A Sysmex Case Study

Digitising the COVID-19 testing workflow for New Zealand

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Executive Summary

COVID-19 testing remains one of our key tools for curbing the spread of the virus, and the critically important work of medical laboratories has been highlighted throughout the pandemic. Laboratory facilities are managing thousands of COVID-19 swabs for New Zealand's population and quarantine facilities. High volumes of tests along with the unique situation has driven the necessity for digitisation and accelerated a sense of urgency to innovate in this space.

Over the course of the pandemic, Sysmex have been delivering the core digital and data solutions behind New Zealand's leading COVID-19 testing responses. Digitising the testing workflow has been a significant undertaking, requiring the rapid assembly of solutions under immense pressure. The vision from the outset was to consolidate the lab testing and data workflow to support the nation's COVID-19 response team.

The New Zealand response to COVID-19 is leveraging experience in aggregating population testing data. It has also enabled New Zealand to innovate to integrate a digital testing workflow for laboratories for COVID-19 tests across border management and community testing facilities.

Sysmex Eclair – Digital Testing Workflow Solution
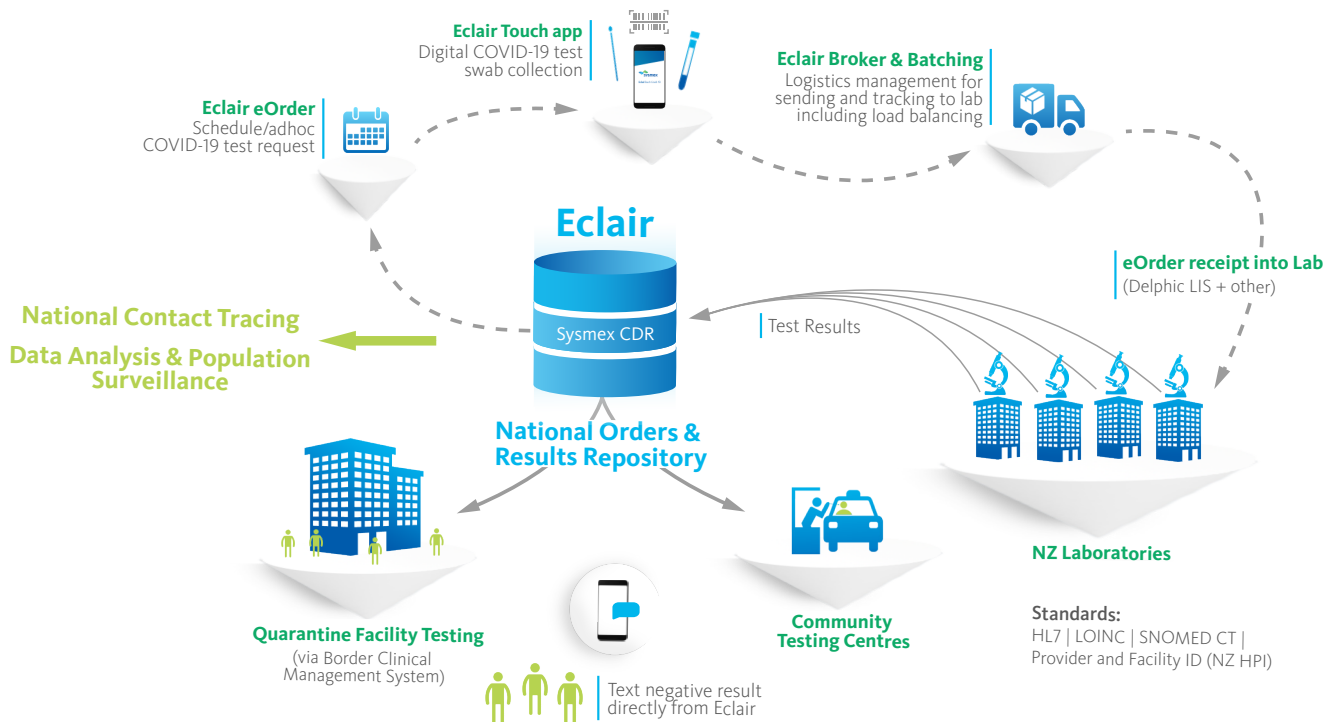
The Challenges

