



Initial user- centred design of an AI- based clinical decision support system for primary care

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Introduction

Why is this subject relevant?

Challenges of General Practitioners (GPs) in Primary Care



Patients with nonspecific symptoms → Diagnostic range



Long-term diagnostic process vs. limited time



Unique role of GPs as 'gatekeeper'



Rapidly growing knowledge

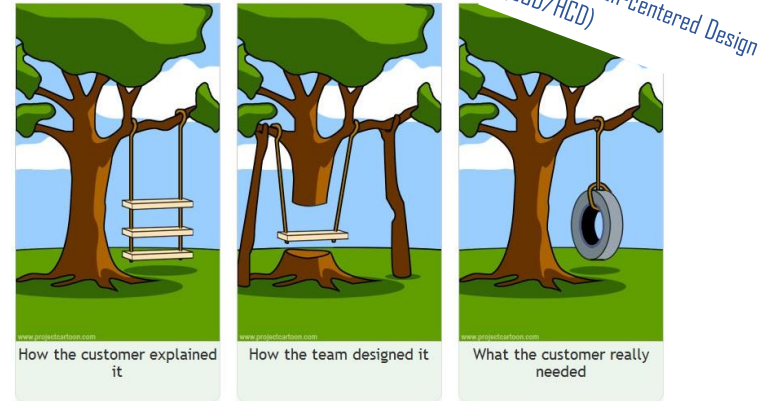


Background



Project aim

- Support the diagnostic process
- CDSS for unclear and rare diseases
- 3 different AI methods



The user plays an essential role!

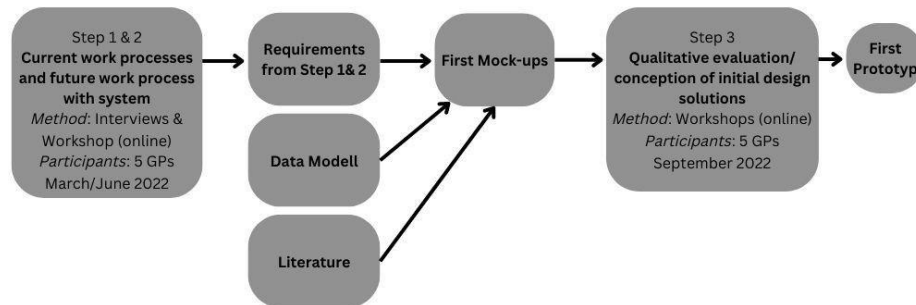
→ **Research question:** How do general practitioners envision the user interface of an AI-based clinical decision support system for primary care?



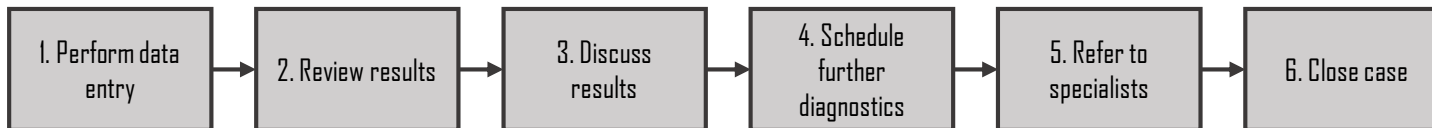
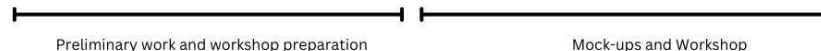
Methods

Conception of an initial design

- Mock-up creation balsamiq®
resulted of the preliminary work



- and the designed task model





Methods

Evaluation workshop

- 2 workshops : discussing the mock-ups
- online video conference tool (with recording)
- discussion guide and protocol

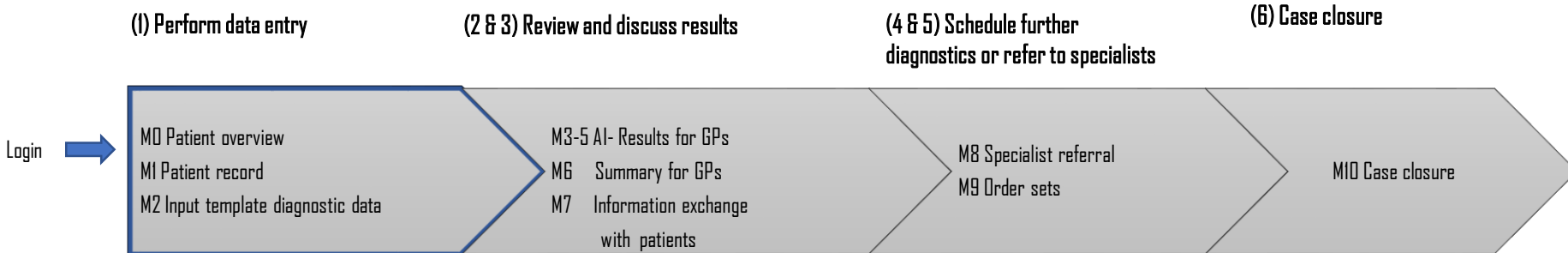
Result analysis

1. **Paraphrasing** answers to the guideline questions
2. **Consolidating** notes and results of the audio analysis
3. **Summarising and categorizing** the key messages



