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Abstract

In clinical settings, clinicians need a fast, patient-level view of when events have happened. A Theograph is a proof-of-concept patient timeline that brings together GP contacts, diagnoses, prescriptions and selected biomedical results in a single interactive view. Built in R Markdown and Shiny, it allows users to filter by patient, diagnosis, prescription or biomedical test, hover for precise dates/values and export the currently filtered slice for MDT discussion or notes. Early feedback has been strongly positive, with clinicians complimenting the ability to visualise multiple appropriate and valuable timeseries in one glance.

Where did we start?

Our starting point was a simple question from clinicians: "Can I see this patient's story on one page?" From the outset, stakeholders described persistent frustration with existing systems. Primary-care contacts, diagnoses, prescriptions, and biomedical assay results are scattered across multiple platforms, forcing clinicians to jump between screens and views to assemble a complete picture.

We built a minimal interactive version that loaded a single patient, plotted contacts as a baseline, and added toggles for one diagnosis, one prescription and one assay. Even this early iteration proved useful: being able to hover to confirm exact dates and values reduced back-and-forth across multiple systems. Positive reactions from an initial demo gave us the mandate to extend the model and make it robust enough for everyday use.

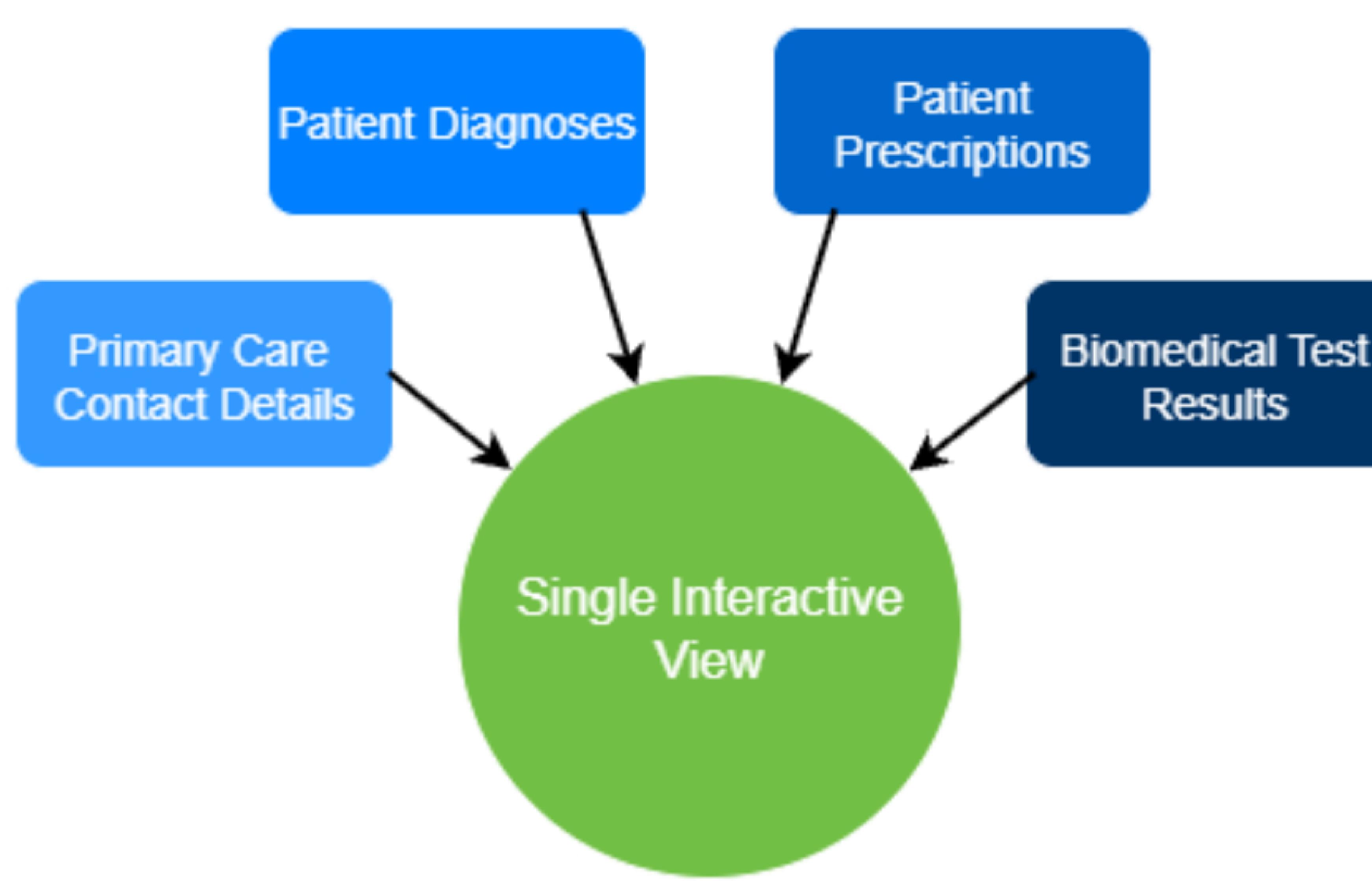


Figure 1 - a simple diagram illustrating the four disparate datasets leveraged for the Theograph. Prior to this tool being created, each of those datasets existed on separate systems, requiring clinicians to cycle through various tools to create a complete picture of their patient's care.

How did our methodology evolve and why?

We iterated on four priorities: usability, clinical relevance, reliability and performance. Afterall, a timeline is only helpful if it is readable, meaningful, dependable and accessible.

- Usability.** We added a searchable patient selector; consistent, colour-blind-safe palettes; larger markers; and concise tooltips with value, unit and date. Filters allow either comparison across series or a focused single-series view to avoid clutter. Labels scale for accessibility.