1. Data Access

Since the onset of the pandemic, there emerged the need to pull together a national view of the population testing data. While the Ministry of Health had in place the ESR notifiable disease database, EpiSurv, to manage notifications of positive test samples, establishing a system that would constitute a single source of truth for all laboratory COVID test results – whether it be positive or negative – was of high priority. COVID-19 clinical data from testing laboratories provide valuable information on daily testing volumes, the number of positive cases, as well as enabling data analysis and surveillance. Immediate access to testing data was required by the Ministry of Health to guide their national response strategy to COVID-19.

2. Inefficient, Paper-based Workflows

Managing unprecedented testing volumes amidst the outbreak highlighted inefficiencies with the existing paper-based workflow, which relied on a manual process for test ordering and sample collection. The need was recognised for an integrated, paperless solution that would alleviate the administrative overhead on collection and testing teams, improve data accuracy, as well as optimise the end-to-end data workflow.

3. Testing in Managed Isolation Facilities

Notably, an essential component of NZ's response has been the establishment of strict quarantine and testing protocols through dedicated facilities at the border. Testing was performed on overseas arrivals at the border and border-facing workers. All those entering New Zealand were required to quarantine for 14-days in managed isolation and have mandatory testing on days 0, 3, and 12, as well as test negative for COVID-19 before entering the community. Therefore, it was necessary to establish a digital system to support this rigorous process.

The Approach

Eclair CDR for Results and Orders

At the heart of the digital solution is the Sysmex Clinical Data Repository (CDR), Eclair, which was implemented in March 2020, at the national notifiable disease centre (ESR – Environmental and Scientific Research) as a key initiative for New Zealand's response to the COVID-19 pandemic.

Eclair is the COVID-19 test results repository and provides a single, consolidated view of all COVID-19 testing data in New Zealand. Every time a COVID-19 test is performed the result is sent electronically directly to the Eclair system, allowing timely supply of Ministry of Health data requirements and daily reporting. In addition, integration of the data with New Zealand's contact tracing system enables surveillance on a national scale and testing coverage tracking across the population.

The Eclair platform laid the groundwork for several digital initiatives that followed:

• electronic order requests

• paperless swab collection

• the ability to 'broker' an order request to support the logistics for laboratory test allocation

• communication of negative test results electronically, supported by a follow-up system which enables call centres to ensure the delivery of messages

Interoperability with MIQ

New Zealand's digital border system manages the arrival process and care in managed isolation. To support the mandatory scheduled testing over the two-week quarantine period, Sysmex worked to develop secure integration between the MIQ system and the ESR Eclair CDR, to coordinate the orders; collection and results.
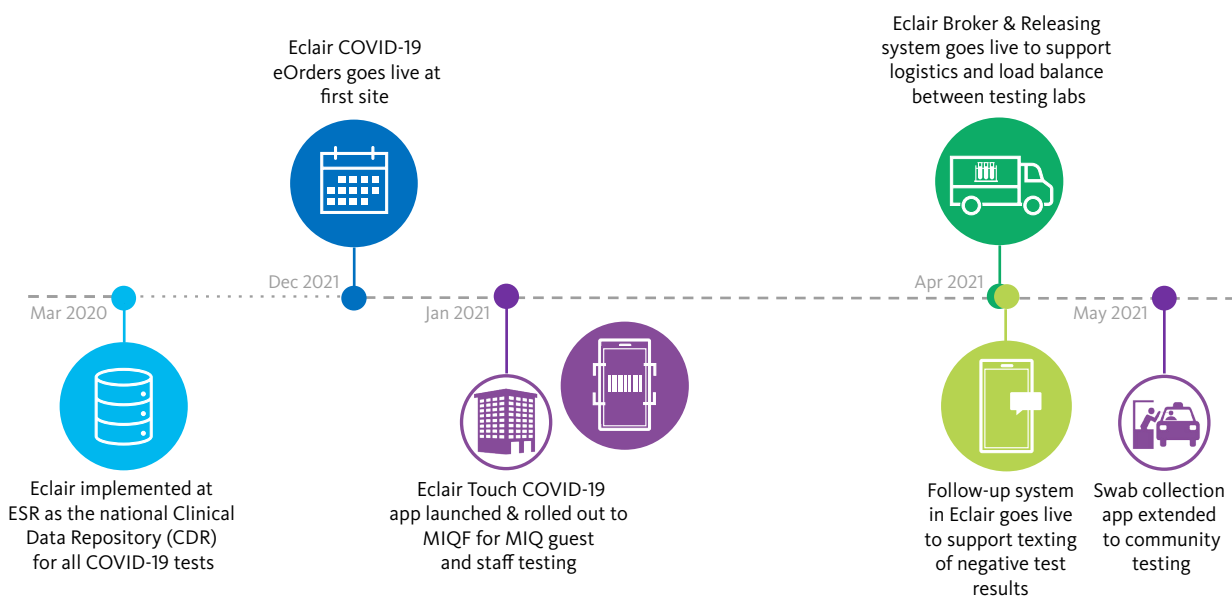
Recognition of Collaboration

