



Contextualizing Clinical Information

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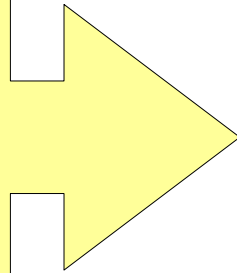
Contextualizing clinical information ...



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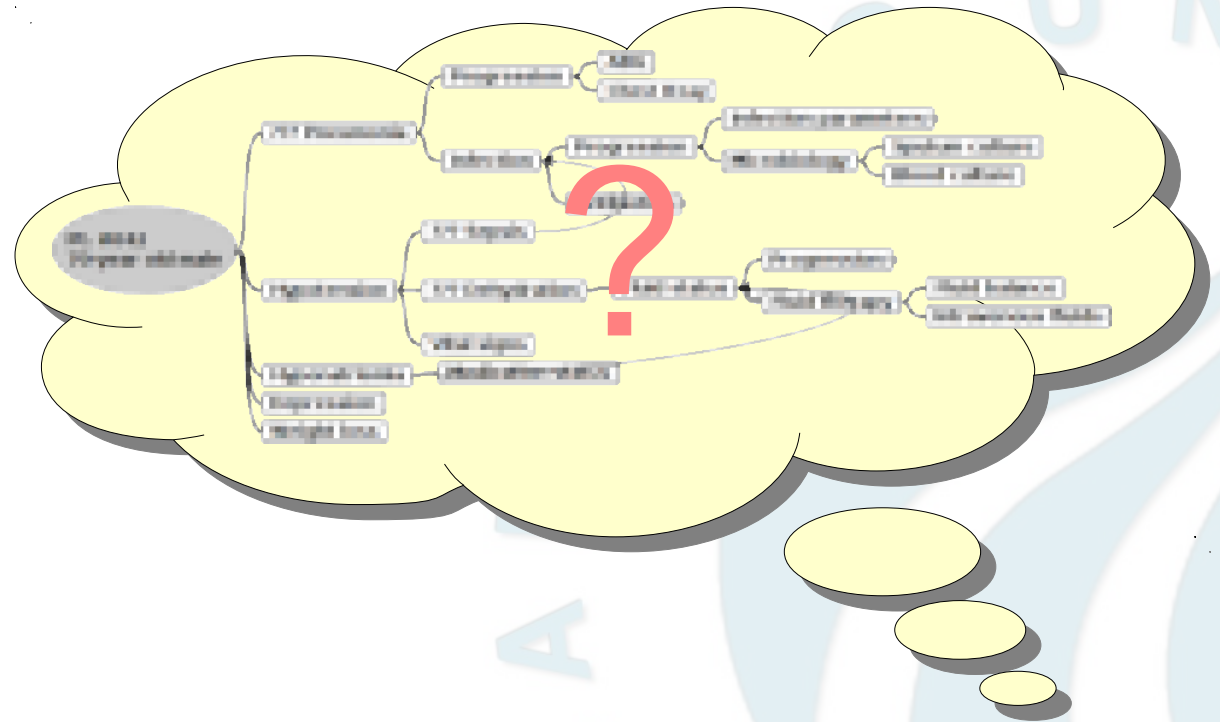
Contextualizing clinical information ...



... is in the given situation to separate the relevant from the non-relevant, and to gather the relevant into a coherent context.



Contextualizing clinical information ...



Q1: Is it possible to depict the doctor's clinically logical structure of contextualized information?



The health record in the Capital Region of Denmark

The collage consists of several interconnected components:

- Flowcharts:** Multiple diagrams showing patient pathways, such as 'Flowchart of Arterial Hypertension' and 'Flowchart of Diabetes', detailing clinical decision points and treatment steps.
- Tables:** Numerous data tables, including a 'Table 1' with patient counts and a 'Table 2' with clinical parameters, providing quantitative data for various conditions.
- Line Graphs:** A 'Line Chart of Arterial Hypertension' showing patient numbers over time, and a 'Kaplan-Meier' survival plot showing the proportion of patients free of infection over 30 days.
- Diagrams:** A 'Pie Chart' showing the distribution of patients with schizophrenia (N=47) and depression (N=47), with categories like 'Schizophrenia' and 'Depression'.
- Textual Content:** Several text boxes and boxes containing lists, such as 'Agencies of the Healthcare Research and Quality - Five Phases of the RIM 2016' and 'World Health Organization's Global Alliance for Patient Safety - Forward Programme 2016-2020', which provide context on research and safety initiatives.
- Medical Records:** A central 'Patient Chart' showing a detailed medical history, including symptoms, physical examination, and laboratory results.

The health record in the Capital Region of Denmark

.. is a source-oriented and fragmented mixture of digital and paper-based data

{{Bansler, Havn, et al. A study of the fragmentation of the medical record. 2012.}}

Logical sections of the fragmented health record

Health record

Electronic board

Progress notes

Nurse documentation
EWS chart
Fluid balance chart
Nursing care plan

Medication list

ECG

Telemetry monitoring
Real-time monitor
Trend analysis

Microbio. lab results

Biochem. lab results

Radiology info. system

Most important diagnoses, isolation status

Narrative about past and present illness and therapy

Vital signs, including SAT & temperature
Patient's intake and output, including IV-fluids
Nursing assessment, planning, and evaluation

Past and present medication

Monitor-ECG
ECG waveform and arrhythmia analysis

Various cultures of blood, urine, stool, etc.
Various tests for antibodies and pathogens

Various biochemical analysis of blood, urine, etc.

On-screen image access, radiology reports

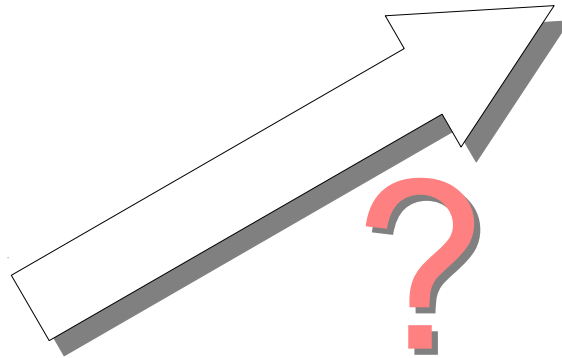
Digital
 Paper-based
 Both

Contextualizing clinical information ...

Q1: Is it possible to depict the doctor's clinically logical structure of contextualized information?

Q2: How does the fragmented structure of the health record support the doctor's contextualisation?

| Health record |
|--|
| Electronic board |
| Progress notes |
| Nurse documentation EWS chart Fluid balance chart Nursing care plan |
| Medication list |
| ECG |
| Telemetry monitoring Real-time monitor Trend analysis |
| Microbio. lab results |
| Biochem. lab results |
| Radiology info. system |



Methods and materials

Video-supported observation of doctors in the medical department of a 700-bed hospital in the Capital Region of Denmark.

Observation of doctors performing an ordinary task: The experienced doctor's first review of a newly admitted patient.

- The patient's record exists and is loaded with primary results.
- The doctor's objective is to confirm or adjust the current plan for the patient.
- The doctor has a very limited knowledge of the patient → lots of contextualisation.

Eight experienced doctors, 33 patients.

Videosupported "obser-view"

- Simultaneous observation & interview
- Relaxed think-aloud

Analysis

| Time | Microbiological lab results | Biochemical lab results | EWS chart |
|----------|--|-------------------------------------|--|
| 00:05:20 | (opens system) | | |
| 00:06:00 | blood culture stool samples | | |
| 00:06:10 | clostridium clostridium test, no result | | |
| 00:06:43 | blood culture negative | | |
| 00:06:50 | (closes system) | (opens system) | |
| 00:07:23 | | liver function tests | |
| 00:07:51 | | WBC count, previous minor decline | |
| | | WBC count, actual increase | |
| 00:08:02 | | CRP, no decline | |
| | | treatment without convincing effect | |
| 00:08:18 | | | "values", collects nursing documentation |
| 00:08:49 | | | varying fever (temperature) |
| | | | treatment without convincing effect |
| 00:09:04 | | | EWS (vital signs) OK |

Registration over time:

