Thivya THEVATHAS - M2 MCI EUR GER
My L1 : **Maëlle BOZO BERRIOS**

Paper 3 : Process mining for healthcare: Characteristics and challenges

Google scholar : https://www.sciencedirect.com/science/article/pii/S1532046422000107

This article discusses the different characteristics and main challenges of process exploration techniques used in many fields, including healthcare (PM4H). This research will help to meet each of 4 important objectives: improving population health, reducing costs, improving the patient experience and improving the work-life balance of healthcare professionals.
The document is divided into the following sections:

I. Presentation of the basic concepts of process exploration in healthcare
II. Presentation of the ten characteristics
III. Presentation of the ten challenges
IV. Conclusion

I. Introduction to the basic concepts of process exploration in healthcare

Process operation is a set of techniques that are represented by the different stages of process models and the different paths a process can take.
HISs present to support the healthcare process are vendor-supplied electronic medical record (EMR) systems. These store data that can be used to create an event log. An event log presents the execution of a treatment process for a patient; an identifier for each case, the activities included in each case, and a reference to when each activity was performed. In addition to this information, an event log can also contain information concerning the type of event ("Transaction type"), the resource associated with an event ("Resource"), and other attributes relating to the activity or case. Using these, we can call upon process mining to acquire additional information:

- Discovery: algorithms useful for obtaining process models reflecting process behavior from an event log.
- Conformity checking: algorithms that require a process model, obtained either through a discovery algorithm or designed previously, and aim to compare behavior in the event log.
- Enhancement: algorithms that help enrich and extend an existing process model using process data.

With the help of process mining, the analysis of process variants is necessary to make the process more efficient. Disease trajectory modeling developed a bow-tie visualization, which led to the discovery that pneumonia and gastrointestinal disorders commonly occurred before sepsis.
The challenges of modeling disease trajectories using process mining are developing easy-to-understand models (i.e. clear visualizations of trajectories) and comparing these models with clinical guidelines using compliance checking.

II. Introducing the ten characteristics

We're talking here about the ten distinguishing characteristics of healthcare processes, which have implications for PM4H.

- Variability is itself divided into several factors: diversity of activities that can typically be performed, several sub-processes that can be performed simultaneously, and the influence of differences in the preferences/personalities of patients, clinicians and other healthcare professionals. PM4H researchers need to be aware of the problem of variability when proposing solutions, tools and frameworks for understanding and dealing with this variability.
- Infrequent behavior: Bypasses can also highlight that different paths through a treatment process lead to the same result, providing information on treatment variations relevant to treating a particular disease.
- Guidelines and protocols: facilitating the application of process mining to obtain the information needed to improve by evaluating their effectiveness and efficiency.
- « Breaking the glass » :
- Multi-level data: there are high-level data and low-level data. Low-level data is very fine data, recorded by medical equipment or sensors in healthcare facilities. And high-level data, which is

more coarse-grained, generally enables more significant patterns to be obtained during analysis without the need for aggregation.
- Multidisciplinary team: a multidisciplinary team must be formed, closely involved in all stages of the process mining effort: data collection, data analysis, data interpretation, communication of its results and translation into practical action.
- Patient: involves both the clinical perspective and the patient experience perspective.
- White-Box: enable healthcare professionals to understand the origins of certain observations.
- Sensitive, low-quality data: health data is sensitive because of its confidentiality (a patient's current medical status, co-morbidities and treatments) and its use, storage and transfer are strictly regulated by institutions, countries and even international treaties.
- Rapid developments and new paradigms : the ever-evolving field of healthcare, with new knowledge and skills, paradigm centered implies that care must take careful account of the needs, values and preferences of each individual patient.

III. Presentation of the ten challenges

These characteristics give rise to challenges that need to be investigated by PM4H to begin process mining in healthcare properly, here are the ten different major challenges:
- Adapted methodologies and frameworks: creating a specific method to guide researchers through the different phases of PM4H analysis.Discovering beyond discovery: a clear evolution of new techniques for event and trace abstraction, simulation, and predictive process monitoring
- Concept change: high process variability, clinical research and protocols tend to change over time
- Facing reality: social and healthcare research
- Do it yourself: analysis should be done with or without experts
- Paying attention to data quality: data quality is important for the development of techniques (evaluation and improvement)
- Confidentiality and security: safeguarding data is important for the security and confidentiality of PM4H
- The patient's point of view: making analyses from the patient's point of view in the field of society can help doctors understand the situation.
- Completing SISs with a process perspective: the use of Health Information System data will complete the process.
- Evolving in the healthcare field: PM4H's methods must adapt to the constant evolution of the healthcare field.

III. Conclusion

The main purpose of this article has been to introduce new PM4H techniques into the healthcare process. This evolving field faces certain characteristics and challenges in society. A close collaboration between both parties is important to be able to pay attention and develop new innovative process methods.