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

Olga Belorus,
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YNAO, Salekhard, Russia
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.
Pilot project of artificial intelligent implementation into Yamal Healthcare

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

Our prerequisites for the AI implementation

APM (100%)
3649
Outpatient care

APM (100%)
1596
Inpatient care

100% Region medical organizations

100% Region hospitals
Work with EHR systems

96% physicians (1349 из 1416) provided by
digital signatures

96% Electronic Health
records

33,1% 50,3% 60,0%
NUMBER OF DIGITAL RESEARCH
FROM TOTAL RESEARCH STUDIES

2016 year 2017 year 2018 year

3649
APM (100%)

1596
APM (100%)

178
ultrasound

34
mammograph

12
CT scan

3
MRI

RADIATION DIAGNOSTICS DEVICES

43%

из них:
cифровых аппаратов
от числа аппаратов со
сроком использования
< 10 лет

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FROM TOTAL RESEARCH STUDIES

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43%

из них:
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Healthcare system nowadays

Healthcare system in the future

Healthcare system nowadays

January 2019

Yamal is leading region
where performances
indicators of EGisz
Roadmap are performed

Prevention
Treatment

Prevention and early diagnostic
Treatment

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Products search: Focus on Prevention

Ministry of Health of Russian Federation

The development directions are defined: movement to the prediction, prevention and a healthy lifestyle.

National project “Healthcare”

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»


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

Took part in the review of clinical decision support systems
Open Innovations Forum October 2018

http://nbmz.ru/2018/10/19/smotr/

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.
The physician can send a comment to CDSS:

Experts can analyze the data and improve the system quality:

Send feedback to developers
Work scope in the pilot project medical organization

During of pilot project period from 14.01.2019 to 31.03.2019 hospital addressed to AI > 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) 9%
- 1 points (bad) 1%
How do doctors assess the risks?

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

1. 100 de-identified patient profiles
2. 20 medical parameters every patient questionnaire
3. 115 physicians took part in investigation
4. 1947 quantity of patient questionnaire
5. 7788 risk assessments have been received

Participants

1. 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)

Overall results of risk assessment

<table>
<thead>
<tr>
<th>Specialization</th>
<th>Therapists</th>
<th>Cardiologist</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctly</td>
<td>51%</td>
<td>49%</td>
<td>0%</td>
</tr>
<tr>
<td>Incorrectly</td>
<td>49%</td>
<td>51%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Russian recommendation

- Correct answers: 44%
- Overestimated risk: 16%
- Underestimated risk: 37%
- Cannot be applied: 3%

Score

- Correct answers: 64%
- Underestimated risk: 9%
- Overestimated risk: 21%
- Cannot be applied: 15%

Framingham

- Correct answers: 59%
- Underestimated risk: 3%
- Overestimated risk: 39%
- Cannot be applied: 0%

Procam

- Correct answers: 58%
- Overestimated risk: 39%
- Underestimated risk: 3%
- Cannot be applied: 0%
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**

<table>
<thead>
<tr>
<th>Данные</th>
<th>Сердечно-сосудистый риск</th>
<th>Диагноз</th>
<th>Услуги</th>
<th>Результаты</th>
</tr>
</thead>
<tbody>
<tr>
<td>Пол: Женщина</td>
<td>Возраст: 62 лет.</td>
<td>Статус курения: Не курит</td>
<td>169 мм. рт. ст.</td>
<td>7,6 ммоль/л</td>
</tr>
<tr>
<td>Систолическое АД:</td>
<td>Уровень общего холестерина:</td>
<td>Риск смерти от сердечно-сосудистых заболеваний в ближайшие 10 лет:</td>
<td>4 %</td>
<td>умеренный риск</td>
</tr>
<tr>
<td>Степень риска:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Retrospective assessment of health examination by Webiomed**

<table>
<thead>
<tr>
<th>Итоговая оценка СС-риска Webiomed: Очень высокий</th>
<th>Оценка риска по шкале Score: 8 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Группа риска по шкале Score: Высокий</td>
<td>Выявленные факторы риска: Абдоминальное ожирение; Ожирение II-й степени; Гипертрихоз; Гипертоническая болезнь с поражением сердца</td>
</tr>
<tr>
<td>Сравнение результатов: Оценка Webiomed выше оценки врача</td>
<td>Пропущенные врачом факторы риска: Ожирение; Гипертрихоз</td>
</tr>
<tr>
<td>Другие отметки:</td>
<td></td>
</tr>
<tr>
<td>ID запроса Webiomed: 61165</td>
<td>Дата передачи запроса в Webiomed: 27.03.2019</td>
</tr>
</tbody>
</table>

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

Completeness of information about identified risk factors in health examination:

- Health records with missed risk factors: 63%
- Risk factors are full indicated: 37%

The risk factors that missed during medical examination:

- Hypercholesterol: 2556
- Overweight: 670
- Tobacco smoking: 138
- High blood pressure: 100

Quantity
0 500 1000 1500 2000 2500 3000
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 card and Webiomed:

- 61% Assessment in medical record is lower than Webiomed evaluated.
- 37% Estimates coincided.
- 2% Assessment in medical record is higher than Webiomed evaluated.

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Assessments in Health Record</th>
<th>Assessment of Webiomed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undentified</td>
<td>2561</td>
<td></td>
</tr>
<tr>
<td>Low Risk</td>
<td>217</td>
<td>591</td>
</tr>
<tr>
<td>Moderate Risk</td>
<td>353</td>
<td>2109</td>
</tr>
<tr>
<td>High Risk</td>
<td>44</td>
<td>305</td>
</tr>
<tr>
<td>Very High Risk</td>
<td>79</td>
<td>75</td>
</tr>
</tbody>
</table>
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 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.

**Real effective using**

- Using 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**

- SAMD was launched in Roszdravnadzor.
- ESC technology report accepted.
Thanks for your attention!