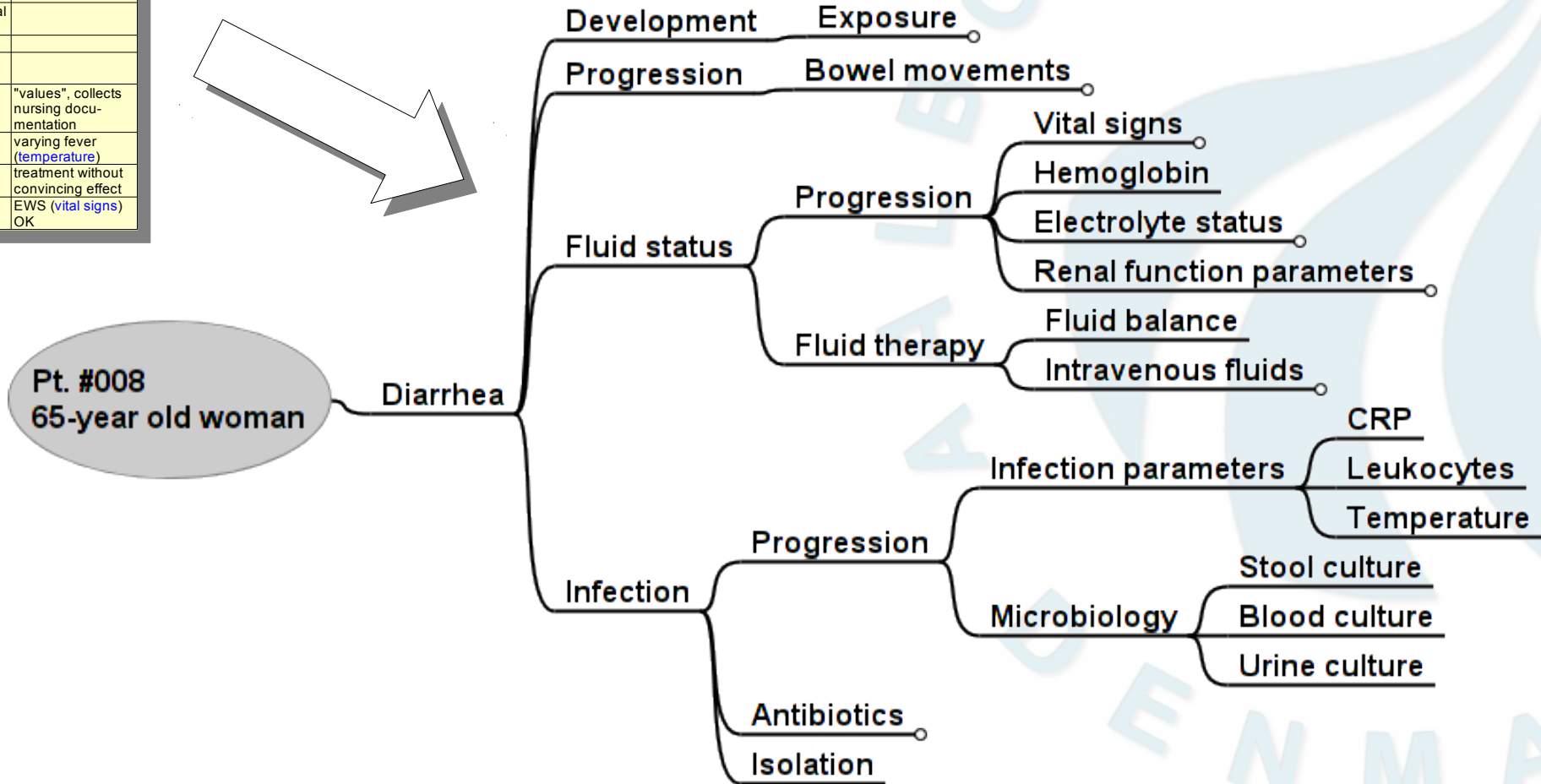
- From which section of the health record is the information contextualized?
- What topic or piece of information is in the doctor's mental focus?

The structure of contextual information

| Time | Microbiological lab results | Biochemical lab results | EWS chart |
|----------|--|---|--|
| 00:05:20 | (opens system) | | |
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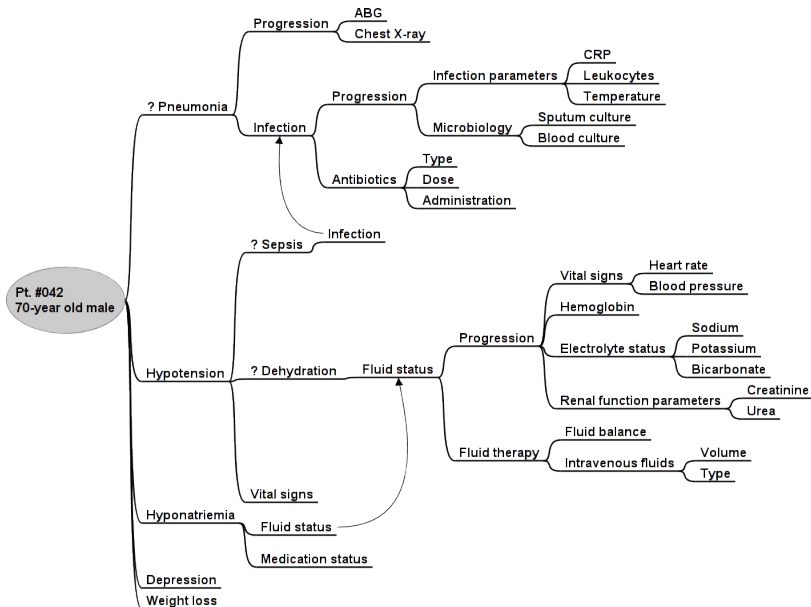
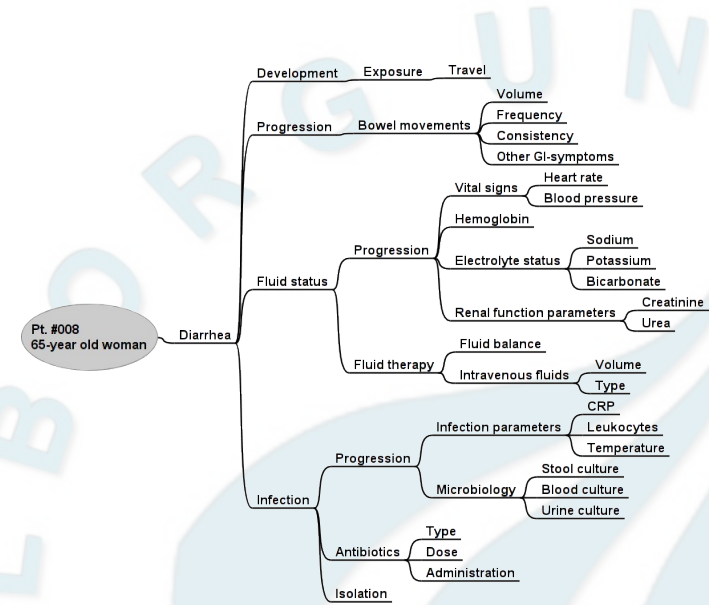
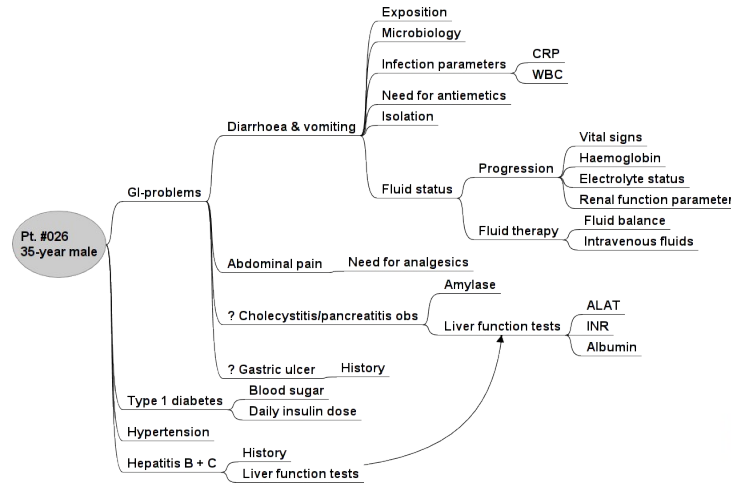
Observed topics was assembled ...

... into a clinically logical information structure

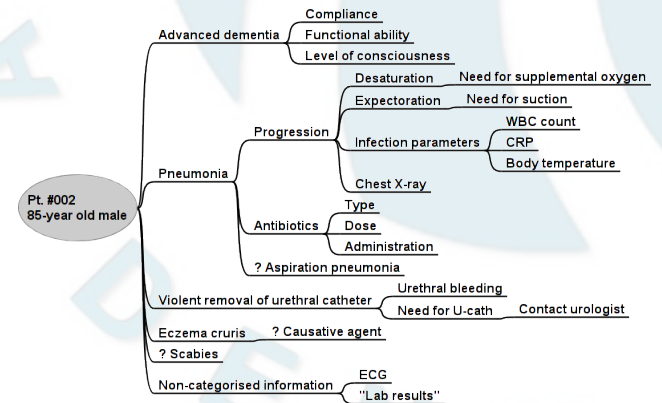


The structure of contextual information

Some patients are more complex than others.

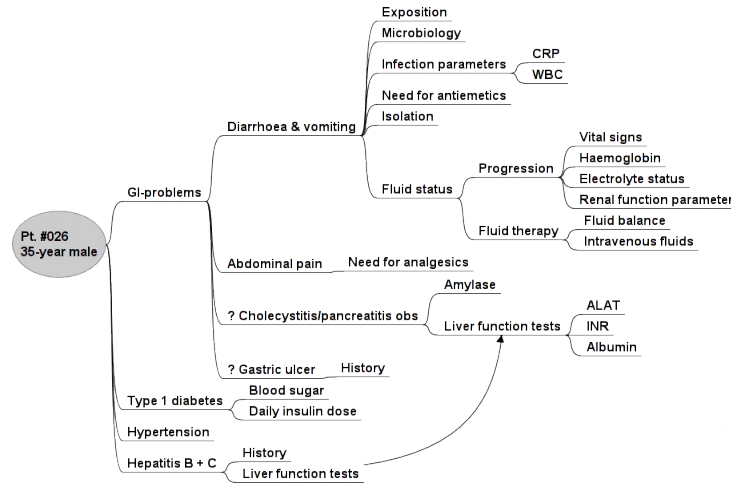


So are the resulting maps of contextual clinical information.

