# Expert microbiological report

Presentation of IT-product

(Information system "Abiogram")

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**Empirical therapy** - the use of antimicrobial agents before obtaining information about the causative agent and its susceptibility to these drugs

**Etiotropic therapy** - therapy based on identification of the causative agent and its susceptibility to antimicrobial agents

Microbiologic diagnostics, generation of a microbiological report
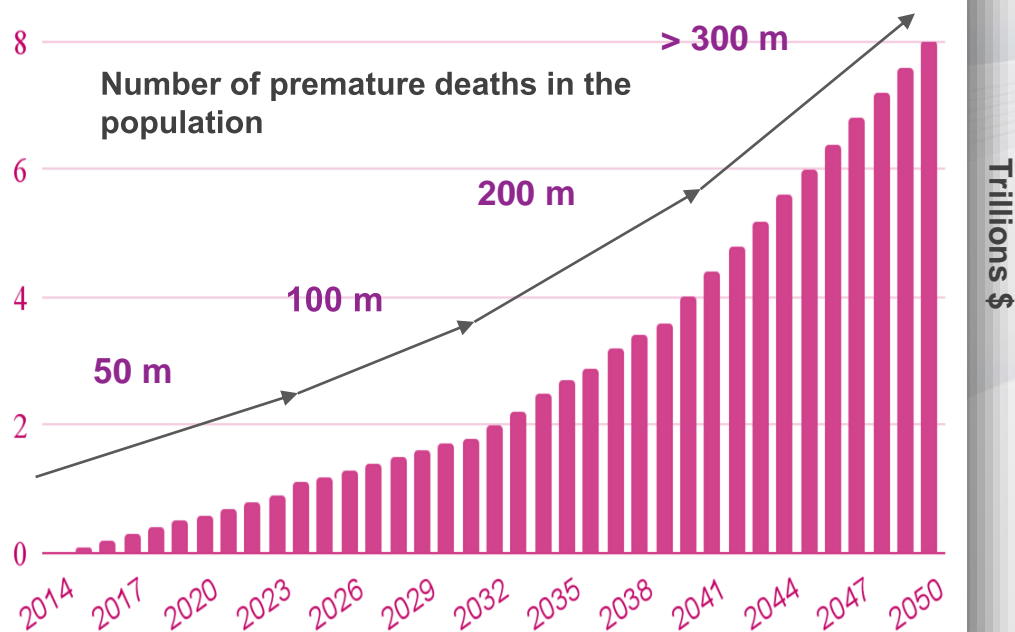
**Empirical therapy** → **Etiotropic therapy**

# Antimicrobial resistance. Statistics

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The impact of the growth of antimicrobial resistance on the health care system

o Increased length of disease and hospitalization of patients

o Increased cost of treatment

o Increased incidence of mortality due to infectious diseases
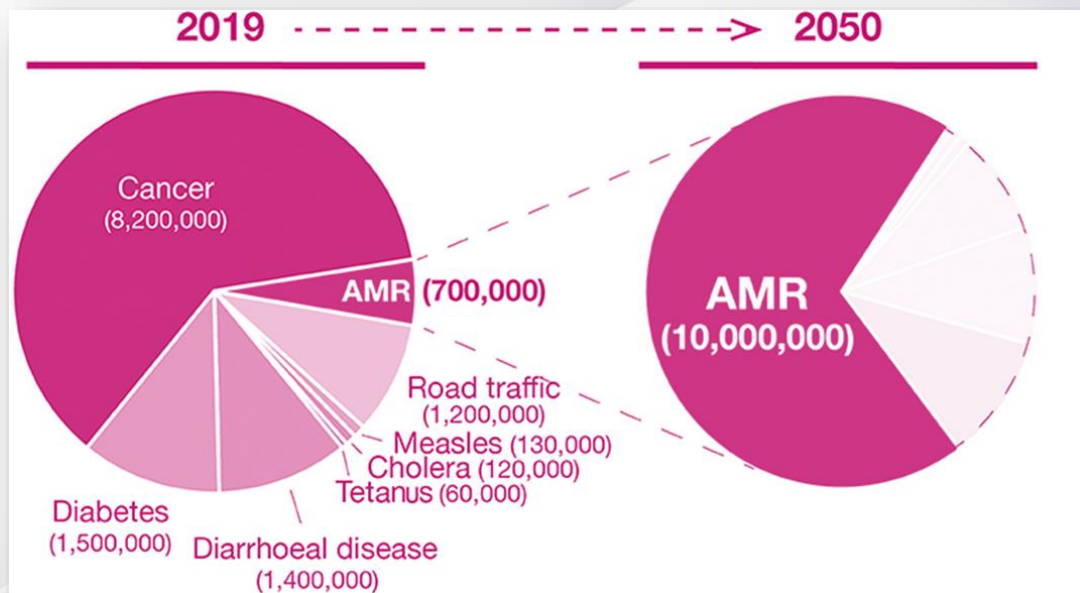
## GDP losses by year