Collaboration was key from the outset – experts from Sysmex, the Ministry of Health, the ESR surveillance team, District Health Boards (DHBS) and all NZ Laboratories worked together to develop and deliver working digital solutions in rapid time.

Efforts from the team were well-recognised through their finalist nomination for the 'Excellence in Digital Health' category at the NZ Excellence in IT Awards 2021. As the nature of the pandemic evolves, collaboration continues with the team involved to meet emerging requirements and increasing demands for the country's pandemic response.

Standards enabling interoperability

The system design enables full interoperability by using current pathology messaging standard (HL7 2.4) as well as tests codes standard (LOINC) and diagnostics coding standard (SNOMED CT)[1].

Implementation Timeline

Eclair COVID-19
eOrders goes live at
first site

Eclair Broker & Releasing
system goes live to support
logistics and load balance
between testing labs

Dec 2021

Apr 2021

Mar 2020

Jan 2021

May 2021

Eclair implemented at
ESR as the national Clinical
Data Repository (CDR)
for all COVID-19 tests

Eclair Touch COVID-19
app launched & rolled out to
MIQF for MIQ guest
and staff testing

Follow-up system
in Eclair goes live
to support texting
of negative test
results

Swab collection
app extended
to community
testing

Solution Highlights

Eclair eOrders - Digital Test Requests

Paper-based COVID-19 test orders present many challenges for data accuracy and can delay processing. To minimise these issues, COVID-19 test requests are centralised electronically in the national Eclair repository. Electronic order requests (eOrders) can be created via an API from the Border Clinical Management System (BCMS) for guests in quarantine facilities, or directly in the Eclair system for community testing facilities. The implementation of an electronic ordering system enables traceability and accuracy for all tests throughout the pre-analytical workflow.

In August 2021, New Zealand was hit with community transmission of the highly infectious Delta variant. The pace of the outbreak drove an aggressive surveillance and testing effort to closely monitor the spread of the virus. This saw the country hit new daily records in the number of COVID-19 tests processed by laboratories – reaching over 40,000 tests in a single day[2]. On 23rd August 2021, NZ's Director General of Health expressed that "e-ordering through the Eclair system does very much speed up the [testing] process", and it has enabled laboratories to cope with a huge surge in testing volumes much more efficiently[3].

Swab Collection App

The Eclair Touch app digitises the collection of COVID-19 test swabs. This accurately links the test order, the patient and the COVID test specimen through barcode scanning and confirmation of the identification of the patient – all cohesively managed via the national Eclair repository.

Use of the app in Managed Isolation and Quarantine Facilities (MIQF) considerably speeds up collection rounds.

"Paperless swab collection has been a real game changer. Our collection times have reduced from up to four hours to 1.5 hours."