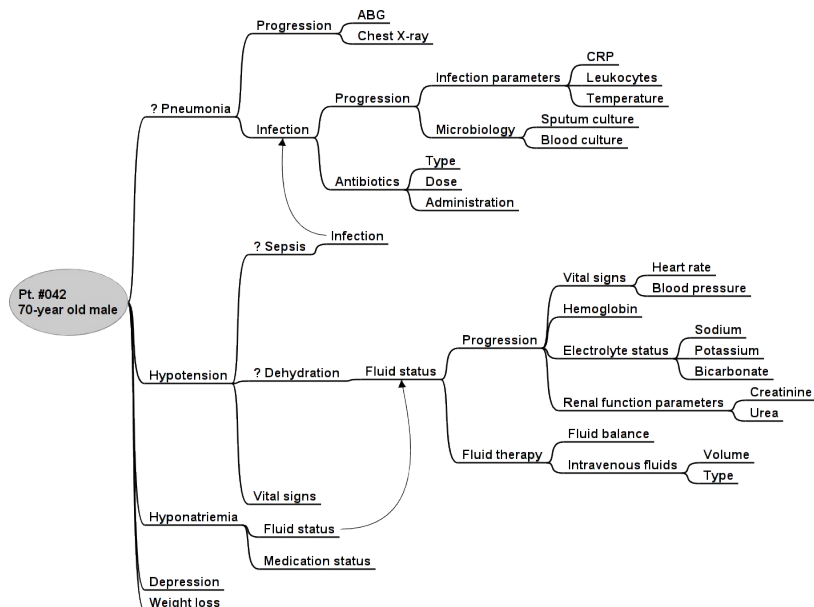


The structure of contextual information

Some patients are more complex than others.



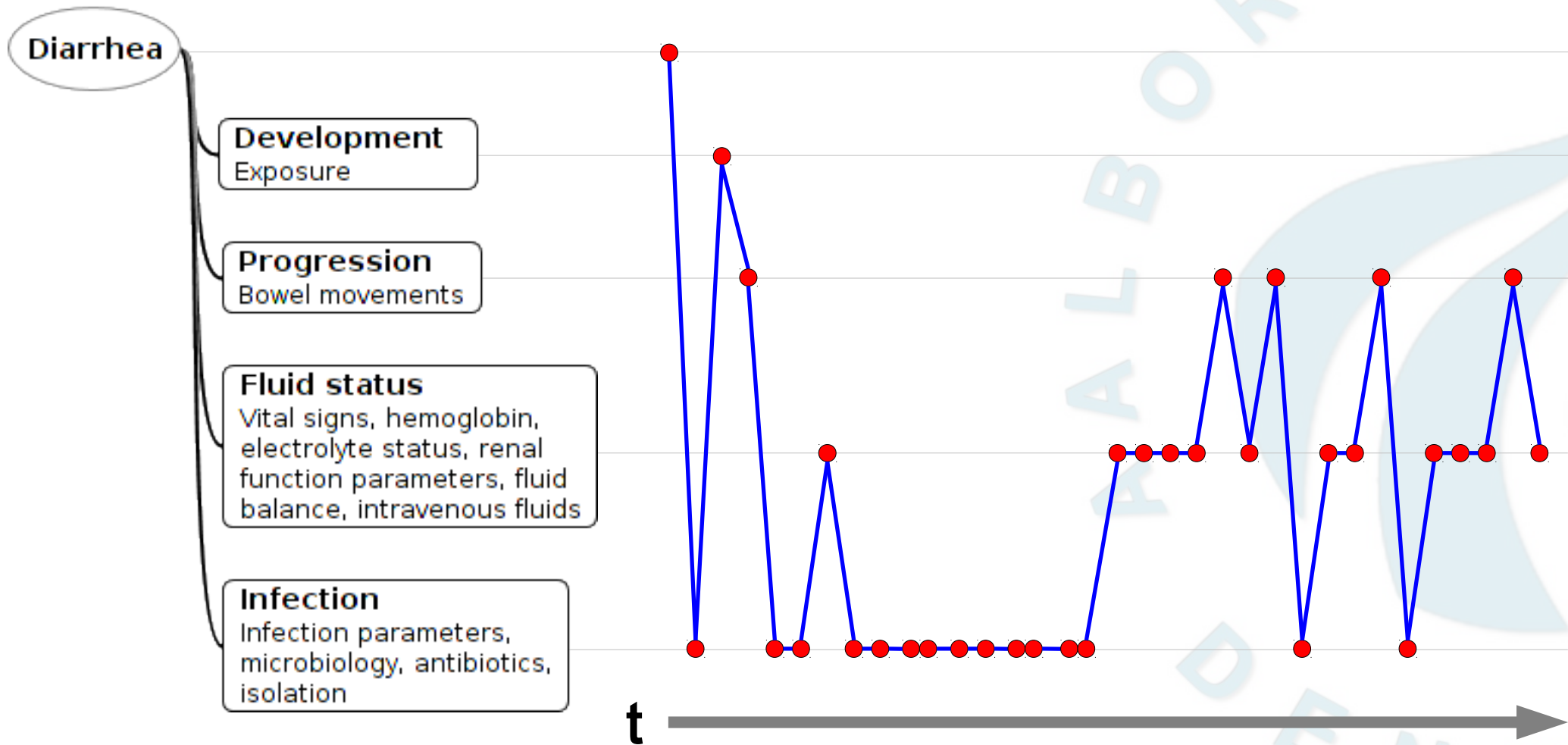
None of the 33 maps had any resemblance to the health record's structure.



So are the resulting maps of contextual clinical information.

| Health record | |
|------------------------|---|
| Electronic board | |
| Progress notes | |
| Nurse documentation | EWS chart Fluid balance chart Nursing care plan |
| Medication list | |
| ECG | |
| Telemetry monitoring | Real-time monitor Trend analysis |
| Microbio. lab results | |
| Biochem. lab results | |
| Radiology info. system | |

Typical plot of contextualized topics vs. time



Typical plot of content

Split-attention occurs when persons are required to split their attention between two or more mutually dependent sources of information (e.g. text and diagram), which have been separated either spatially or temporally.

{{Chandler, Sweller. The split-attention effect as a factor in the design of instruction. 1992.}}

Diarrhea

Development

Exposure

Progression

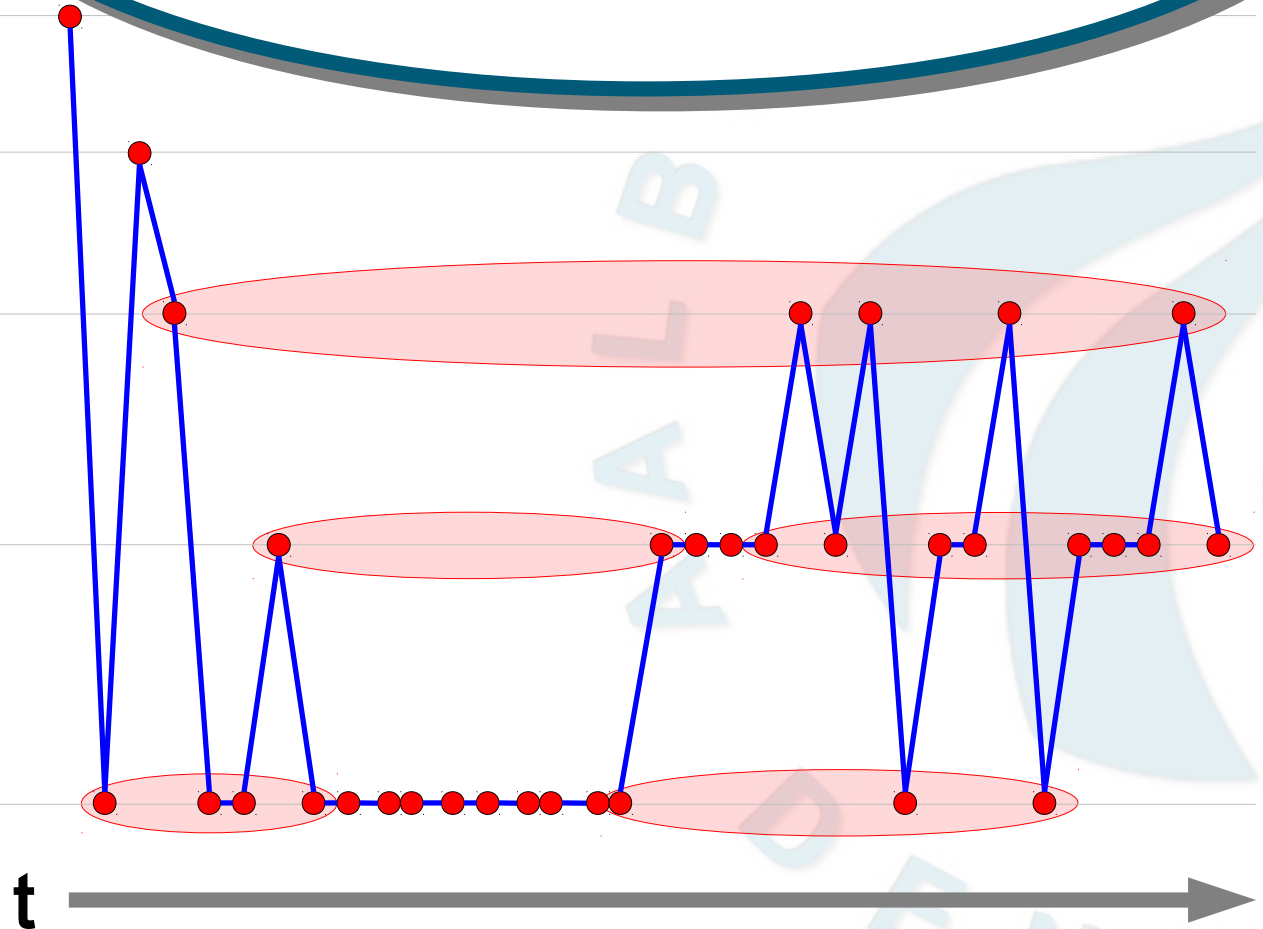
Bowel movements

Fluid status

Vital signs, hemoglobin, electrolyte status, renal function parameters, fluid balance, intravenous fluids

