Improvement of inter-services communication through a CDSS dedicated to myocardial perfusion scintigraphy

Julie Niès
MEDASYS, Gif-Sur-Yvette, France

Gersende Georg,
French National Authority for Health (HAS) Saint-Denis La Plaine, France
Marc Faraggi,
Department of nuclear medicine, Georges Pompidou European Hospital, Paris, France
Isabelle Colombet and Pierre Durieux
Medical Informatics Department, Georges Pompidou European Hospital, Paris, France

Oral presentation at MIE 2011 – 29th August 2011 – Oslo
**Context**

**CDSS** can improve **clinical practices** and **patient outcomes**, particularly under the form of **on-screen computer reminders**.

Studies shown **no learning effect**.
Using an **alternating-time series design**, each time the **system** was inactive, medical practices came back to the initial level before intervention.

The **present work** consists in implementing an **on-screen computer reminder** to help ordering **Myocardial Perfusion Scintigraphy** (MPS).
It was performed in the Georges Pompidou European Hospital using an entirely computerized HIS with patient centered EHR, DxCare®.

The EHR allows the computerized prescription of **drugs, imaging and laboratory tests by means of a CPOE system**. All MPS orders are made by physicians through the CPOE.
Ordering process in HEGP

Physicians of the nuclear medicine department answer demands and schedule examinations on the basis of information transmitted by prescriber through the CPOE, in a free-text field associated to orders.

- patient characteristics
- aim of the examination
Myocardial perfusion scintigraphy

The myocardial perfusion scintigraphy consists in creating **functional images** of the myocardium **showing where the blood is flowing**, by following over time the distribution of tracers injected into the blood stream.

This examination is performed to search for **myocardial ischemia**.

Knowledge of **clinical context** and **diagnosis objective** is needed:
- to anticipate the conditions of tracer administration, 
  - at rest, 
  - during a muscular effort, 
  - during a pharmacological stress; 
- to appropriately schedule the examination; 
- to prepare patients.
CDSS design

During the MPS ordering, a **dedicated questionnaire** appeared once by patient stay, helping the prescriber to complete clinical data required by the patient-specific reminder:

1) **coronary disease history**, myocardial infarctions and/or revascularization interventions;
2) **coronary risks factors** when needed, in case of primary diagnosis objective;
3) **contra-indications** for stress test.

The reminder was displayed to the prescriber, proposing:
- one or several **MPS types** according to the patient characteristics,
- a **memo** (pre-formatted text).

The content of the reminder and a dedicated questionnaire **have been designed with the physicians** performing the MPS.
The memo is **not automatically integrated** in the order window. The prescriber can:

1) **copy/past** the CDSS memo in the comment area of the order window,
2) **modifies** the CDSS memo, or
3) **writes** his own comment.
Quantitative Evaluation - Method

Study period: 31 months, from January 2005 to July 2007
Alternated series:
- CDSS activated, activity periods A1 and A2,
  - CDSS not activated, control periods C1 and C2,
    - C1 – 23 weeks
    - A1 – 43 weeks
    - C2 – 23 weeks
    - A2 – 43 weeks

Impossibility to directly link the imaging orders with their realization.
We could not verify if the reminder had an impact on the MPS cancellation.

Primary outcome: number of comments influenced by the CDSS
Secondary outcome: number of empty comments
Comments were blindly classified by two authors in 4 categories:
Divergences were resolved by consensus.
Comments classified as ‘Identical’ or ‘Modified’ correspond to comments influenced by the CDSS.
### Quantitative Evaluation - Results

<table>
<thead>
<tr>
<th>Type of comment</th>
<th>C1 (N=859)</th>
<th>A1 (N=779)</th>
<th>C2 (N=323)</th>
<th>A2 (N=801)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Identical</strong></td>
<td>N/A</td>
<td>75 (9.6%)</td>
<td>N/A</td>
<td>57 (7.1%)</td>
</tr>
<tr>
<td>(copied and pasted from the CDSS memos)</td>
<td></td>
<td>[7.6-11.9%]</td>
<td></td>
<td>[5.4-9.1%]</td>
</tr>
<tr>
<td><strong>Modified</strong></td>
<td>N/A</td>
<td>213 (27.3%)</td>
<td>N/A</td>
<td>257 (32.1%)</td>
</tr>
<tr>
<td>(partly copied and pasted from the CDSS memos with additional information; totally written by the prescriber containing information from the CDSS memos, with or without complementary information)</td>
<td></td>
<td>[24.2-30.6%]</td>
<td></td>
<td>[28.8-35.4%]</td>
</tr>
<tr>
<td><strong>Different</strong></td>
<td></td>
<td>739 (86.0%)</td>
<td>414 (53.2%)</td>
<td>314 (97.2%)</td>
</tr>
<tr>
<td>(with no link with the CDSS memos)</td>
<td></td>
<td>[83.5%-88.2%]</td>
<td>[49.5-56.6%]</td>
<td>[94.7%-98.7%]</td>
</tr>
<tr>
<td><strong>Empty</strong></td>
<td>120 (14%)</td>
<td>77 (9.9%)</td>
<td>9 (2.8%)</td>
<td>32 (4.0%)</td>
</tr>
<tr>
<td></td>
<td>[11.7%-16.4%]</td>
<td>[7.8%-12.1%]</td>
<td>[1.3%-5.2%]</td>
<td>[2.7%-5.5%]</td>
</tr>
</tbody>
</table>

n (%) [95%CI]: 95% CI for proportions were computed using exact binomial distribution.

Percentage of **empty comments decreased** after the first activated period and the contents of comments were **directly influenced** by the CDSS display.
Qualitative Evaluation

Method

Comparative study of the comments content for every period. Use of a software dedicated to statistical analysis of texts: Tropes™. We focalized on concepts used by the CDSS and appearing in C2 period.

Results

Some concepts
- are present in every periods, such as the goal of the examination, ‘search for ischemia’ or ‘search for viability’,
- which didn’t exist in C1 appeared in C2,
  ‘contra-indications’ (179 occurrences),
  ‘asthma’ (11 occurrences), and ‘aneurysm’ (10 occurrences),
- are more represented in C2,
  6 occurrences representing beta-blocking drugs in C1; 37 in C2.

All these concepts were used in the memos proposed in A1.

We can thus deduce a type of learning effect or sensibility to the information to be communicated to the nuclear medicine department.
Previous studies: the support compensated an error or omission; as long as the system was active, the reminder was efficient but all effects stopped when the system was disabled.

Our experiment: the support was used to structure reasoning which is always done by the prescriber but which is not reported along with the order.

Further work: specific analysis of the content of ‘Modified’ comments from A1 and A2 periods in order to determine the information which is not displayed by the CDSS but considered important to be communicated by the prescriber.
Thank you for your attention.


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