- Clinical relevance.** With clinicians, we prioritised a short, sensible list of conditions, prescriptions and assays that are commonly reviewed together (e.g., diabetes mellitus, HbA1c and metformin). We included a compact patient header (including age, sex and key dates) so the context is visible without scrolling.
- Reliability and data quality.** We standardised date formats, removed duplicates, and surfaced soft data quality flags such as overlapping events or improbable sequences. The export function captures exactly the visible slice (filters included) to support MDTs, audit and handover.
- Performance.** Using R/Shiny keeps deployment lightweight and portable; dynamic plot generation avoids rendering large, unreadable static charts and reduces load on shared environments.

Throughout the development cycle, we engaged with clinical colleagues from the University Hospitals of Liverpool Group and operational/analytical colleagues at the University of Liverpool. These sessions combined formative usability feedback with iterative requirements validation, enabling us to refine specifications and plan ahead.

In parallel, we provided technical assurance; covering data handling, reproducibility, and performance and delivered targeted training to support effective adoption of the tool.

How can this help clinicians?

This Theograph dashboard was designed to achieve the following:

- Sequence confirmation in seconds.** The timeline makes temporal order obvious; clinicians can verify that an abnormal result preceded a prescription change and see how quickly a review followed. That reduces ambiguity and repetition.
- Context at a glance.** Dense periods of contact around a new diagnosis stand out; equally, gaps between key results and follow-ups are visible without paging through notes. This helps target questions in consultation/MDT.
- Shareable, reproducible view.** The on-screen export, already filtered to the question at hand, travels cleanly into MDTs or notes. Because the export mirrors the display, what was discussed can be reconstructed later.

The final build balanced depth with readability by supporting up to two conditions, two prescriptions and two assays simultaneously. That's enough for most clinical feedback without overwhelming the eye.

