Requirements for workflow-based EHR systems

Results of a qualitative study

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Electronic Health Records are useless...
OntoHealth

data

get documents for patient ID=1234567

get documents from patient ID=1234567

Extract prescribed medication

Check for interactions

Functionality
Example

Electronic Health Record (EHR)

Task
- Function: retrieve
- Data: medication
- NFP: performance

End user

workflow

results

OntoHealth

Web Services
- Extract medication
- Get documents
- Check interactions
- Visualize results

Electronic Health Record (EHR)
Requirements Engineering

- Systematic review
  - scientific literature, standards, best-practices,…
  - Results: categorization of building blocks for clinical workflows (data-elements, actions, contexts)

- Direct observations
  - EHR tasks during physician-patient contacts
  - Analyzed process structure and information needs

- Experts interviews
Interviews - Objectives

• Validation of previous results
  o Literature analysis (information needs) und
  o observations (required functions, process-related requirements)

• Process-related requirements
• Information needs
• Functions
• Non-functional requirements
Methods

Interview Guideline

Personal experience
Non-functional requirements
Needs
Desires
Vision
OntoHealth
Future changes
Currently used documentation system
Information needs
Positive
Negative

Examination process
Preparation
Examination
Postprocessing
Decision
Assessment
Organizational tasks
Situation-related
Case-related
Process-related

Non-functional requirements
Future changes
Currently used documentation system
Information needs
Methods

- Recruited contacts per telephone and email
- Conducted interviews personally in the participant's office
- Audio recorded all interviews
- Qualitative content analysis using MaxQDA

1 http://www.maxqda.de/
Results

• 7 Interviews (m=5, f=2)
  o 4 Diabetes specialists from hospitals
  o 3 physicians from private practices
• Mean working experience: 19.7 years (range: 10-32)
• 526 annotated codes
• Main categories:
  o information needs during diabetes examination (N\textsuperscript{1}=157)
  o process-related requirements (N=146)
  o required functions (N=113)
  o non-functional requirements (N=26)

\textsuperscript{1} multiple assignments possible
Results - Functions

• „… cumbersome to interpret the results of other institution’s reports”.
• “… where I need to read through the complete document to find e.g. the currently prescribed medication.”
• “… hard to find the interesting facts, like pathologic results”
• “The system now is very inflexible: I always get the same presentation, I’d like to chose different contents or functions to process the data …”

• Needed functions
  o Information filtering (N\(^1\)=11, NP\(^2\)=5)
  o Templates for different situations (N=10, NP=5)
  o Flexible workflow management (N=9, NP=6)
  o Shared workflow (N=5, NP=4)
Results – Non-Functional Properties

• Important NFP for Service selection:

- Usability
- Efficiency/Performance
- Security/Privacy
- Availability
- Costs

• OntoHealth utilization: User differences between hospitals and private practices
Discussion

• Need for individual, flexible EHR access
  o Workflow support
  o Data flexibility
  o Functionality flexibility

• Non-functional properties for service selection

• Triangulation approach: involve different point of views

• Limitations
  o Limit on physician-patient contacts
  o Reduced number of physicians → natural saturation
  o QCA: Only one researcher
## Conclusion

*Workflow-based EHR Systems need to…*

<table>
<thead>
<tr>
<th><strong>Flexibility</strong></th>
<th>• … offer flexibility in defining user needs (domain-specific definition)</th>
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<tbody>
<tr>
<td><strong>Individual Information</strong></td>
<td>• … provide the needed information in the right form, without unwanted details</td>
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<td><strong>Situation related</strong></td>
<td>• … cover context- and case-specific information structures</td>
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<td><strong>Modularity</strong></td>
<td>• …. be based on modular approaches (SOA) flexible to dynamic changes</td>
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<td><strong>Quality requirements</strong></td>
<td>• … propose user specified quality parameters for service-selection would facilitate the adaption of IT for certain user requirements</td>
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Outlook

• Requirements are used for
  o Modelling the OntoHealth ontology “WISE-DM”
  o Defining Sample Services
  o Defining Sample Use-Cases and workflows
Electronic Health Records are useless…

…if they don’t comply with individual clinical workflows

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