Infection

Infection parameters, microbiology, antibiotics, isolation



Typical use of the health record for contextualization

Health record

Electronic board

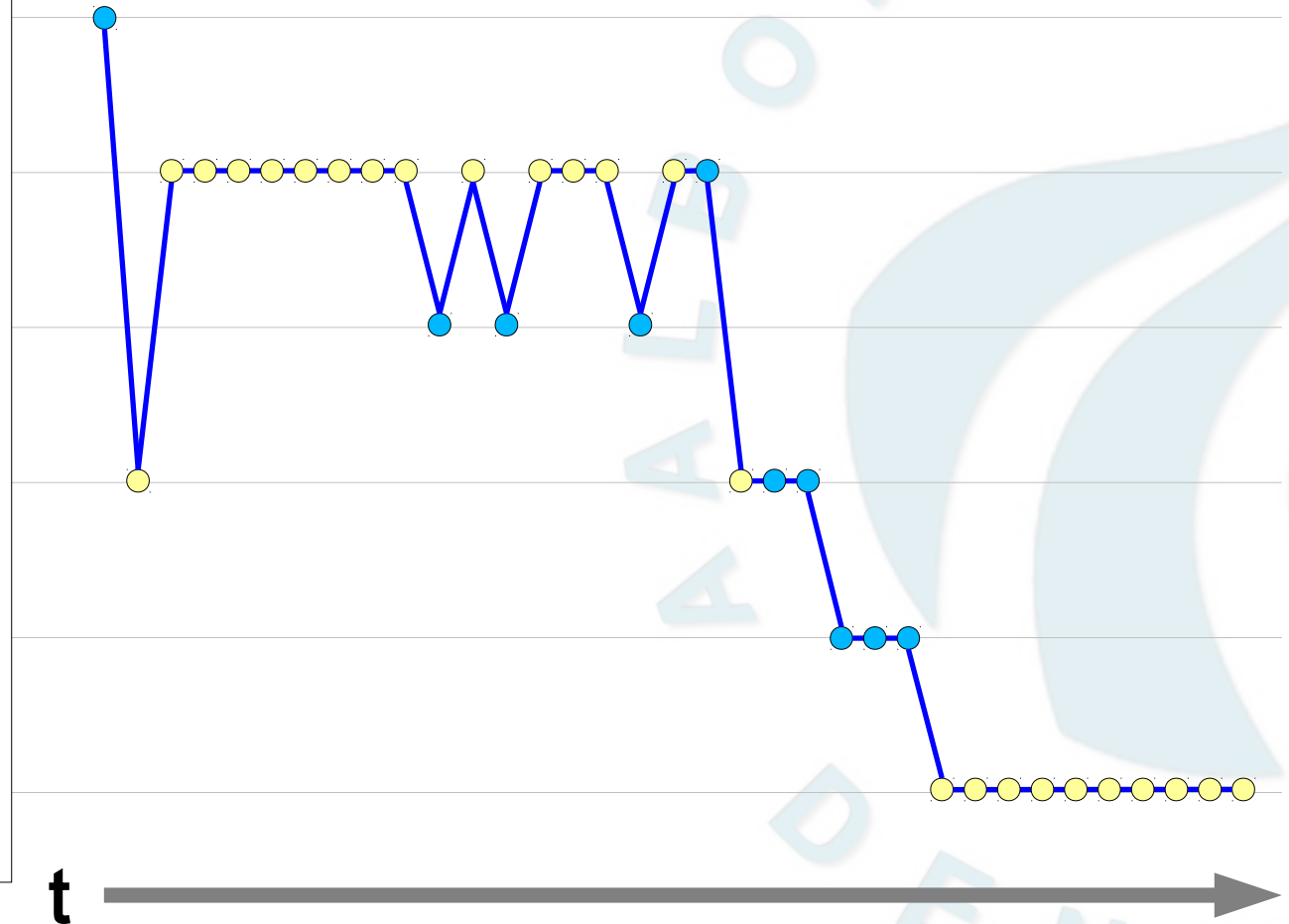
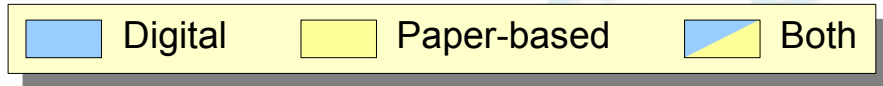
Progress notes

