Method for estimation of efficiency of telemedical consultation

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### Table 2. Outcomes Used for Telemedicine Evaluation

<table>
<thead>
<tr>
<th>Components</th>
<th>Number of evaluations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical outcomes</td>
<td></td>
</tr>
<tr>
<td>Clinical effectiveness</td>
<td>3 (2.7%)</td>
</tr>
<tr>
<td>Patient satisfaction</td>
<td>26 (23.2%)</td>
</tr>
<tr>
<td>Diagnostic accuracy</td>
<td>49 (43.8%)</td>
</tr>
<tr>
<td>Cost</td>
<td>9 (8.0%)</td>
</tr>
<tr>
<td>Nonclinical outcomes</td>
<td></td>
</tr>
<tr>
<td>Technical evaluation</td>
<td>15 (13.4%)</td>
</tr>
<tr>
<td>Management evaluation</td>
<td>10 (8.9%)</td>
</tr>
<tr>
<td>Total</td>
<td>112</td>
</tr>
</tbody>
</table>

**For example...**

- Financial benefits
- Moral aspects
- Changes of clinical parameters
- Management improvements


Bergmo TS; PalaninathaRaja M et al.
Siden HB; Chan FY et al.
Lambrecht CJ; Rendina MC
Rollert MK et al; Rosser JC et al
Own classification for methods of telemedicine efficiency investigations (MTEI) (presented at Med-e-Tel 2006)

1. Clinical MTEI:
   investigation of establishment activity efficiency;
   investigation of diagnostic and treatment activity, outcomes efficiency;
   investigation of diagnostical accuracy;
   investigation of moral efficiency.

2. Non-clinical MTEI:
   investigation of economical efficiency;
   investigation of psychological status;
   investigation of technical efficiency;
   investigation of management efficiency.
Complex method for estimation of efficiency of telemedicine consultations

It should be the set of objective criteria which it would be possible to use for statistical processing with the purpose of comparison, studying of different kinds of telemedical consultations etc...
Relevance of teleconsultation - conformity of the distant adviser’s answer to information and medical needs of the attending physician ( subscriber)

Questionnaires for definition of relevance
Subjective questionnaire (3 mark scale)

Discrepancy of answers to questions
1 point

Incomplete conformity of answers to questions, an illegibility of formulations and recommendations
2 points

Full conformity of answers to questions, presence of the additional confirming information (articles, links, references, similar clinical cases etc)
3 points
# Objective questionnaire

*(terms, conformity of answers, additional confirming information, influence on the clinical decisions, inquiry for additional diagnostic tests, expert propositions, consilium, transportation)*

## 1. Terms. Teleconsultation is lead:

<table>
<thead>
<tr>
<th>Terms</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before the necessary terms</td>
<td>3</td>
</tr>
<tr>
<td>In the necessary terms</td>
<td>3</td>
</tr>
<tr>
<td>After necessary terms</td>
<td>2</td>
</tr>
<tr>
<td>In terms of full loss of the urgency</td>
<td>1</td>
</tr>
</tbody>
</table>

## 2. Conformity of answers:

<table>
<thead>
<tr>
<th>Conformity</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full conformity</td>
<td>3</td>
</tr>
<tr>
<td>Incomplete conformity of answers to questions, an illegibility of formulations and recommendations</td>
<td>2</td>
</tr>
<tr>
<td>Discrepancy of answers to questions</td>
<td>1</td>
</tr>
</tbody>
</table>
3. Presence of the additional confirming information (articles, links, references, similar clinical cases etc), evidence-based recommendations:

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

4. Influence on the clinical tactics:

<table>
<thead>
<tr>
<th>Tactics of the adviser is completely accepted</th>
<th>Essential change of own tactics</th>
<th>Acknowledgement of own tactics</th>
<th>Refusal of adviser’s recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

5. Inquiry for additional diagnostic tests:

<table>
<thead>
<tr>
<th>No/ Accessible tests</th>
<th>Accessible tests with an investment of significant expenses (work, money)</th>
<th>Inaccessible tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
6. Expert has propose:

<table>
<thead>
<tr>
<th>Option</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>One clinical program</td>
<td>3</td>
</tr>
<tr>
<td>A few clinical programs</td>
<td>2</td>
</tr>
<tr>
<td>Preconditions for formation of the program</td>
<td>1</td>
</tr>
</tbody>
</table>

7. A few distant experts take a part:

<table>
<thead>
<tr>
<th>Option</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>3</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
</tr>
</tbody>
</table>

8. Transportation after teleconsultation

<table>
<thead>
<tr>
<th>Option</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>3</td>
</tr>
</tbody>
</table>

18-24 points - high relevance
13-17 points - average relevance
8-12 points - low relevance
Criterion relevance for telemedical system