Results

Mock-ups






Results

Mock-ups

MI

A Web Page

https://www.saturn-info.de

 SATURN
Software for Automated Treatment and Reporting in UNdernutrition

≡ 8

Patient Record

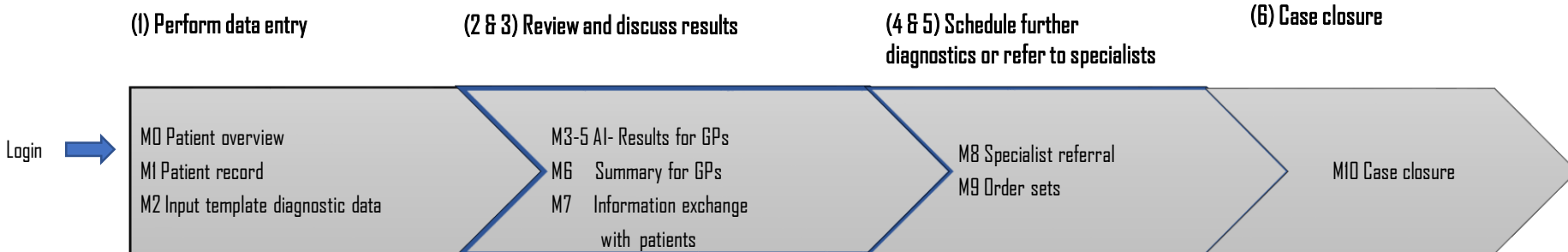
ID:	12345	<- automatically generated
Sex:	<div>female male unknown</div>	
Age:	<div>40-45 0-9 10-19 20-29 30-39 ...</div>	
Weight (kg):	73	
Height (cm):	160	
BMI:	28,5 (Overweight/ Preadiposity)	<- automatically generated
Existing pregnancy	<input type="radio"/> yes <input checked="" type="radio"/> no	<- only for sex= female

Save Edit Go to Data Entry



Results

Mock-ups





Results

Mock-ups

M3-5

Results

Current patient
Patient 12345
Demographics

Parameter	Entered value
Age	40-50
Sex	male
Weight	73 kg
BMI	28.1 (Adipositas)
ZIP	60570

Parameter of the patient

Parameter	Entered value
Suspected diagnosis	Drug-induced thyroiditis (ICD-10 code: E06.4)
Symptoms	Fatigue (HPD Code: HP0012378 Fatigue)
Vital signs	-
Laboratory values	Thyroxine in serum (plasma) (4.5 IU/L; u.30- 4.30)
Medication	Levothyroxine-Natrium (ATC-Code: ATC:H03AA01)
Examination results	Thyroid sonography (OPS code: 3-003.1) Detection of nodules in the thyroid gland

Case-based Reasoning | Machine Learning | Rule-based System

Similar patients

Patient 1	More Informations	Patient 1	More Informations
Similarity (total)	0.75	0.54	
Diagnosis	Autoimmune thyroiditis (ICD-10 code: E06.3)	Drug-induced thyroiditis (ICD-10 code: E06.4)	
Secondary	-	-	

Patient 1	Similarity	Patient 2	Similarity
Age	50-60	30-40	0.90
Sex	male	female	0.50
Weight	88 kg	90 kg	0.65
BMI	24.7 (Normal weight)	33.1 (Adipositas I)	0.65
ZIP	60590	61462	0.75
Symptoms	Fatigue (HP-0012378 Fatigue)	-	
Vital signs	Blood pressure: 140/90	-	
Laboratory values	TSH Qn > Reference value	FT3 < Reference value	0.00
Examinations	Thyroid sonography (OPS code: 3-003.1)	Thyroid sonography (OPS code: 3-003.1)	0.00
Medication	-	Levothyroxine-Natrium (ATC:H03AA01)	1.00
Schwangerschaft	x	nein	1.00

Show patient details | Hide Patient

Case-based Reasoning | Machine Learning | Rule-based System

Patient 12345
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Medication	Levothyroxine-Natrium (ATC-Code: ATC:H03AA01)
Examination results	Thyroid sonography (OPS code: 3-003.1) Detection of nodules in the thyroid gland

Probability (%)