MIQ Collection Staff, Canterbury Managed Isolation and Quarantine Facility

From the community perspective, the Eclair Touch app has been successfully rolled out across testing centres nationwide. This allows people tested in the community to be accurately identified against their unique NHI number at the point when a test is taken, removing the need to manually complete paper lab request forms which reduces delays in the collection process as well as in the laboratory. "The whole collection process now takes just nine clicks for community testing staff to complete[4]," says Lara Hopley, Clinical Advisor Digital Innovations at Waitemata DHB.

Solution Highlights

Assisting with Logistics for Testing Labs

To accommodate surges in testing volumes and to enable balanced workload between diagnostic labs, Eclair provides a broker system which determines which laboratory will process batches of COVID tests. Tracking the transfer of specimens from point of collection to the assigned laboratory is an important part of the solution.

Upon arrival at the testing lab, the batch of swabs can be received as an HL7 order message from Eclair into the laboratory information system (LIS) for processing and analysis. For instance, electronic test order requests created in Eclair are received directly into the Sysmex Delphic LIS and are then activated upon receipt of COVID-19 specimens in the laboratory. This process eliminates manual data entry for laboratory staff and reduces the potential for data integrity issues, e.g. an incorrect surveillance code or mismatching of patient information.

Testing Data and Results for the NZ Population

All laboratories across New Zealand that are performing SARS-CoV-2 PCR testing send results via HL7 to the Sysmex CDR to enable a complete representation of the data set for precision public health initiatives. The data integrates with New Zealand's contact tracing system and guides daily reporting by the Ministry of Health. Testing data is also used for surveillance analysis, for example linking population demographics to testing patterns such as location and volume[5]. Automated text notifications directly from Eclair inform people who had been tested of their negative COVID-19 test result. This eliminates the need for phone calls, saves staff resources and ensures the communication of test results in a timely manner.

"Each COVID specimen take on average 2 minutes to manually register but only 30 seconds using the Eclair eOrders, which is significantly quicker and allows labs to handle considerably more volumes."

Colin Osborne, LIS Support at LabPlus, Auckland DHB

Current Results

The establishment of an end-to-end digital solution for COVID-19 testing has seen impressive outcomes that have supported New Zealand's pandemic response.
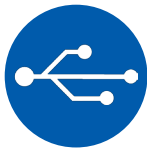
A fully digitised process for ordering, collection, results delivery, and reporting accelerates the important work completed by NZ's COVID-19 testing team

Eclair's electronic ordering and collection solution had gone live in managed isolation facilities and community testing centres nationwide