Number of premature deaths in the population

> 300 m

200 m

100 m

50 m

Trillions $

8

6

4

2

0

2014 2017 2020 2023 2026 2029 2032 2035 2038 2041 2044 2047 2050

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Forecast of the impact of antimicrobial resistance on the health care system to 2050

**10 000 000** death

**100 trl. $** total economic losses



2019 → 2050

Cancer (8,200,000)

AMR (700,000)

Diabetes (1,500,000)

Diarrhoeal disease (1,400,000)

Road traffic (1,200,000)

Measles (130,000)

Cholera (120,000)

Tetanus (60,000)

AMR (10,000,000)

# Rising antimicrobial resistance reduces the chance of effective therapy

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**Expenses of medical organizations for the supply of antimicrobial drugs for systemic use in the Russian Federation for 2022**

**33.2% of the cost of all drugs**

*(antineoplastic drugs - 35,7%, other drugs - 10% or less)*

**33% in the volume of total purchases**

*(antineoplastic drugs - 4,4%, other drugs - 23% or less)*

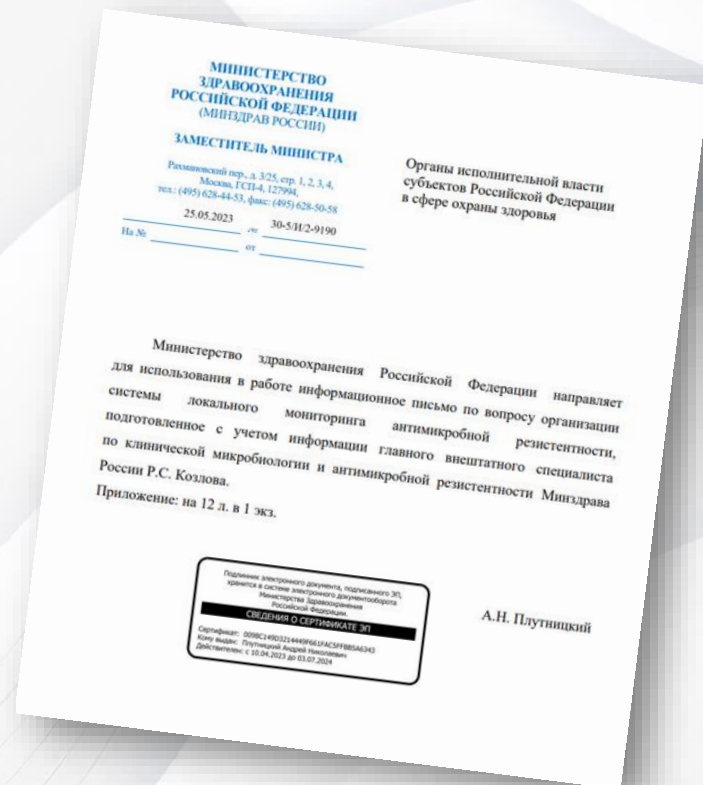https://dsm.ru/docs/analytics/Annual_report_2023_rus.pdf

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# Information letter of the Ministry of Health of the Russian Federation on the organization of the system of local monitoring of antimicrobial resistance

**Key statements:**

❖ Approved requirements for mandatory AMR surveillance in healthcare organisations (hospitals) over 500 beds

❖ Implementation of a digital system for local surveillance of AMR in multidisciplinary medical organizations (hospitals)

❖ **Quality control of susceptibility data and generated microbiological reports** in order to provide the local surveillance system with reliable results and **as a basis** for the correct choice of etiotropic treatment for a patient.