Diagnosis	Code of Diagnosis	Relevant Parameters	Details/Informations	Vote
Autoimmune thyroiditis	ICD code: E06.3	Symptom 1 (.) = Lab value MY (.)		
Drug-induced thyroiditis	ICD code: E06.4	Symptom 2 (.)		
Thyrotoxicosis with diffuse goitre	ICD code: E05.0	Lab value Z		

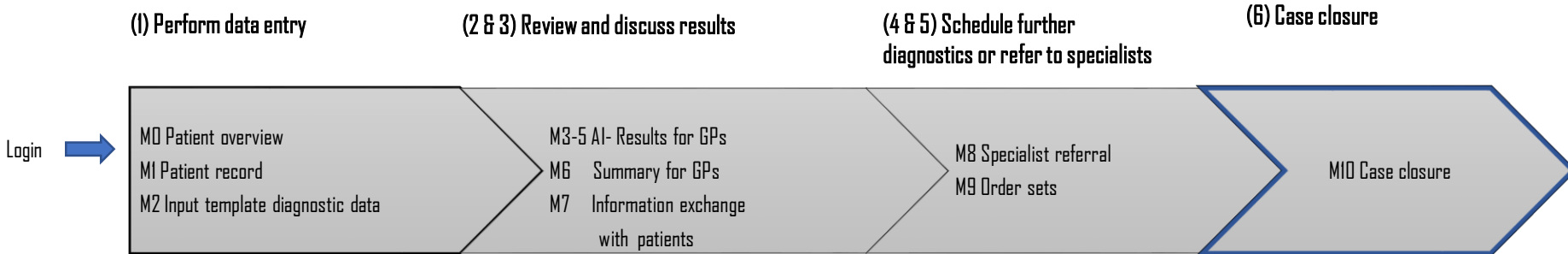
Alternative or Additional

Graphic Visualization e.g. Histogram



Results

Mock-ups








Results

Mock-ups

MID

A Web Page

https://www.saturn-info.de

Case Closure

Patient 12345
Demographics

Parameter	Entered values
Age	40-50
Sex	weiblich
Weight	73 kg
BMI	28.5 (Präadipositas)
ZIP	60590

Parameter of the patient


Parameter	Entered values
Suspected diagnosis	Drug-induced thyroiditis (ICD-10 code: E06.4)
Symptoms	Fatigue (HPO Code: HP0012378 Fatigue)
Vital signs	-
Laboratory values	Thyrotropin in serum/ plasma (4.5 mIU/l; 0.30– 4.20)
Medication	Levothyroxin-Natrium (ATC- Code: ATC.H03AA01)
Examination results	Thyroid sonography (OPS code: 3-036): Detection of nodules in the thyroid gland


ID: 12345

Diagnosis: < ICD-10-GM codes

Bezeichnung:

Type: Code:

Date of diagnosis: 

Diagnostic safety: 



Results

Workshop Results

Demographics of participants

- gender: 40% ♀ 60% ♂
- mean age: 40.8 years
- general feedback on mock-ups
e.g. relevance of clarity

Key messages

for the improvement of the design proposals

No.	Task	Category	Key message
1	1	Entry and processing	Intelligent request of parameters, based on previous inputs.
2	1	Entry and processing	No usage of mandatory fields.
3	1	Entry and processing	Ability to transfer information from other sources.
4	1	New data fields	Provide basic categories for diagnoses and symptoms.
5	2	Visualisation	Aggregation of all AI results in a clear presentation.
6	3	Access authorization	Individual access for patients, controlled by GP.
7	3	Entry and processing	Patient symptom entry function (portal access provided).
8	4	Provided information	Brief information on suspected diagnosis (in case of rare disease).
9	4	Search assistance	Possibility to filter information on specialists according to their proximity to the place of residence.
10	6	New data fields	Possibility to document diagnosis history at case closure.
11	1+ 6	Entry and processing	Possibility to enter and edit file attachments.
12	1- 6	Visualisation	Focus on clarity.



Discussion

Methods

- 5 GPs:

small group size vs. intensive task-based mock-up discussion

→ Groups of 5-8 people are also described as a good group size by various other sources, e.g. Geis, 2018

- More general presentation of the mock-ups
wide range of visualisation methods):

limitation vs. allowing space for ideas

(does not cover the



Discussion

Outcome

- General feedback + key messages for the improvement of a CDSS design proposals for primary care in Germany
- Further course of the project: results -> functional requirements
- Iterative feedback from GPs will be collected regularly
- Feedback reflects findings from other studies
 - e.g. Importance of integration of CDSS into the work routine of the individual practitioner



Conclusion and outlook

- Valuable feedback on GPs' expectations of the UI
- Recommendation of further close involvement of GPs

Regular stakeholder involvement in CDSS projects is very valuable!



Thank you!

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