Experience of using products based on artificial intelligence in the Yamal Healthcare

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Pilot project of artificial intelligent implementation into Yamal Healthcare

chief of Medical Information and Analytical Center (YNAO) O.V. Belorus

It was not easy to make a decision in the AI experiment

Advantages

• It allows to analyze all available data, including data from previous periods. The processes is completely automatic without human intervention
• It allows to apply an unlimited number of different techniques thereby increasing the probability of a correct assessment
• It allows to perform analysis about patient pathway care and receive research results
• It allows to perform automatic analysis of all existing data in medical organizations/region and identify a potentially high-risk group without necessity of the reference in medical organization

Obstacles

• There are lot of profanity and hype around this topic
• The shortage of the proven clinical efficiency
• Unwillingness of medical staff to trust artificial intelligence
• Unreadiness of IT specialists
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Our prerequisites for the AI implementation

- **100% Region medical organizations**
- **100% Region hospitals**
  - Work with EHR systems
- **96% physicians** (1349 из 1416) provided by digital signatures
- **96% Electronic Health records**

**Radiotherapy diagnostics devices**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>2016 year</th>
<th>2017 year</th>
<th>2018 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasound</td>
<td>33.1%</td>
<td>50.3%</td>
<td>60.0%</td>
</tr>
<tr>
<td>MRI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT scan</td>
<td>12%</td>
<td></td>
<td></td>
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<tr>
<td>Mammograph</td>
<td>34%</td>
<td></td>
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</tbody>
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**NUMBER OF DIGITAL RESEARCH FROM TOTAL RESEARCH STUDIES**

- **100% Digital images**
- **Accumulate with region PACS**
  - IV Quarter of 2018

**Healthcare system nowadays**
- Prevention
- Treatment

**Healthcare system in the future**
- Prevention and early diagnostic
- Treatment

Yamal is leading region where performances indicators of EGISZ Roadmap are performed
We have set ourselves the following tasks:

- To select several products for training their performance in our conditions.
- Focus on prevention, because this is one of the most important trends of the National project “Health”.
- To find a competent partner for help in consulting and professional teams.
- To launch the pilot project without funding and in a short period of time.
- Achievement of measurable and scalable results.
Collaboration with the National Medical Knowledge Base Association

Contacted the association «National Medical Knowledge Base »

Took part in the review of clinical decision support systems
Open Innovations Forum October 2018
http://nbmz.ru/2018/10/19/smotr/

The meeting with developers was held to determine the tactics and parameters of the project

The Government of the region and NMKB signed the cooperation agreement
Physicians are working in EMR system that integrated with CDSS

EMR analyzes data of the patient health record automatically and sends de-identified request to Webiomed. In response to this request Webiomed returns the identified risk factors and the appropriate assessment of risk group patients. The results are displayed on the system website page.
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The physician can send a comment to CDSS:

Experts can analyze the data and improve the system quality:

Send feedback to developers

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Work scope in the pilot project medical organization

During the pilot project period from 14.01.2019 to 31.03.2019, the hospital addressed to AI more than 60 times.

Size of EHR base for training AI
- 37 thousand patients
- 328 thousand causes of diagnostics and treatment
- 1.3 million medical records

Statistics of processing EHR in CDSS
- Average time for 1 patient: from 30 sec. up to 2 minutes (depends on the size of EMR)
- Total processing time of the all attached population (25 thousand people): 123 hours or about 5 days

The distribution of patients' risk groups changed after analysis of results and revision of algorithms
- The number of cards where the assessment was not performed reduced from 14.2% to 4.9%
- The proportion of low-risk patients reduced from 63% to 49.3%
- The proportion of very high-risk patients increased from 11% to 28.6%

Assessment of satisfaction about identified risk factors and risk group
- 5 points (excellent) 96%
- 4 points (good) 1%
- 3 points (passably) 2%
- 2 points (unsatisfactory) 0%
- 1 point (bad) 2%
The aim of investigation
- Analysis of the assessment accuracy: the cardiovascular risks by physicians in comparison with the assessment provided by the CDSS

Study materials
- 100 de-identified patient profiles
- 20 medical parameters every patient questionnaire
- 115 physicians took part in investigation
- 1947 quantity of patient questionnaire
- 7788 risk assessments have been received

Participants
- 15 medical organizations
  - Male: 10%; Female: 90%
  - Age: from 24 to 66
  - Work experience: from 1 to 42 years
  - Participants by specializations
    - Therapists (78%)
    - Cardiologist (12%)
    - Other (10%)

Methods, clinical scales
1. Score (Systematic Coronary Risk Estimation): 10 year relative risk of fatal CVD
2. Framingham: 10 year risk of developing acute cardiovascular disease (myocardial infarction, stroke, fatal CVD)
3. Procam: 10 year risk of coronary complications
4. Russian recommendation: Diagnosis and correction of lipid metabolic disorders for the prevention and treatment of atherosclerosis (VI revision)

How do doctors assess the risks?