Rational antibiotic therapy is choosing the appropriate agent

The microbiology laboratory is a centerpiece in the process of diagnosing and treating infections

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Microbiological report is a key tool in the selection of antimicrobial therapy

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The microbiological report (antibioticogram) provides the doctor with a direct indication of which drug or group of drugs can be used for treatment and which cannot

# What is the impact of the microbiological report on the choice of therapy?

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- ❖ The likelihood of prescription of an antimicrobial drug is 3 times higher when drug susceptibility is reported in the microbiology report

- ❖ Reporting of back-up medicines increases likelihood of prescribing these medicines as first-line treatment

- ❖ Creation of an image of empirical therapy (reserve drugs are increasingly being prescribed on an empirical basis)

Clinician's thoughts:

- ❖ «If the laboratory reports a result, then the result is significant and antibiotic therapy will be required»

- ❖ «If the laboratory reports this antimicrobial, then it can be prescribed»

https://academic.oup.com/jac/article/51/2/379/748621?login=true
https://www.clinicalmicrobiologyandinfection.com/article/S1198-743X(20)30713-8/fulltext

**Microbiological report incorrect**

=

**Inappropriate antimicrobial treatment**
(The doctor relies entirely on the report)

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# Stages of forming a microbiological report

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## 1

**Use of interpretive breakpoints**
(EUCAST, CLSI, ECOFF etc.)

## 2

**Performing a expert assessment, taking into account testing context**
(species, intristic resistance, consistency of results for antimicrobials, etc.)

## 3

**Generation of a report for selection of etiotropic therapy for a certain patient**

# Major obstacles in forming a correct microbiological report to select antimicrobial therapy for a certain patient

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**1** Multiple devices with different antimicrobial susceptibility breakpoints
(outdated software and recommendations)

**2** Needs to annually update antimicrobial susceptibility breakpoints

**3** Increased probability of errors and/or discrepancies with high flow of analyses

**4** Changes in the nomenclature (names) of infectious pathogens

**5** Emergence of new indications for antimicrobials

**6** Ignoring the expert rules in the microbiological report
(expected resistance, rare phenotype, risk of resistance development, S/I/R correction using indicator antibiotic, S/I/R extrapolation using indicator antibiotic, etc.)

**7** Using agents for susceptibility testing for which the activity of other antimicrobials cannot be predicted

**8** Microbiological report lacks explanatory information on the specifics/scope of use of the antimicrobial for clinicians

# Consequences of an incorrect microbiological report

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❖ **It is not possible to select** an adequate etiotropic antimicrobial therapy

❖ **Increase in the cost and duration of hospitalization** for severe patients (complicated urinary tract infections, pneumonia, sepsis) - approximately >$750 per day of ineffective therapy

❖ **25% of patients are hospitalized again** within 30 days (complicated urinary tract infections, pneumonia, sepsis)

❖ **Costs to the microbiology laboratory** of obtaining susceptibility results that were invalid for making decisions about etiotropic therapy

❖ Costs associated with the **inability to make administrative decisions** based on the accumulated adequate microbiological data at the level of a medical organization (modification of initial antimicrobial therapy schemes, procurement of antimicrobial drugs)

