**Digitalization of the Healthcare Sector in Taiwan -** Celonis Process Analytics for maximizing Healthcare business performance A briefing for Institute for Biotechnology and Medicine Industry, Taiwan presented by Vialto Consulting Ltd. April 6, 2023

**Slide 2**

**What is process mining?** Process Mining is a set of techniques for the analysis of operational processes based on event logs extracted from company’s databases, information systems, or business management software such as enterprise resource planning (ERP), customer relationship management (CRM), electronic health records (EHR), Hospital Information Systems (HIS), etc. In simple words, it’s about finding out how the processes are actually performed to discover problems and areas for improvement.

 **Let me explain!** In an ever-digitalizing world most business processes today are fully run in, or at least supported by various IT systems. Healthcare processes are no different and the data stored in those systems is extremely valuable. But this trend is also challenging due to its exponential extent.

With an increasing number of digitized process steps, more and more source systems are being involved and more and more data is being gathered in those systems. So a few **questions** arise:

* Do traditional approaches around process analysis and process optimization really cope with these challenges?
* Is it enough to draw simple process models describing how the process should look, in the hope that everything will follow this guidance?
* When observing deviations, is it an efficient method to come together and exchange subjective views on the process behaviors and derive some sort of consensus?

**Obviously** there is a strong need for another, data driven approach, which is precisely the goal of PM Technology.

As noted earlier the starting point of PM is IT based work, regardless of which process or workflows you are dealing with.

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Any process interaction produces data that is stored in transactional systems like, SAP, Oracle, Salesforce, or others. KLICK

**Slide 3**

Independent of the system, the data always contains 3 important pieces of information:

1. Information about the **process steps**, or **activities** that are being conducted,
2. Information about the **points in time** in which the activities were carried out
3. Information about the **object or ID** for which the activities are being executed

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The combinations of these 3 pieces of information are called a **digital footprint.** CLICK

**Slide 4**

Every transaction in an IT system leaves digital footprints. This is also true in hospitals.

Whether we are talking about:

* the patient delivery process,
* ER triage,
* or when a doctor records a diagnosis,
* a nurse sends a request, or
* the laboratory determines the blood level, every activity is logged with a time stamp in the database.

Process Mining extracts these digital traces within the hospitals' IT systems to automatically visualize and reconstruct the actual, as-is-process flow, in real-time

So not only you get a 100% transparent and objective view of how your processes that you actually run, but it also detects any **deviation**s to the *to-be processes*.

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**Slide 5**

A *process explorer* initially shows the **Happy Path** - the most frequent process variant. That is the most frequent starting activity and the most frequent ending activity as well as all stages and other activities that are included in the variant connecting those two.

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**Slide 6**

A variant is an end-to-end trace through the process activities and each case follows exactly one variant. Each variant has a different throughput time.

You can control which variants are shown in the Variant Explorer. The Variant Explorer is a Celonis EMS Analysis tool that helps you explore how a specific process flows through your organization.

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**Slide 7**

If we think about a process as a road trip, each process variant would be a potential route. Each activity within a process would be a waypoint along a route, and the connections between activities are like the roads that connect the stops. Each trip a person makes along a particular route would be a case.

Since there are many variants for many cases, they are sorted by their frequency.

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Celonis Variant Explorer can show **all process variants** within the event log.

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**Slide 8**

Normally, any activity executed in a hospital by a physician, nurse, technician or any other hospital resource giving care to a patient is stored in a HIS (compound of databases, systems, protocols, events, etc.). Activities are recorded in event logs for support, control and further analysis.

Process models are created to specify the order in which different health workers are supposed to perform their activities within a given process along a Care Path, or to analyze critically the process design.

Using PM techniques in healthcare processes helps to:

* ensure all procedures (not only the Care Paths) are clearly understood, incl. the real behavior of resources and patients;
* identify which are the activities causing bottlenecks in the process;
* identify decision rules applied in different cases ;
* redesign and improve the efficiency of all processes;
* analyze the performance to reduce waiting & service times and improve collaboration;
* predict the behavior of patients according to previous cases;

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**Slide 9**

Five applications healthcare providers can use PM to improve processes:

1. **Billing and revenue cycle management** Using data that is already contained within healthcare systems, providers can build end-to-end digital models of their day-to-day processes and uncover opportunities for improvement. Ways to improve include

* automating debt collection,
* reducing bad debts,
* or carrying out continuous monitoring of patient treatments to reduce complaints and maximize revenues

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2. **Emergency Departments** In many developed nations the average time taken to process a patient who arrives in ER was over 4 hours, growing as we speak. Providers can use process mining to build a comprehensive, realistic model of processes that includes variations and exceptions so to:

* predict and prepare for busy times,
* reduce door-to-doctor time and
* eliminate the need to re-enter patient data for different processes