Medication list

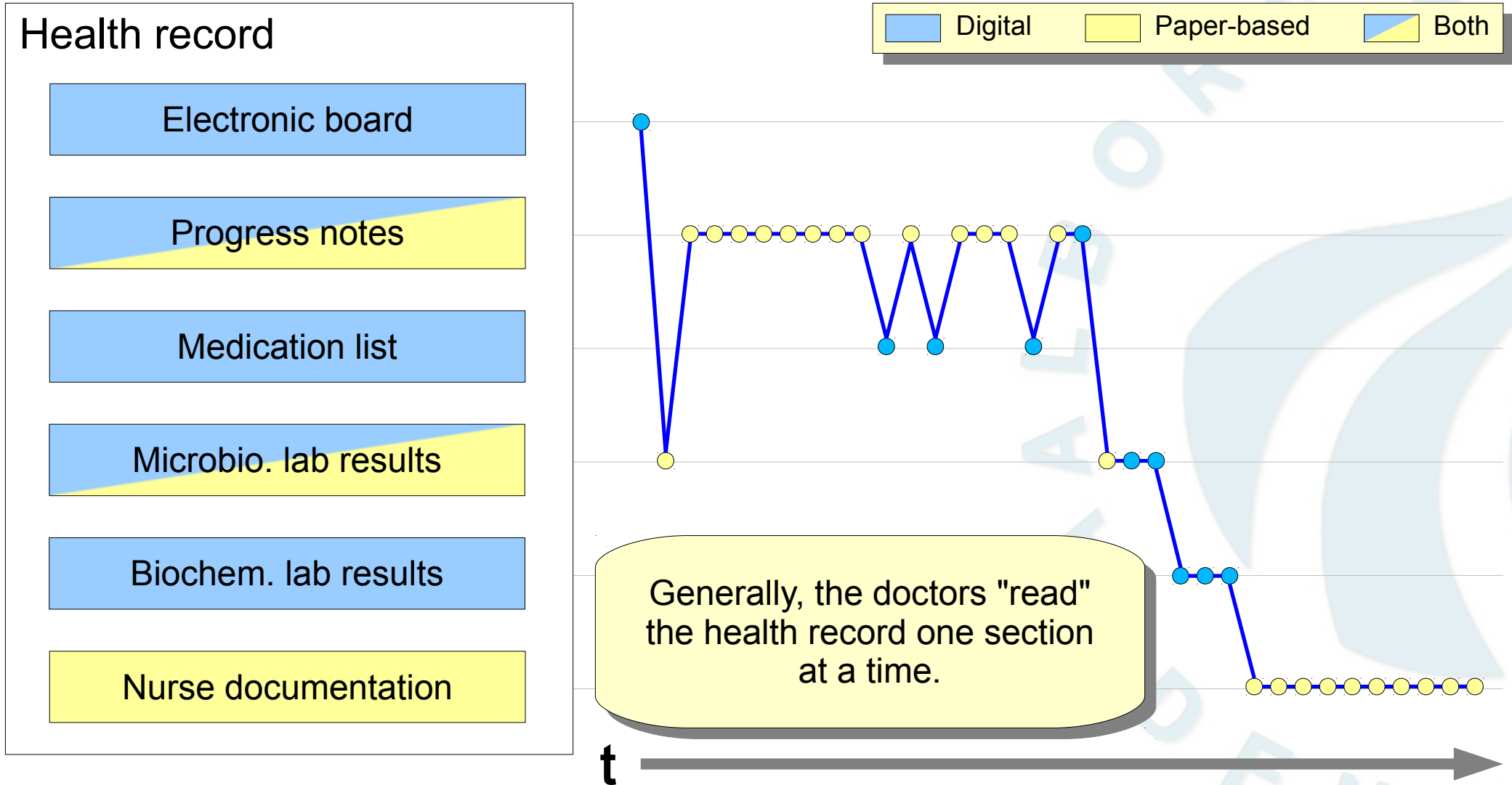
Microbio. lab results

Biochem. lab results

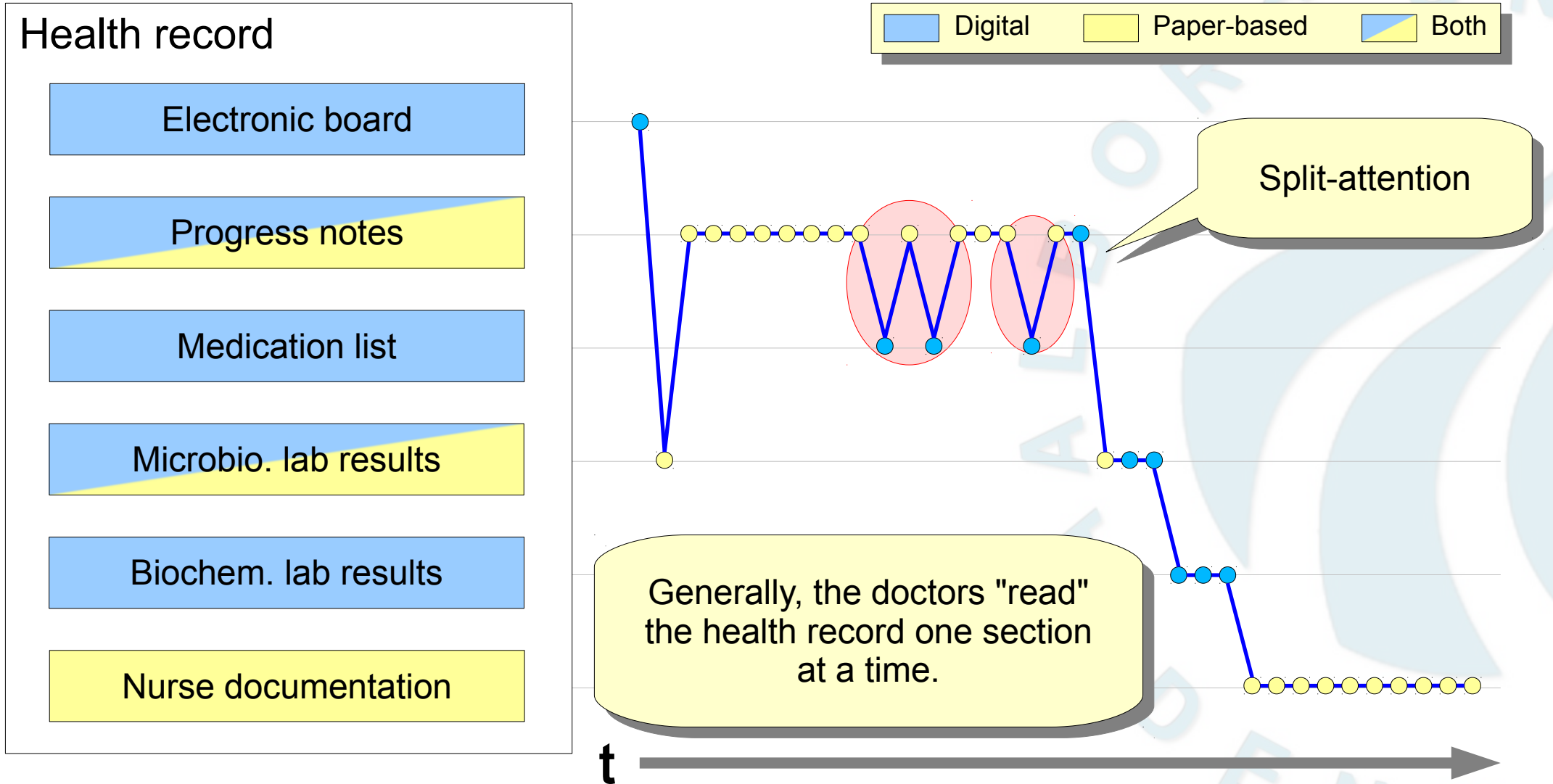
Nurse documentation



Typical use of the health record for contextualization



Typical use of the health record for contextualization



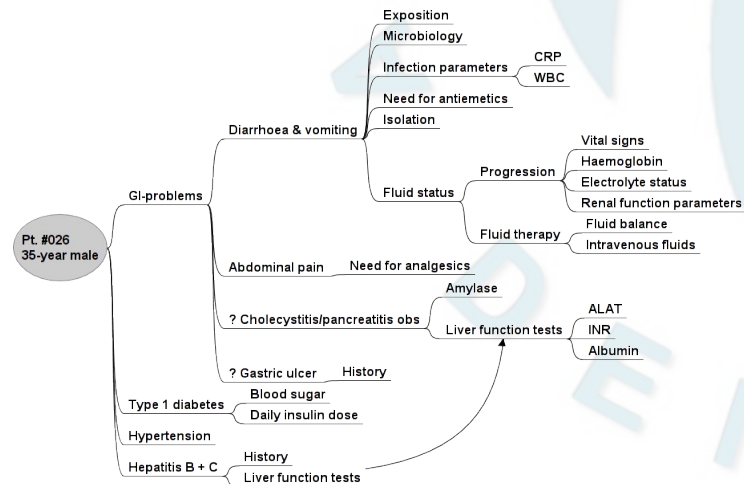
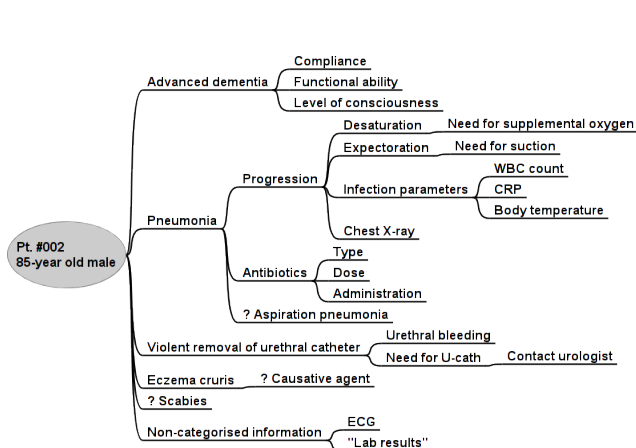
Conclusions...

Q1: Is it possible to depict the doctor's clinically logical structure of contextualized information?

A1: The obserview method makes it possible to depict the coherent, contextualized clinical information in the form of a mind map.

However, one must be aware that

- the method requires the observer's understanding of the domain
- the interactivity makes the results susceptible to observer bias.

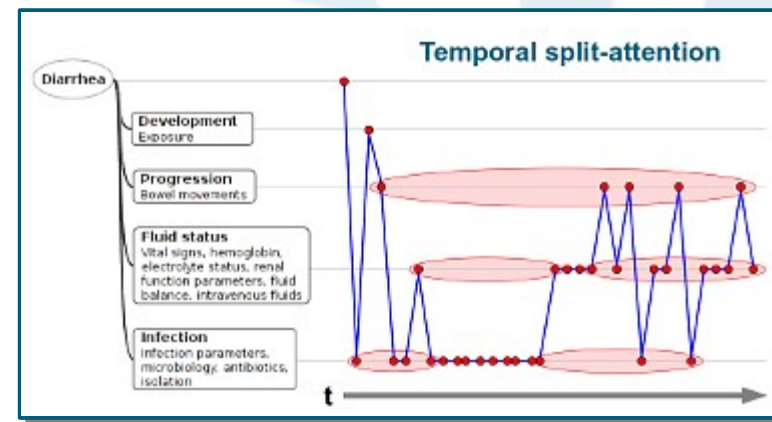
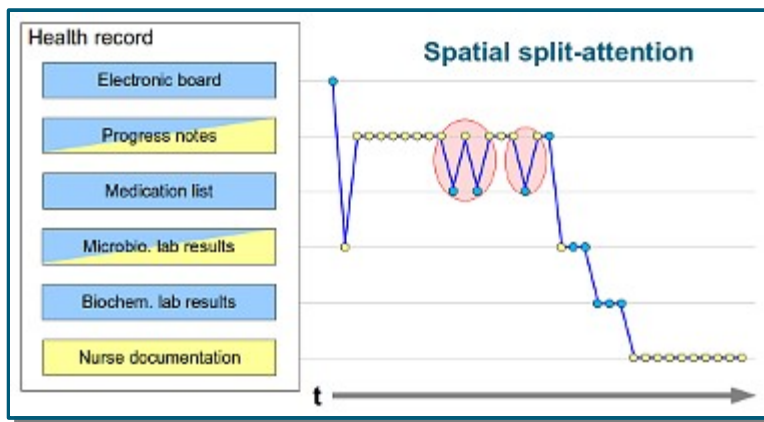


Conclusions...

Q2: How does the fragmented structure of the health record support the doctor's contextualisation?

A2: Poorly!

- The shift between sections of the health record gave rise to idle time and stress.
- The general picture was characterised of split-attention.
- Doctors were observed to actually forget topics.



Thank you
for your attention!