**Relsys**

\[
\text{Rel}_{\text{sys}} = \frac{\text{TK}_{\text{rel}}}{\text{TK}}
\]

TKrel - quantity of teleconsultations with specific relevance (high and/or average), TK - total quantity of teleconsultations

Accordingly, in ideal situation this parameter aspires to 1
Economic feasibility

Cost of teleconsultation (Stk)

Profitability of teleconsultation (Rtk)

After calculation of Stk and Rtk researcher can compare results with other services...
**Quality indicators**

- parameter of presence/absence of the expert’s answer (A)
- parameter of average duration (T)
- average quantity of the experts’ answers (Aq)
- timeliness of teleconsultations (Pt)
- quality of teleconsultations (Pq)
A - parameter of presence/absence of the expert’s answer

0 – absence of answer

1 – presence of answer

To define a parity of taken and not taken place teleconsultations...

T - parameter of average duration

\[
\overline{T} = \frac{\sum_{i=1}^{n} T_i}{n}
\]

in numerator - the sum of durations of all teleconsultations

in denominator - quantity of teleconsultations
**Aq - average quantity of the experts’ answers**

\[
Aq = \frac{\sum_{i=1}^{n} Aq_i}{n}
\]

- In numerator: quantity of answers (experts)
- In denominator: quantity of teleconsultations

**Pt - timeliness of teleconsultations**

\[
Pt = \frac{m(t \leq t_{дон})}{n_t}
\]

- In numerator: quantity of duly received teleconsultations during certain time
- In denominator: total quantity of teleconsultations for the same period of time
**Pq** - quality of teleconsultations

\[ Pq = \frac{m}{n} \]

- \( m \) - quantity of teleconsultations of admissible quality
- \( n \) - total quantity of teleconsultations

**Pt** - probability of effective teleconsultation

\[ P_{tk} = Pt \times Pq \]

*In ideal situation this parameter aspires to 1*
Teleconsultation №1
Teleconsultation №2
Teleconsultation №N

Sampling (by time period, by technology etc)

Estimation of quality indicators
- A-parameter
- T-parameter
- Aq-parameter

Estimation of relevance for each teleconsultation
Estimation of relevance for telemedicine system (Rel_{tel})

Comparative and qualitative statistical analysis

Estimation of prime price (S_{k_1})
Estimation of profitability (R_{k_1})

Estimation of quality indicators
- Pq-parameter
- Pt-parameter
- P_{k_1}-parameter

Programming of further activity
Regional Telemedicine Network

27 teleconsultation (in traumatology and orthopedics) during 2006 year

Quality Indicators, Relevance, also Clinical Outcomes Comparison

3 rural hospitals, 2 town hospitals From Donetsk region
A-parameter (of presence/absence of the expert’s answer):
All teleconsultations were successful. A-parameter - 1.

**Excellent!**

T-parameter (of average duration of teleconsultations):
synchronous - total 8, most fast takes 20 min., most slow takes 38 min., T-parameter - 28.5 min.

**Nothing to compare!**
asynchronous - total 19, most fast takes 12 hours., most slow takes about 70 hours, T-parameter - 30 hours.

**Excellent!**
Aq (average quantity of the experts’ answers): total - 27, from 1 to 6 opinions for each case. Aq = 1.85

Bad!

Pt - timeliness of teleconsultations: Total 27, 24 - in the actual terms, 3 - after necessary terms Pt = 0.9

Good!

Relevance

RELsys = 1.

Excellent!
Clinical outcomes - anatomical and functional results of treatment (tactics proposed by experts)

**Good!**

Pq - quality of teleconsultations

- by Relevance
  
  \[ \text{Pq} = \frac{\text{High} + \text{Medium}}{\text{Total}} \]
  
  Pq=1

**Excellent!**

- by Outcomes
  
  \[ \text{Pq} = \frac{\text{Excellent} + \text{Good}}{\text{Total}} \]
  
  Pq=0.6

**Good!**
Ptk - **probability of effective teleconsultation**

Ttk1 = Pt*Pq = 0,9*1=0,9 - probability of enough relevant teleconsultation is 90%

**Good!**

Ttk2 = Pt*Pq = 0,9*0,6=0,54 - probability of teleconsultation which will give positive clinical results is 54%

**Bad!**
CONCLUSION

- all teleconsultation was delivered in pretty good terms (average duration - excellent, timeliness – good)

- quantity of the experts’ answers was low (1,85), but with good quality (high relevance – 60%, medium – 40%)

- quality of teleconsultations by relevance excellent, by outcomes good

- probability of enough relevant teleconsultation is 90% (good), but probability of teleconsultation which will give positive clinical results is only 54%

- to increase total quantity of teleconsultation

- to attract at least 2-3 independ experts for each clinical case

- experts’ opinions should be more clear and appropriate to conditions of rural hospitals
THANK YOU VERY MUCH!

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