Overall results of risk assessment

- Therapists (78%)
- Cardiologist (12%)
- Other (10%)

- Correct answers: 58% Framingham, 49% Procam, 37% Score
- Overestimated risk: 39% Framingham, 16% Procam, 11% Score
- Underestimated risk: 3% Framingham, 37% Procam, 51% Score
- Cannot be applied: 0% Framingham, 3% Procam, 0% Score

Specialization
- 0% Other
- 40% Therapists
- 60% Cardiologist
Retrospective assessment of clinical examination

The aim of investigation

Find out the difference in the risk assessment between doctors and CDSS

Were studied

1. Risk assessment of cardiovascular diseases that determined by physicians and CDSS Webiomed
2. The health group assigned by doctors according to the results of the medical examination, compared with the overall assessment of the development of CVD, provided by CDSS Webiomed

Study materials

- 5447 medical examination card from Muravlenkovskaya Hospital
- Male: 38,9%, Female: 61,1%
- Age of patients: from 20 to 89, average: 57,9
We received 2 assessment: doctor and CDSS (AI)

Final risk assessment of cardiovascular diseases by Webiomed

Risk of fatal CVD (Score) by Webiomed

Risk factors that were identified

Doctors did not mark these factors in the medical examination or missed / failed to identify

Calculation of cardiovascular risk

| Пол: | Женщина |
| Возраст: | 62 лет |
| Статус курения: | Не курит |
| Систолическое АД: | 169 мм. рт. ст. |
| Уровень общего холестерина: | 7,6 ммоль/л |
| Риск смерти от сердечно-сосудистых заболеваний в ближайшие 10 лет: | 4 % |
| Степень риска: | умеренный риск |

Retrospective assessment of health examination by Webiomed

Итоговая оценка СС-рискаРебиомед: Очень высокий
Оценка риска по шкале Score: 8 %
Группа риска по шкале Score: Высокий
Выявленные факторы риска: Абдоминальное ожирение; Ожирение II-й степени; Гиперхолестеринемия; Гипертоническая болезнь с поражением сердца
Пропущенные врачом факторы риска: Ожирение; Гиперхолестеринемия
Сравнение результатов: Оценка Webiomed выше оценки врача
Другие отметки: ⏩ Состоят на ДУ по ССЗ
ID запроса Webiomed: 61165
Дата передачи запроса в Webiomed: 27.03.2019

Шкала Score для оценки сердечно-сосудистого риска
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Detection of risk factors: physicians compared to AI

Completeness of information about identified risk factors in health examination:

- risk factors are full indicated 37%
- health records with missed risk factors 63%

The risk factors that missed during medical examination:

- hypercholesterol: 2556
- overweight: 670
- tobacco smoking: 138
- high blood pressure: 100

Quantity graph showing the distribution of missed risk factors.
The correctness of risk assessment by doctors compared to AI

Results:

- Webiomed determined at high risk patients 6.9 times more than was noted in medical examination cards.
- In 60.8% causes Webiomed set the score scale evaluation higher than marks of physicians in the medical examination card.

Coincidence of risk assessments according to clinical examination cards and Webiomed:

- 61% of assessments in medical record is low than Webiomed evaluated.
- 37% Estimates coincided.
- 2% Assessment in medical record is higher than Webiomed evaluated.
After analyzing the results the Hospital administration did a lot of internal work:

1. All adult patients attached to the hospital were evaluated CDSS Webiomed for the risks of developing CVD diseases.

2. Personal lists of patients with a high or very high risk of developing CVD were automatically generated.

3. Personal lists of patients with a high or very high risk of developing CVD were automatically generated. The number of patients is 32% of the total number of those on medical dispensary accounting for cardiovascular diseases.

4. 112 patients have already been invited on additional care at CVD, 307 registered patients have been invited for additional examinations, 393 have been invited for medical examination, work with identified patients continues.

The assessment inside high and very high risk:

- Patients for general CVD-risk in the first group of health:
  - Very high: 5%
  - High: 4%
  - Moderate: 23%
  - Low: 68%

Patients will be examined.

Doctor can be mistaken / We will improve.

Patiens of very high cardiovascular risk were identified.
The results of pilot project

**Received educational Effect**

- the question about the rectification of the algorithm for calculating risks is raised

**Heart attack prediction technology report accepted ESC**

**Real effective using of electronic medical records and image archives obtained**

- an additional tool was provided to help the physician without complicating their work

**Preparation for registration of AI as SAMD was launched in Roszdravnadzor**

ESC: European Society of Cardiology
Thanks for your attention!