🔗 *https://aricjournal.biomedcentral.com/articles/10.1186/s13756-017-0286-9*

**The most crucial factor in a microbiological report that is incorrect**

**Laboratory and Medical Information Systems (LIS/MIS):**
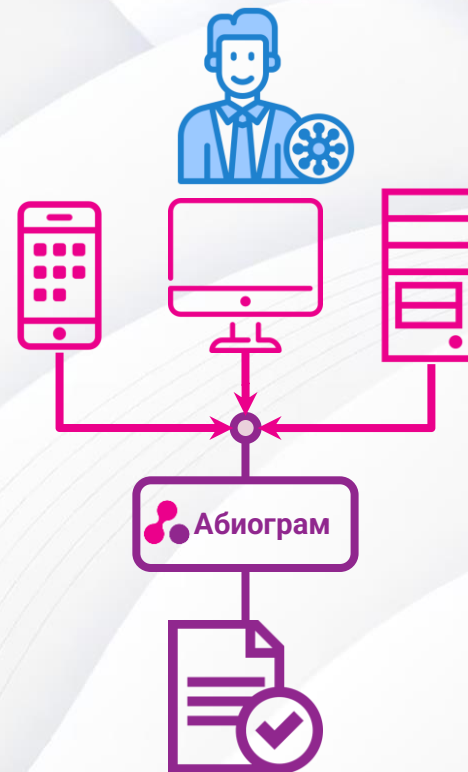
Acting as an information "hub"

Not capable of carrying out the duties of a consolidated think tank and producing a reliable microbiological report
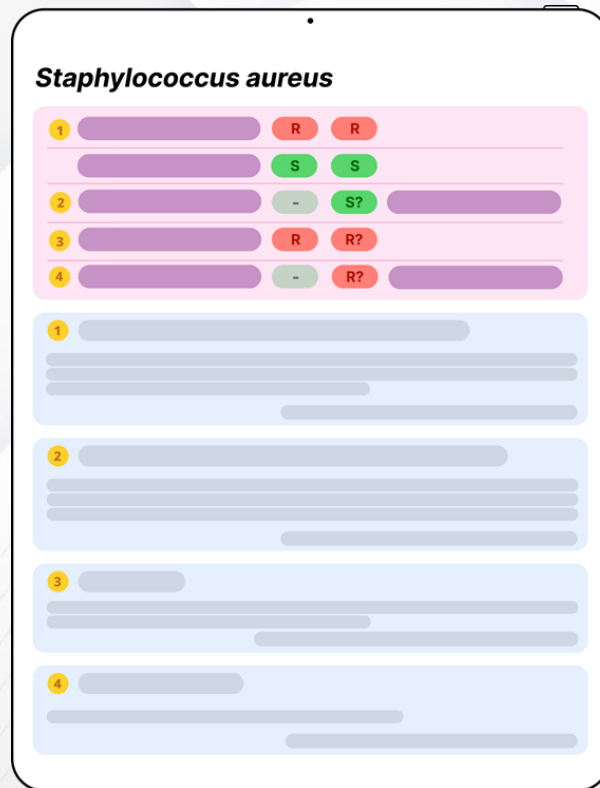
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# Proposed solution

# Main idea



- The solution is a software - **Information System "Abiogram"**

- Assistant for microbiologist and clinical pharmacologist

- Compensating the lack of staff with specialised skills

- System error tracking

- The software integrates with existing LIS/MIS and microbiological analysers

- Regardless of LIS/MIS availability, medical staff can interact directly with the software interface

**The Abiogram information system** allows to:

❖ Generate a validated microbiological report with peer review of results

❖ Carry out automated systemic surveillance of antimicrobial resistance in the medical organisation (interactive analytics, alert system)

# The software generates a validated microbiological report

Uses information on the nature of the pathogen, the results of antimicrobial susceptibility testing for the pathogen and any other available information

Interprets results based on breakpoints established in relevant documents (EUCAST, CLSI, ECOFF)

Use expert rules to validate the result

Generates a microbiological report which is :

o Sent to LIS/MIS

o Provided to the staff in the form of graphical display (when using the software interface directly)

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## Breakpoints

## Expert system

**Interpretation is available according to three guidelines\*:**
- EUCAST Version 13.0, 2023
- CLSI M100, 2023
- EUCAST ECOFF
- Automatic update when new guidelines are in place - no need for manual updates

