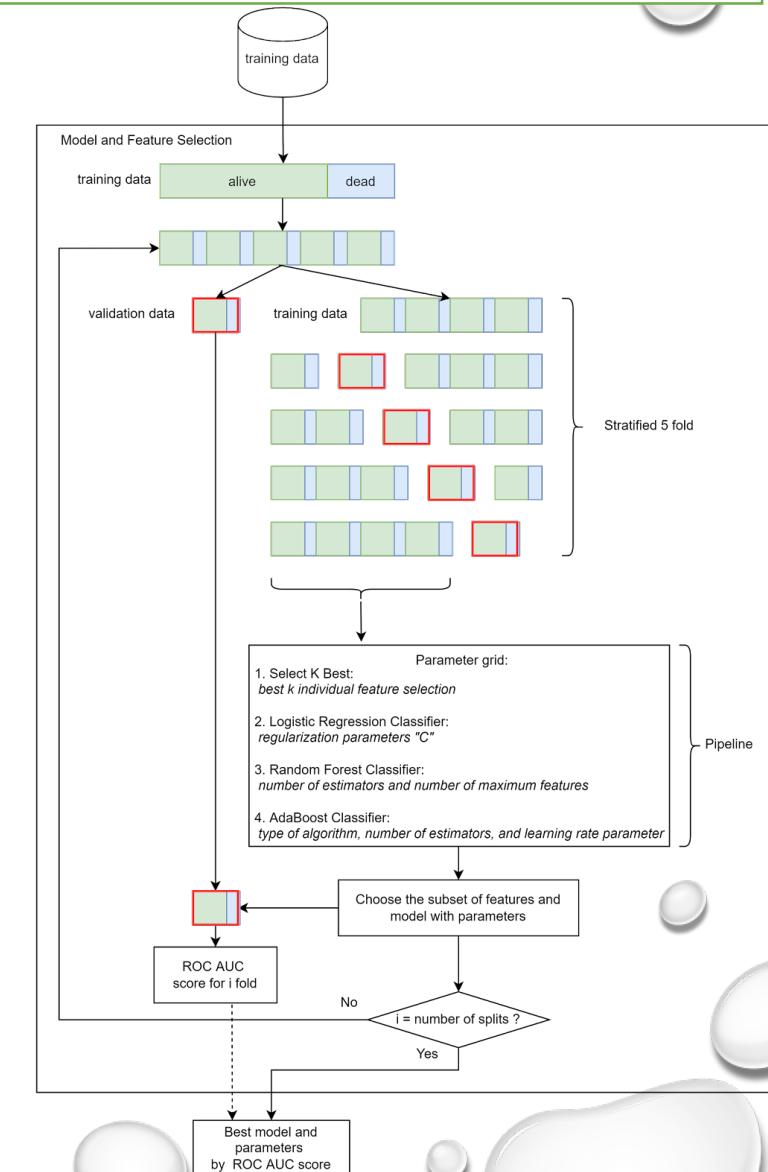
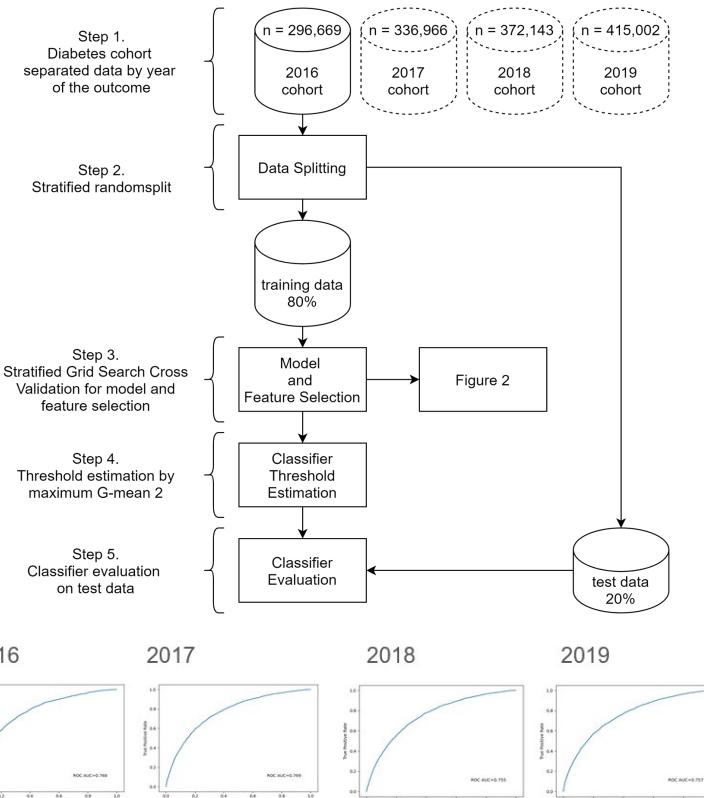
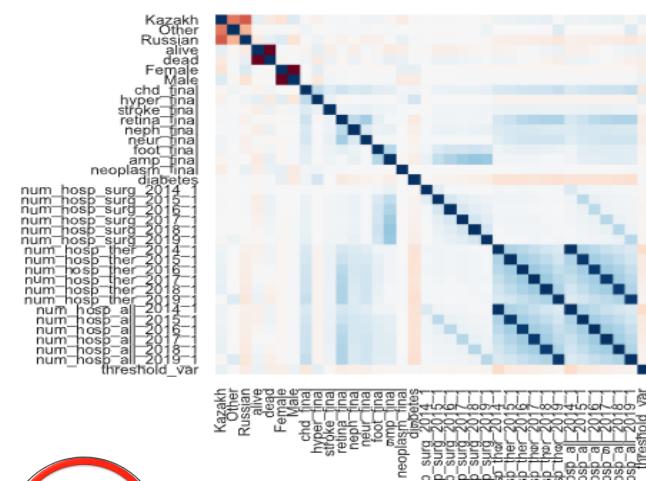
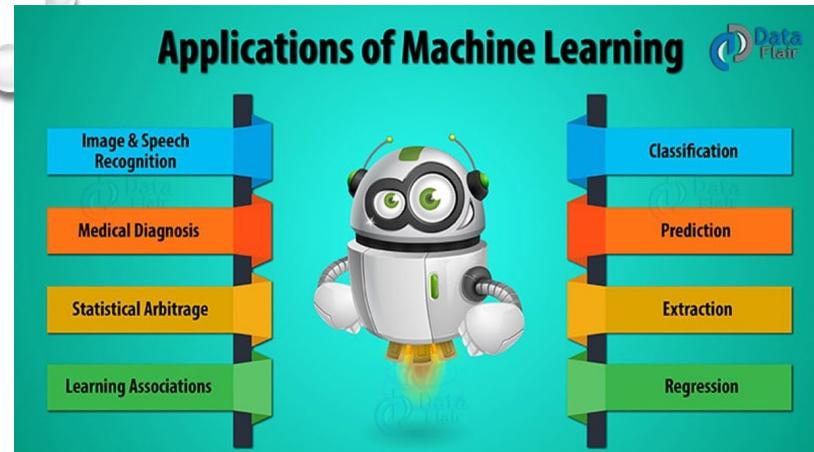
HIV prevalence forecasting with PrEP for various scenarios



Unpublished References

# Machine Learning algorithms to predict outcomes

# Использование алгоритмов машинного обучения и глубокого изучение для определение прогноза смертности



# Future concept

## Development of Epidemiologic Research Data Center for Prevention and Control of Chronic Non-communicable and Communicable Diseases