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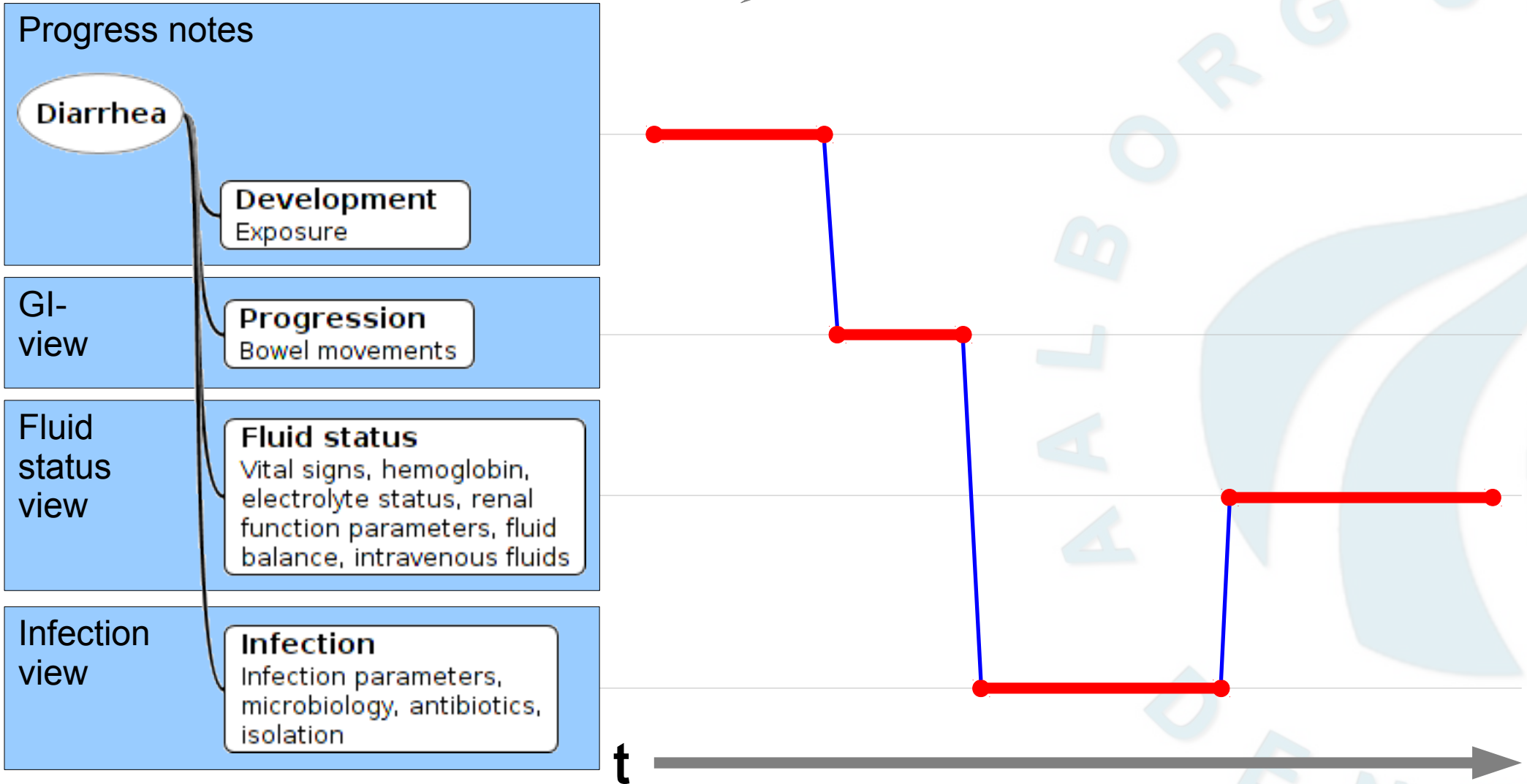
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Outtakes and bonus material

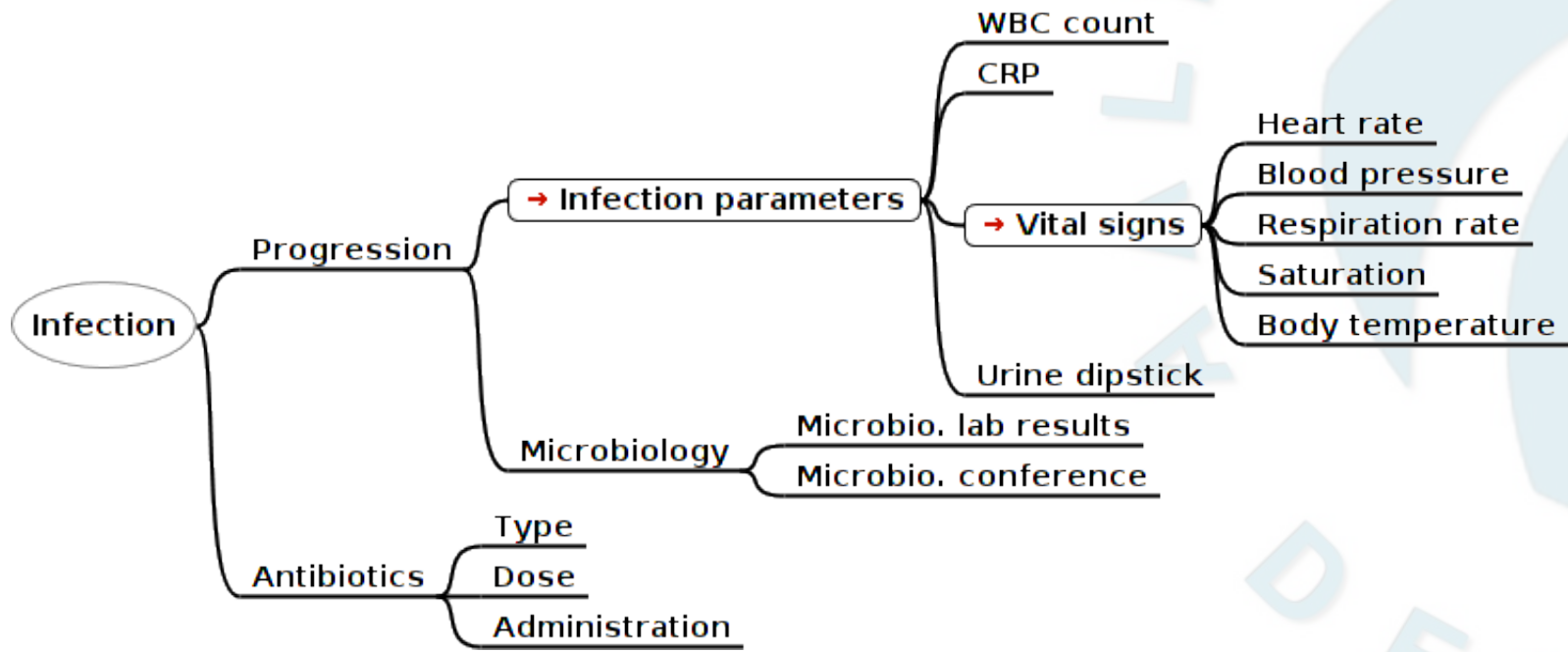
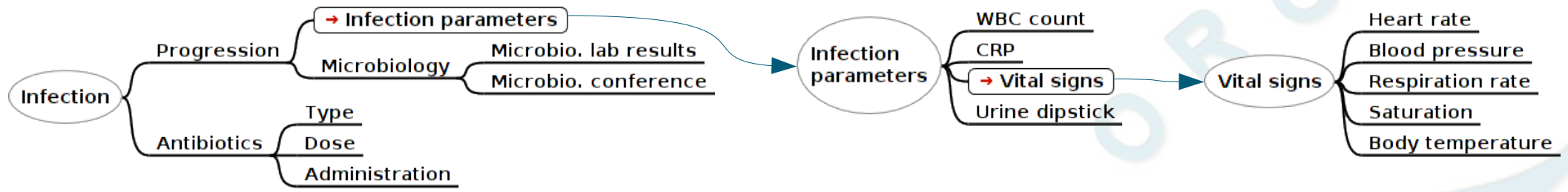
The better health record?

Progress notes as the basic narrative.
Access to general topic-oriented views.



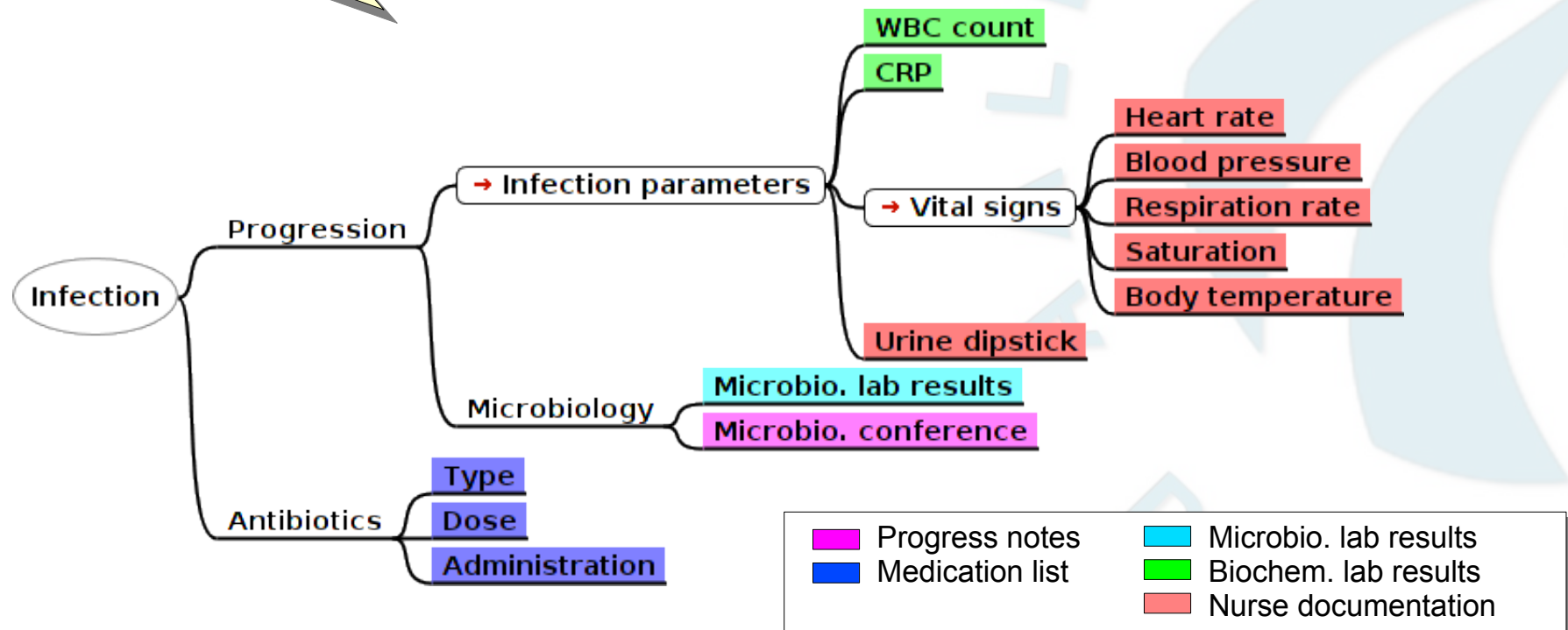
The better health record?

