FLINDERS UNIVERSITY OF SOUTH AUSTRALIA

# Hospital Patient Journey Modelling to Assess Quality of Care: An Evidence-Based, Agile Process-Oriented Framework for Health Intelligence

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# Abstract

The thesis proposes a novel framework to gain Health Intelligence (HI) using an evidence-based, agile process-oriented approach to gain insight into the complex journey of patients admitted to hospital. This is the first systematic evidence-based research undertaking patient journey modelling spanning the entire hospital system using a process mining framework to complement statistical techniques. This is an innovative research of its kind looking at a large and complex cohort of General Medicine (GM) patients. This research investigated the impact of several system-based differences in models of care upon the Quality of Care (QoC) that can be delivered to inpatients in any hospital in Australia. For example team-based and ward-based models of care were compared using real patient data at Flinders Medical Centre (FMC). Hospital outcomes for patients who were admitted to the "wrong" ward (ward outliers) were compared with patients who were admitted as ward inliers.

Because time spent in the Emergency Department (ED) impacts the overall patient journey, the research also compartmentalised the time patients spent in the ED in order to investigate the influence of these separate time compartments upon QoC and further comparison was made depending on whether the patient was admitted inside or outside working hours.

Having demonstrated the complexities of patient journeys using real hospital data on a complex cohort of patients, the research demonstrates and advocates the use of process mining techniques to automate the discovery of process models for simulation projects. This approach avoids those errors that are more likely when applying hand-made process models in a complex hospital setting.

Process mining is an emerging technology that aims to gain insight into a process. This research applied the process mining framework to analyse clinical processes. Although the application of process mining in the healthcare setting is still in its infancy, the concepts surrounding the framework of process mining are sound. The fundamental elements needed for process mining are historical event logs. Process mining generally relies on event logs generated by Process Aware Information System (PAIS). This research establishes a formal framework for deriving an event log in a healthcare setting in the absence of a PAIS. A good event log is a cornerstone of process mining.

This framework will be generalizable to all public hospital settings because it uses the already-collected hospital Key Performance Indicators (KPIs) for data extraction; building on patient journey data to derive the event log which is then used for various analyses thus providing insight into the underlying processes.

The strength of this work derives from the close collaboration with the practising clinicians at the hospital. This close partnership gives clinical relevance to this research and is the main reason the research is breaking new grounds in improving evidence-based clinical practices to provide patient-centred care. Modelling cannot depict everything in a complex environment such as the healthcare system but a systematic and innovative approach to modelling would depict the main behaviour of the system which will consequently lead to knowledge discovery and health intelligence.

# Declaration

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text. There is also no conflict of interest with Flinders Medical Centre (FMC) where the empirical research was undertaken testing the applicability of the framework.

Lua Perimal-Lewis

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*Regard man as a mine rich in gems of inestimable value. Education can, alone, cause it to reveal its treasures, and enable mankind to benefit therefrom.*

*Bahá'í writings*