HUMAN FACTORS BASED RECOMMENDATIONS FOR THE DESIGN OF MEDICATION RELATED CLINICAL DECISION SUPPORT SYSTEMS (CDSS)

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Background of the study

Many safety and quality benefits with medication related CDSS

Yet, their clinical effectiveness has lagged behind expectations in many implementations

BUT poor user acceptance of the presented alerts:
  • Poor usability (the way the alert is displayed),
  • Intrusiveness,
  • Incompatibility with real clinical workflows,
  • Over-alerting

A deeper understanding of the HF issues might reveal relevant insights for their design
Objective of the study

• Part of a European project (PSIP)
  – Design advanced CDS functions
  – Focus on subset of preventable ADE: medication monitoring errors
    ➔ Faulty/Insufficiently monitoring lab values

• Give HF recommendations for improving acceptance of alerts

• Focus:
  – problem of over-alerting, how to reduce false alarms (not useful for professionals)
    • Need for taking into account the clinical context/act as a clinician partner.
  – Identification of the relevant indicators of the clinical context for the monitoring of the treatment based on lab values

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Methods of the study

Methods

• Capitalization on
  – our own knowledge of clinical work situations
  – and literature about the current limitations of existing CDSS

• Completion by focused work analysis on the monitoring process of patients treatments based mainly on corresponding lab values.

Sites

• 416-bed northern France Hospital (Denain) equipped with a EHR (DxCare®) that includes a CPOE with currently limited CDS functions.
RESULTS

Description of the work situation and the cognitive processes involved
Medications ordered and administered to treat the patient according to his/her conditions.
Description of the cognitive processes

Supervision of the evolution of the patient’s conditions

Patient Day 5

Graph:
- min
- max
- K±
Description of the cognitive processes

Is there any medication contributing to this abnormal evolution of lab values? If so, what’s this contribution?

What’s the cost/benefit balance of the med? We should adapt the treatment.

We could use a more adapted med.

I must see the physician before administering the med!

We could use a more adapted med.

I must see the physician before administering the med!
To monitor the patient’s conditions with the lab results, healthcare professionals proceed in three steps:

1. Check whether the lab result is available or not (if not, is the corresponding lab test ordered?)

2. If available, is it recent enough to be valid? (if not, has the corresponding lab order been renewed?)

3. If recent enough, is it within acceptable limits (if not, do we need to consider adapting the treatment)

→ Is the patient’s clinical status alarming or not (yet)?
RESULTS

Recommendation to reduce false alarm:
How can we catch clinical context?
Recommendation

Identification of 8 different clinical contexts and adaptation of the display (or not) of the alert

UML modelling
Medications ordered

Cx-CDSS: checking the presence of the lab results related to the potential ADE

No result available

Result available

Potential ADE indicator monitored

Cx-CDSS: checking whether a lab test corresponding to the potential ADE indicator is ordered or not

Lab test ordered

No result about the potential ADE indicator

Lab test not ordered

1. Potential ADE indicator not monitored but lab test ordered

2. Potential ADE indicator not monitored and lab test not ordered

Last result normal

3. Last result normal and sufficiently recent

4. Last result normal but not recent enough and lab test not ordered

Cx-CDSS: Checking whether a lab test corresponding to the potential ADE indicator is ordered or not

Lab test ordered

5. Last result normal but not recent enough but lab test ordered

Lab test not ordered

6. Last result abnormal but sufficiently recent

7. Last result abnormal and not sufficiently recent

Lab test ordered

8. Last result abnormal and not recent enough but lab test ordered

Last result = normal

Result = abnormal

Last result = sufficiently recent or not

Result = not sufficiently recent

Result = not recent enough

Result = sufficiently recent

Result = not recent enough

Result = not recent enough

Result = not recent enough
Medications ordered

Cx-CDDS: checking the presence of the lab results related to the potential ADE indicator

No result available

Potential ADE indicator monitored

Cx-CDDS: checking whether a lab test corresponding to the potential ADE indicator is ordered or not

Lab test ordered

Lab test not ordered

No result about the potential ADE indicator

Cx-CDDS: checking whether the last result is normal or not

Last result normal

Last result normal and sufficiently recent

Result sufficiently recent

Result not sufficiently recent

Last result normal but not recent enough

Last result abnormal

Result sufficiently recent

Result not sufficiently recent

Last result abnormal but not sufficiently recent

Lab test ordered

Lab test not ordered

Last result abnormal and not sufficiently recent

Information available for users but not interruptive

3. Last result normal and sufficiently recent

Result sufficiently recent

Result not sufficiently recent

Last result normal but not recent enough

Last result异常 but not sufficiently recent

Lab test ordered

Lab test not ordered

Last result abnormal and not recent enough but lab test ordered

Last result abnormal and not recent enough but lab test not ordered

Cx-CDDS: Checking whether a lab test corresponding to the potential ADE indicator is ordered or not

Lab test ordered

Lab test not ordered
No result available

No result about the potential ADE indicator

Lab test ordered

Lab test not ordered

Last result normal

Last result abnormal

Result available

Potential ADE indicator monitored

Cx-CDSS: checking whether a lab test corresponding to the potential ADE indicator is ordered or not

1. Potential ADE indicator not monitored but lab test ordered

2. Potential ADE indicator not monitored and lab test not ordered

3. Last result normal and sufficiently recent

4. Last result normal but not recent enough and lab test not ordered

5. Last result normal but not recent enough but lab test ordered

6. Last result abnormal and not recent enough

7. Last result abnormal and not recent enough and lab test ordered

8. Lab test ordered

Last result = normal

Last result = abnormal

Result sufficiently recent

Result not recently enough

Uncertain and potentially dangerous situation

An advice of monitoring given to the users
• Part of knowledge implemented in CDSS to catch context, for meds monitoring alerts.

• But it requires still to solve knowledge challenges.
  – Normality?
  – Validity?
  – Which lab value?
• Go a step further taking into account the state of the patient and the actions already engaged.

• Need now for:
  – the assessment of model impact
  – The improvement of the knowledge base.
• Set of HF recommendations for the design of CDSS, e.g. be a clinician partner, a teamplayer, ...

• Even if there is still a lot of work to do, this type of initiatives can bring an added value to initiatives as the CUI to improve acceptance and reduce errors
THANK YOU!