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3. **Care Delivery** As the world becomes more consumer-orientated; patients expect more from their healthcare providers: enabling a digital front door to services, offering more tailored correspondence, or getting more out of their interactions with clinicians, patients want information at their fingertips and services on demand. With PM, providers can visualize patient experience from beginning to end to introduce new or improved channels like:

* digital front door to services (self-service portals, or self-check-in kiosks),
* better referrals,
* more tailored correspondence, or
* claims and diagnostics processes expedited by digital workers

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4. **Patient Pathways** Standard patient pathways, whether through treatment programs or particular conditions, can be seen to be too rigid and formulaic, meeting administrative and operational needs rather than patients’ personal biological requirements. With PM, providers can examine data sources to identify and explore common variants in how pathways are followed like:

* check that all of the steps built into a patient pathway have been followed, and what the consequences of missed stages in a pathway can be
* see where there have been side effects to a treatment plan according to age, gender or other variable, which will help to prevent the same problems happening in the future

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5. **Integrated Care** Population health management and integrated care are increasing in significance, and for good reason. The pandemic has demonstrated the importance of working together with other public services and sharing responsibility for people’s welfare and health outcomes. Technology is widely seen as playing a critical role in the development of integrated care systems, helping to bring together disparate systems, processes and people.

* Process mining enables all parties in an integrated care system to identify where these are working well together, or where improvements need to be made.
* Using Celonis EMS intelligent automation, healthcare organizations have access to a software platform that can automate any business process, interacting with line-of-business applications run by all parties.

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LAST SLIDE

In first-ever Magic Quadrant™ of this kind Gartner just named Celonis as the leader. This follows a long history of similar recognitions in their previous Annual Gartner Market Guides for Process Mining.

A user-friendly, integrated Process Mining, Task Mining, and Automation Solution, Celonis was evaluated highest in both completeness of vision and its ability to execute, ahead of other industry leaders.

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**Discussions Qs etc.**

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Improve patient experience and deliver higher quality outcomes.

Accelerate revenue cycle transformation by increasing working capital and driving out costs

Optimize for supply chain resilience by controlling hospital spend and optimizing inventory levels

Maximize performance across healthcare provider processes:

* PATIENT EXPERIENCE - Meet and exceed patient consumer expectations
* HEALTHCARE OPS - Streamline health services and operations
* REVENUE CYCLE - Improve revenue cycle efficiency and working capital
* SUPPLY CHAIN - Reduce spend and optimize inventory levels
* WORKFORCE - Recruit and retain top healthcare talent

**Example 1. Surgery Punctuality**

**Initial position:**

The surgery manager of the client knows that his hospital has problems with the punctuality of surgeries. On a regular basis, patients are not placed in the operations room on time, but he does not know from where the bottleneck is coming from.

Doctors hold the transportation service provider accountable, which, in return, blames the station, because they would forget regularly to prepare the patient in time. The surgery manager himself suspects that his surgery teams is responsible for the problem, as they would forget to call for patients in time.

**Aim of the project:**

The aim of the project is to analyze the severity of the perceived problem and to detect inefficiencies in the process with Process Mining.

**Implementation:**

To answer these questions the patient delivery process is visualized, starting from the call for the patient in the station, via the order acceptance of the transport service provider, through to the reaching of the lock. Therefore, the data was extracted from the KIS and the smartphone application of the transportation service provider.

**Outcome:**

The surgery team and the transport service provider are responsible for the delay in the processes.

Pattern in the call for patients: In the morning reliable, in the afternoon unreliable.

Pattern in the pick-up of the transportation service provider: Significant time difference on Wednesdays and Fridays compared to the rest of the days in the week.

Root cause: On Wednesdays and Fridays there is a higher workload per employee.

Consequences:

The relevant surgery teams were addressed.

Reorganization of the transport service provider by considering the workload per employee.

**Example 2. emergency room:**

**Initial position:**

Emergency rooms have limited capacities and suffer from a rising, heterogeneous patient occurrence. Therefore, it is necessary to standardize the ‘emergency room process’.

**Aim of the project:**

Visualization of the as-is processes in Celonis to get a holistic and realistic picture of the operations in an emergency room to derive organizatory and technical measures.

**Implementation:**

Visualization of the processes from the arriving of the patient via triage, diagnostics, doctor’s visit, medical dismissal, etc. based on the time stamps recognized in the KIS database.

**Outcome:**

Cycle times, especially the ones until triage, are improvable

Quality of triage is good but could be improved as well

To-be-process is not always conforming

**Results**

Discuss cycle times and process deviations with employees on a regular basis to demonstrate the importance of a standardized, efficient way of working

Retrain employees responsible for triage

Technical changes in the process of patient registration and classification