General topic-oriented views made out of topic-oriented building blocks.



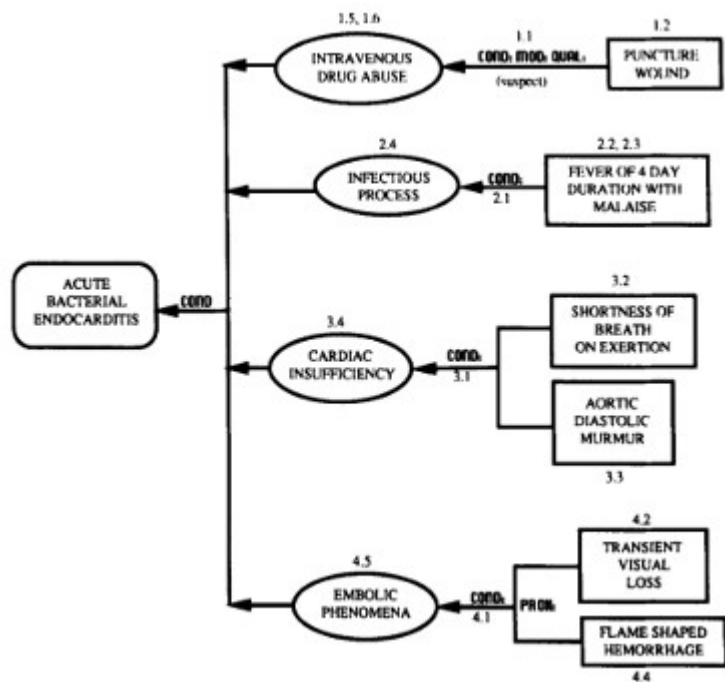
The better health record?

A single topic-oriented view versus five look-ups in different sections of the health record.

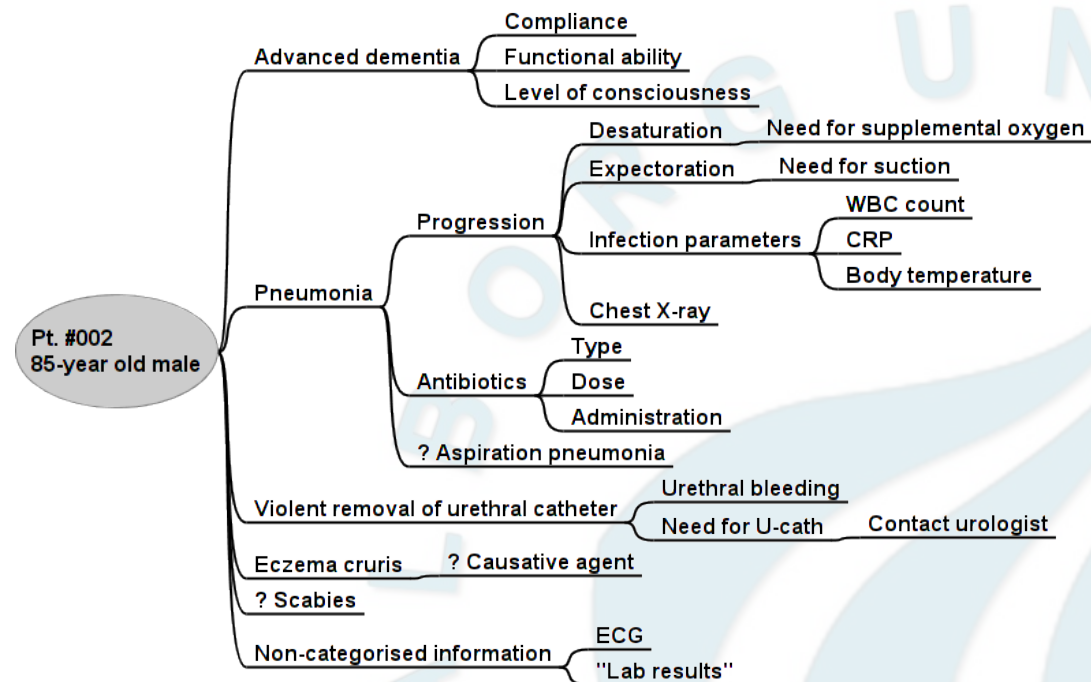


Outtakes and bonus material

Semantic network versus mind map - what's the difference?

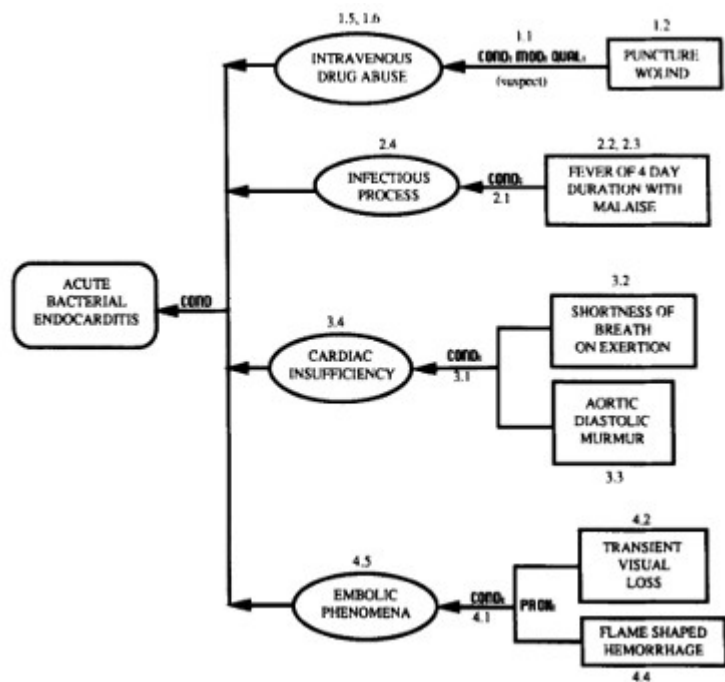


Clinical information used for diagnostic reasoning and depicted as a semantic network.
 From: Patel, Groen, et al. Medical expertise as a function of task difficulty. 1990, figure 1, pg 397.

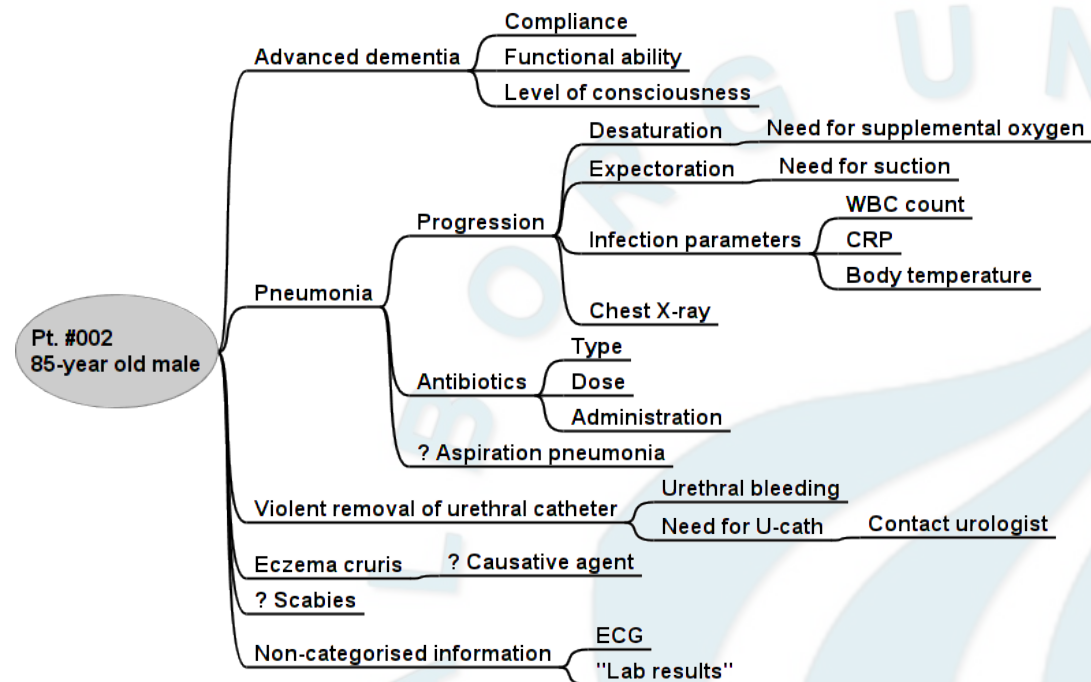


Contextualised clinical information depicted as a mind map.
 From this study.