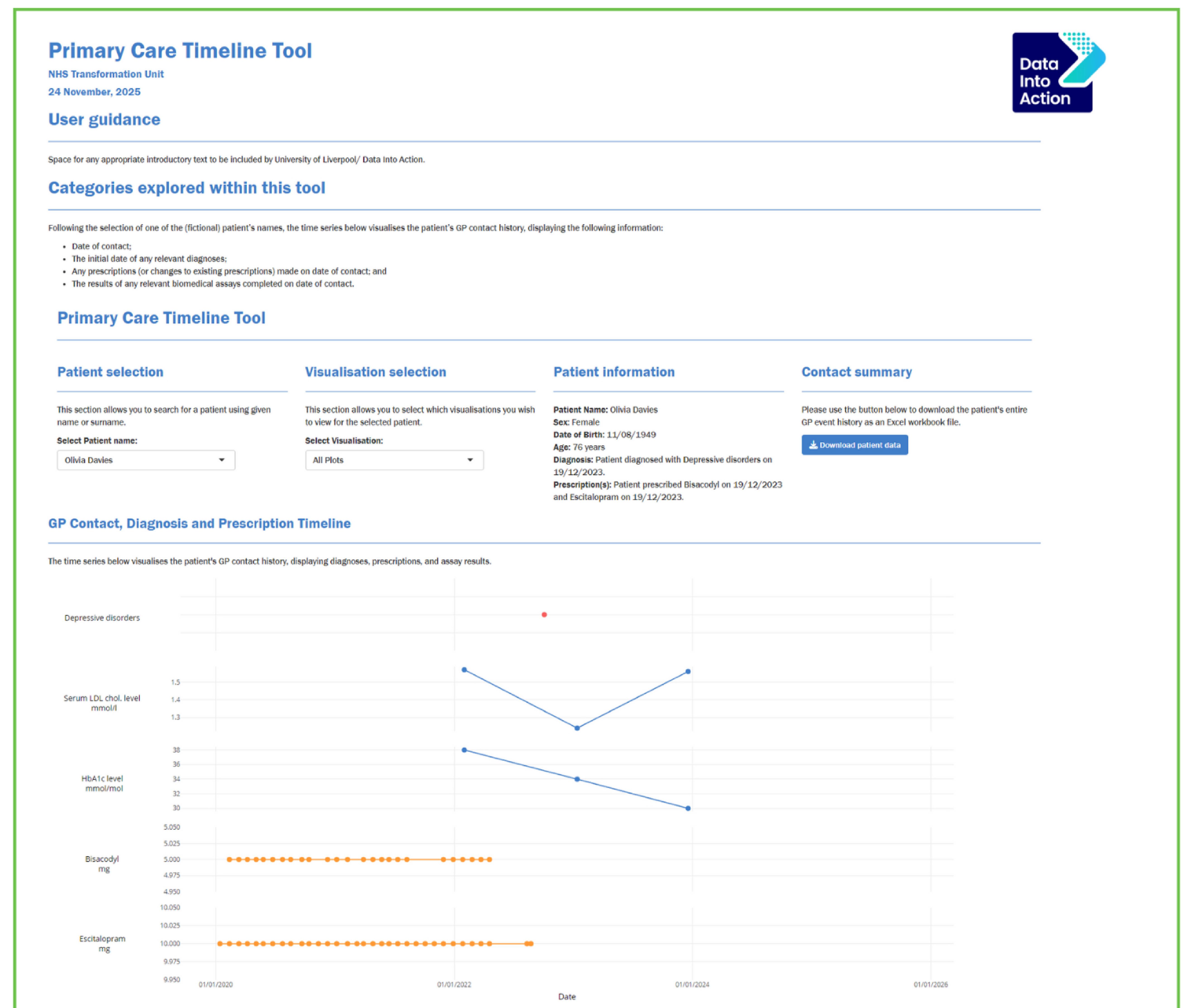


Figure 2 - the final build of the dashboard, here visible with a fictional patient's data.

Where can we go further?

We see three immediate improvements and one strategic direction:

- Broader coverage, sensible defaults.** Expand the lists of conditions/assays in a way that keeps the first-load view uncluttered. Specialty-specific presets (e.g., diabetes, respiratory) would load relevant overlays automatically.
- Auto-summaries.** Add small "insight blocks" that state what the timeline implies: "HbA1c increased 12% over 90 days prior to metformin start; review due in 4 weeks". These would not replace clinician judgement, but speed orientation.
- Preparation for use at scale.** Bake in stronger data quality checks, event deduplication rules and logging. Provide a print-ready MDT sheet that captures the latest events, active filters and a mini narrative.
- Open development.** Publish a clean, parameterised codebase for reuse across NHS partners. A small set of configuration files (data schema, colour palette, visible overlays) would let teams adapt the Theograph readily.

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