![Waitematā District Health Board — Best Care for Everyone]

Complex Data Modelling for Complex Clinical Questions
Waitematā District Health Board

Our Deteriorating Patient Dashboard is one example of complex data modelling used to create Qlik Sense apps at Waitematā District Health Board. Questions about quality and outcomes of healthcare are multivariate, and cannot be answered with a simple star schema. This data model uses link tables to join data with non-hierarchical relationships from many sources including emergency department presentations, vital signs (such as temperature, blood pressure, and the resulting early warning score), inpatient stays, ICU referrals, sepsis screens, calls to the resuscitation team, 'smartpage' messages between doctors and nurses, medication prescribing and administration, lab results, diagnoses and mortality.

The model uses separate link tables with one common key – the patient 'journey' (whole inpatient stay). Other complex data models we build are based on a single master link table which holds keys and linking identifiers from all fact tables. Building these complex data models allows more complex clinical questions to be answered on the fly and improvements to be tracked over time.

Data model diagram with the following clinical question callouts:
- How long does it take for a doctor to respond to a high early warning score?
- How long did patients take to reach ICU following a positive sepsis diagnosis + what was their outcome?
- What proportion patients with positive/negative sepsis screens ended up with sepsis?
- Was an NSAID medication prescribed to a patient with acute kidney injury?

Highlighted entities: ED presentations, Vital signs e.g. temperature, Sepsis screens, Resus calls, Calls: nurses to doctors, Lab requests + results (e.g. creatinine), Medications, Inpatient stays, ICU stays, Mortality, Diagnoses.

DISCOVERIES
- Sepsis screening is not very specific; too many false positives are causing undue alerting.
- A new Early Warning Score (EWS) is about to be introduced with a new escalation protocol. The dashboard has shown an alarmingly high number of anticipated urgent calls to doctors.

ACHIEVEMENTS
The hospital services have never had the ability to track complex process and outcome measures before, nor drill through to individual patients to reflect on care practices. This modelling technique, used in about 20 Qlik Sense apps, helps to illuminate healthcare issues and allows deep dives down many pathways.

DATA SOURCES
- **iPM** (Inpatient stays, ED presentations, Mortality, ICD coded data for diagnoses + co-morbidities)
- **PatienTrack** (Vital signs, EWS, sepsis screens)
- **Laboratory System** (Lab requests + results)
- **MedChart** (Med prescription + admin)
- **Soprano-CVDIS** (ICU referrals)
- **CarePathways** (Resus + MET calls)

AUDIENCE
The app is currently being tested by clinicians involved in the Patient Deterioration Programme. It will extend to all doctors, nurses, clinical directors and hospital managers.

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LEAD WITH DATA