Semantic network versus mind map - what's the difference?

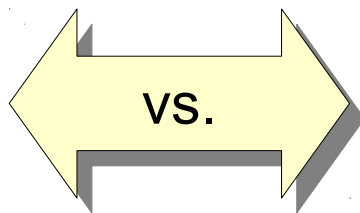


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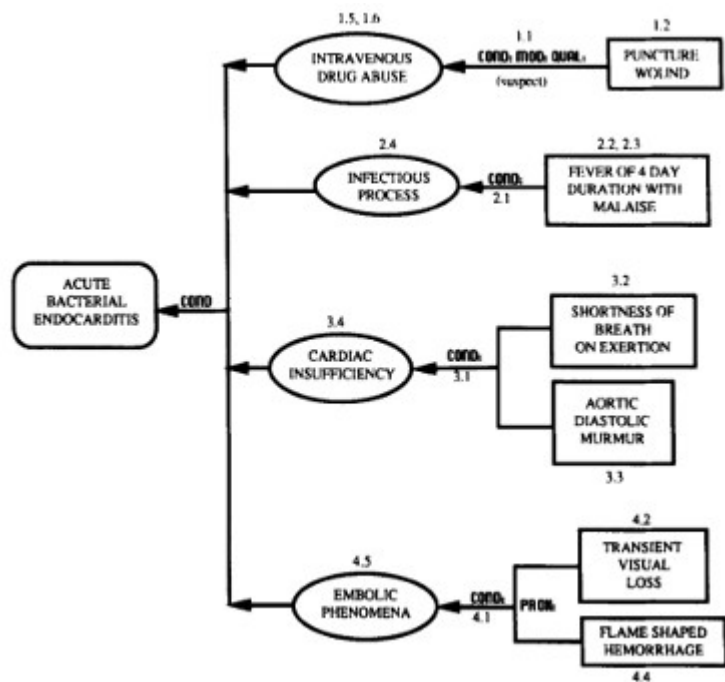
Contextualised clinical information depicted as a mind map.
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Diagnostic reasoning based on cases - i.e. in-vitro study of a single process

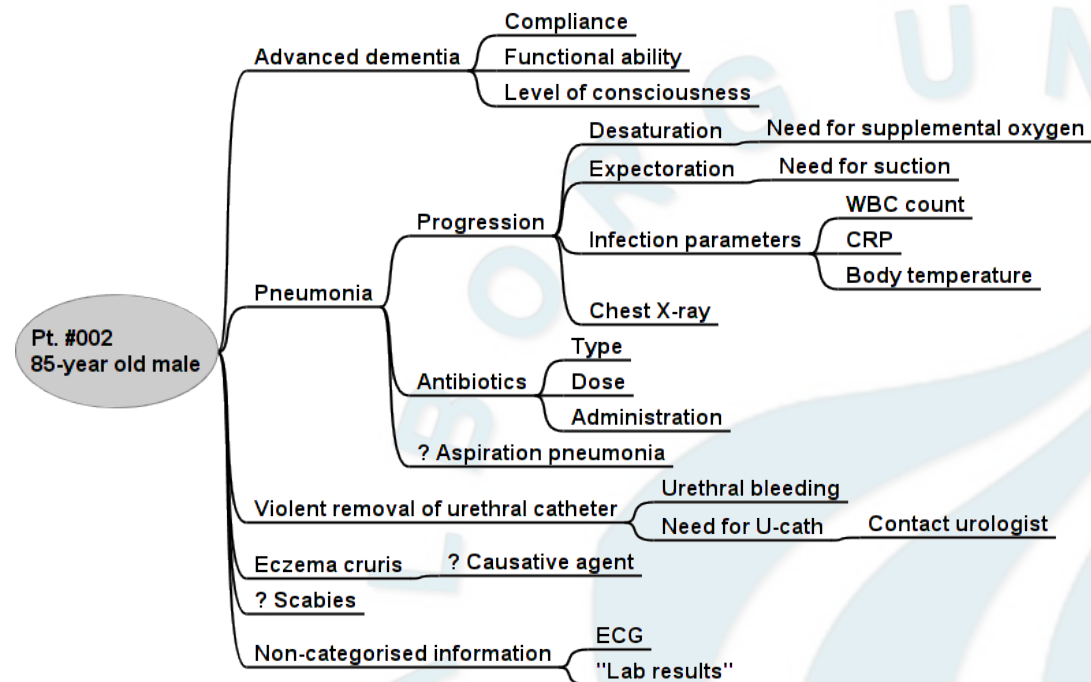


Doctors' mental work on the production line - i.e. in-vivo study of mixed processes

Semantic network versus mind map - what's the difference?

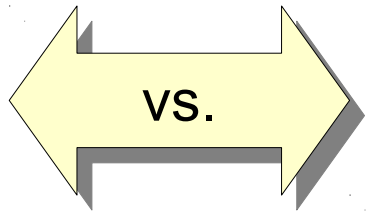


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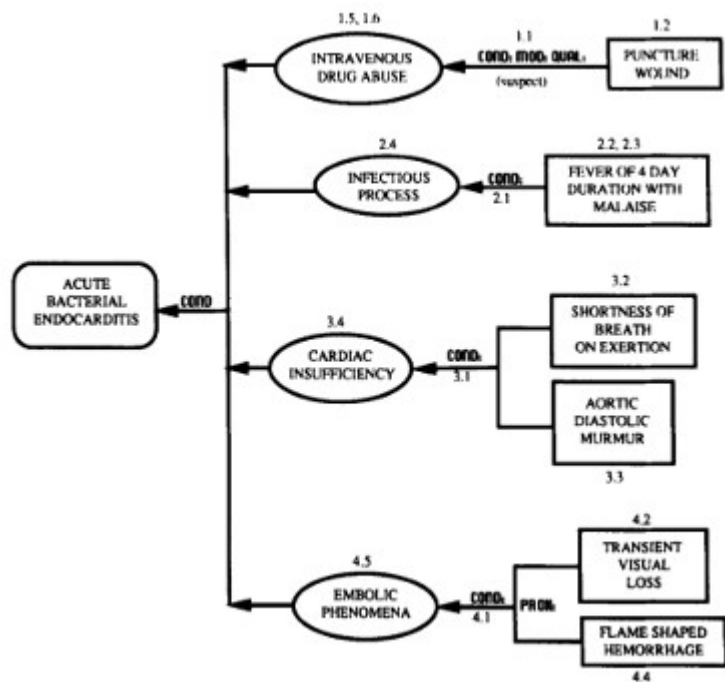
Contextualised clinical information depicted as a mind map.
 From this study.

Depicts only those pieces of information essential to the diagnostic process

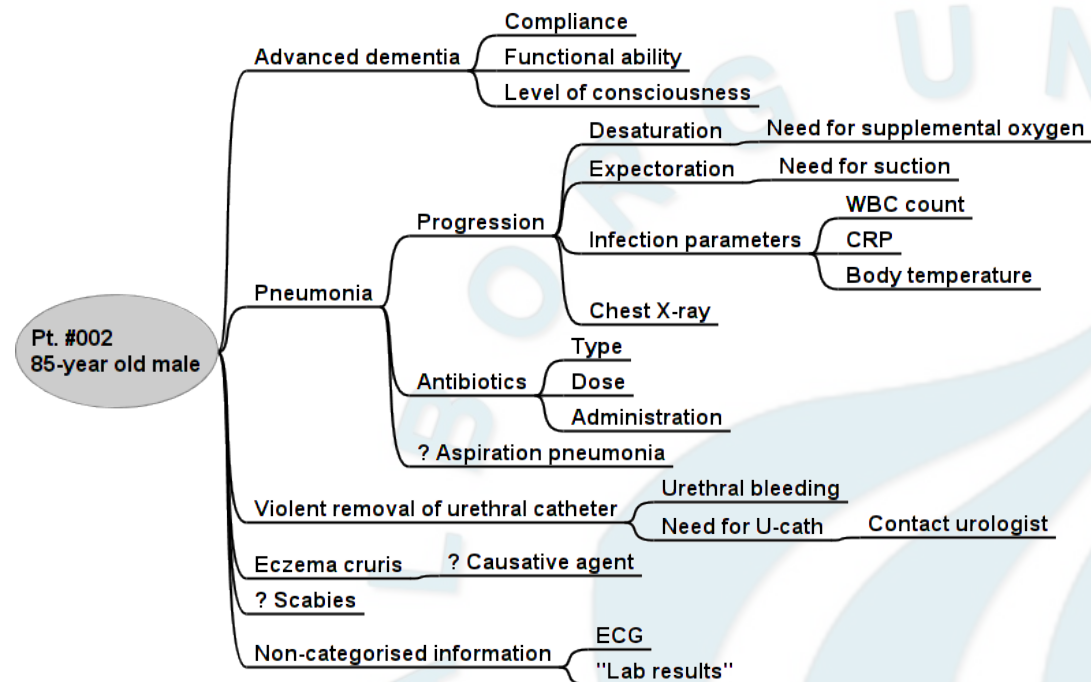


Depicts (potentially) all the contextualized information

Semantic network versus mind map - what's the difference?



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Contextualised clinical information depicted as a mind map.
 From this study.

Relations symbolize specific inference

vs.

Relations symbolize simple subsuming