*\*  August 2023*
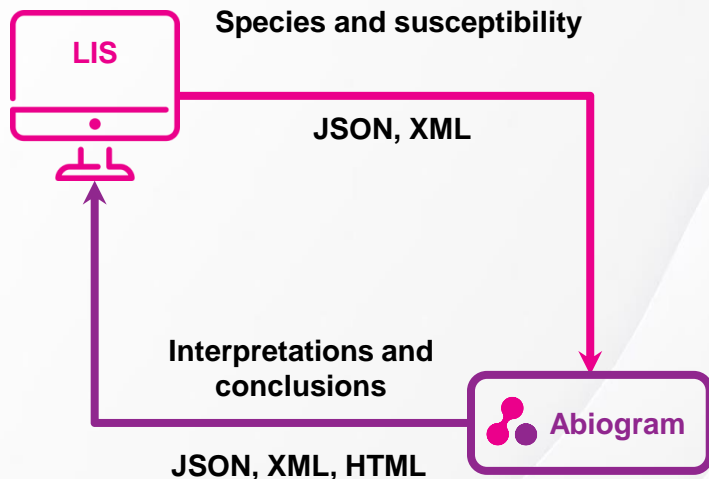*Information is regularly updated*

**Contains more than 1,100 rules\* that allow:**
- Identification of unusual and questionable results
- Prediction of the susceptibility profile to an extended spectrum of antibiotics based on the analysis of indicator drugs
- Notification of potential treatment ineffectiveness
- Intrinsic resistance identification report

**Expert system automatically updated as new antimicrobial and pathogen data becomes available**
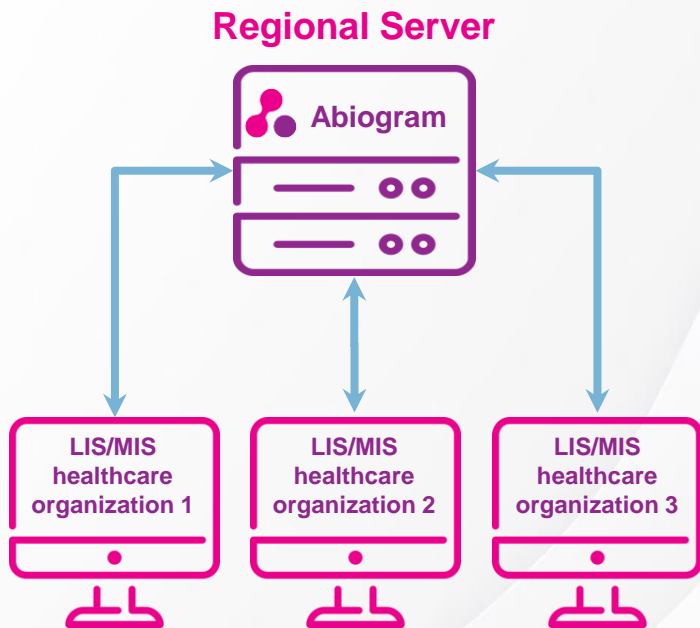
A validated microbiological report is produced based on the results of the interpretation breakpoints and the work of the expert decision system.

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# The software usage scenario in healthcare organisations

**Species and susceptibility**

**LIS**

**JSON, XML**

**Interpretations and conclusions**

**Abiogram**

**JSON, XML, HTML**

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❖ The software is installed on a dedicated physical or virtual server and connected to the organisation's internal network

❖ On the LIS/MIS side, integration with the API is configured for the sending of requests and the display of responses

❖ It is possible to use the web interface:
  - Entry of antibioticogram data from any user device
  - Get results without having to use LIS/MIS integration

❖ Integrated analytics of antimicrobial susceptibility results and antimicrobial resistance surveillance

# The software usage scenario
## at the regional healthcare system/few institutions level

**Regional Server**



- ❖ The software is installed on a dedicated physical or virtual server at the Regional Centre and connected to the Internet

- ❖ Integration and communication with LIS/MIS is set up in each health facility with software located in the Regional Centre

- ❖ No need to install the product in the healthcare facility itself

- ❖ All requests from health facility are processed centrally on a server, allowing any number of institutions to connect to the product (limited only by the capacity of the server on which the software is installed).

- ❖ The regional center can analyse the range of antimicrobial susceptibility testing in real-time whilst monitoring antimicrobial resistance at the regional level

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## Our mission:

Using advancements in biotechnology, microbiology, IT, and data analytics, we aim to save the lives of patients with infectious diseases

Our objective is to address the challenge of selecting the most suitable antimicrobial agent to treat infections, by employing an analytical methodology that incorporates recent developments in biotechnology, and the verification and validation of laboratory findings

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