All laboratories doing COVID-19 testing are securely interfaced to Eclair enabling seamless digital flow of patient and test details via standards-based messaging
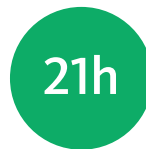
The digital workflow for COVID-19 testing saves laboratories **21 hours** per day by replacing paper-based processing, enabling higher volumes of specimens to be processed per day[6].
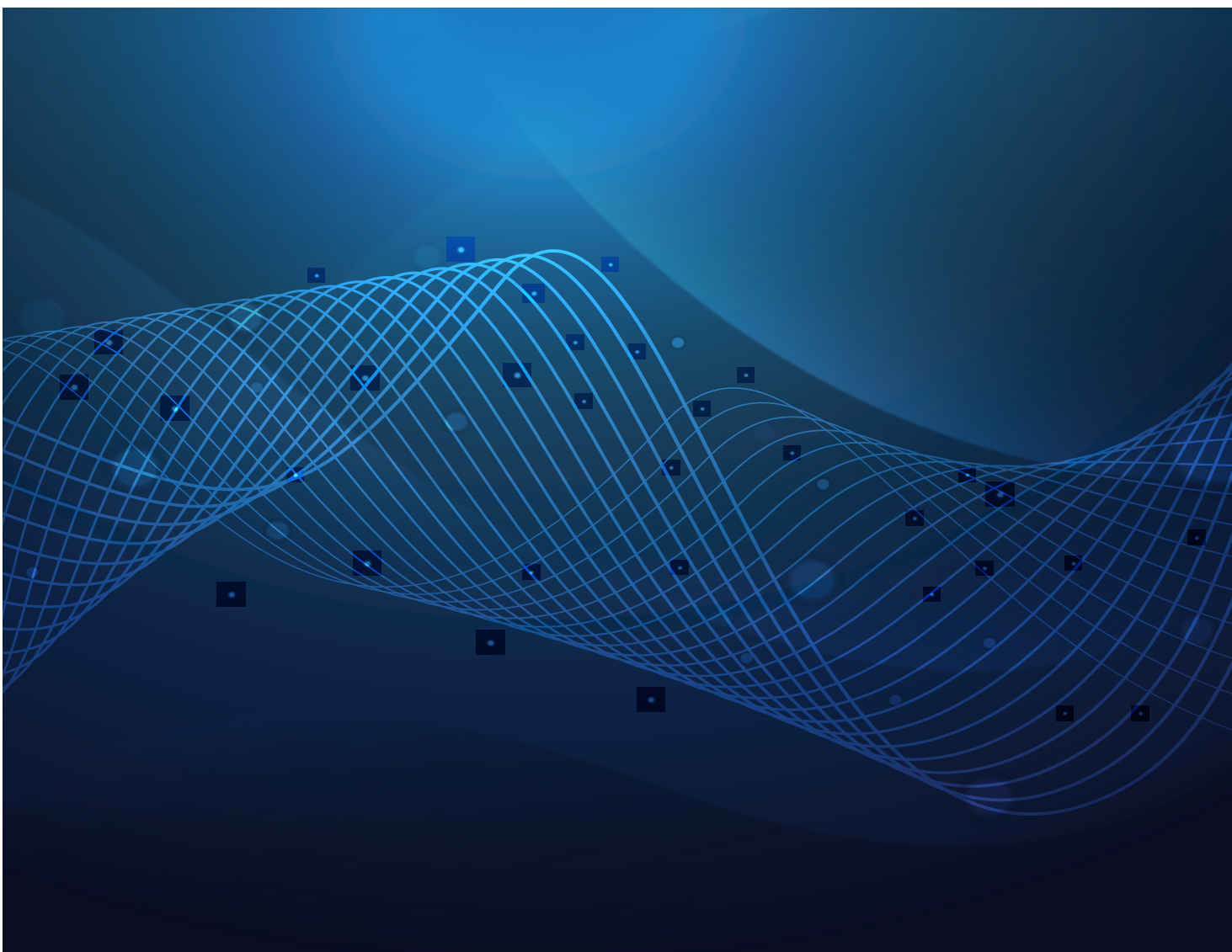
As of September 2021, **over 3 million** COVID-19 test results are held within the Eclair repository.

User feedback has been overwhelmingly positive, with one customer describing the Eclair order and collection solution for COVID-19 as 'making a real difference to those collecting the specimens and providing significant time-saving efficiencies on the ground'.

Platform for Innovation in Digital Diagnostics

The examples of digital health solutions created because of COVID-19 prove what is possible, and how together we can solve problems and create a platform for future innovation. The COVID-19 pandemic has created a pathway for innovation in digital health solutions for diagnostic workflow and data to enhance the current systems in place in New Zealand, to improve the delivery of healthcare and align with the Ministry of Health's Hira (national health information platform) programme.

References

[1] https://www.health.govt.nz/publication/hiso-1000842020-COVID-19-messaging-implementation-guide
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[3] https://www.beehive.govt.nz/sites/default/files/2021-08/Post-Cabinet%20Press%20Conference%203%20August%202021.pdf
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[5] https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(20)30225-5/fulltext
[6] Colin Osborne, LabPlus; 2021 eHTV Webinar, "COVID-19 Testing – Going Digital"

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https://www.esr.cri.nz/home/about-esr/media-releases/streamlining-covid-19-laboratory-data-to-ministry-of-health/