

### What is EMPATH™?

EMPATH™ is a highly configurable modelling framework, used to analyse and compare the performance of care pathways by simulating the complex interaction of patient flow, resources, and facilities. Configurations include defining population characteristics, such as demographics and different case mixes; staffing levels; facility resources, such as theatres, wards, and beds; capacities and opening hours of locations; and more. The framework caters for different types and scales of pathway, from a single surgical specialty, through ED department-level, to hospital, integrated care system level.

### What is it used for?

From a known baseline, EMPATH™ forecasts performance of your current and potential healthcare pathways, allowing you to understand and compare the resilience and efficacy of your systems, when subjected to a range of factors. These factors include changing patient demand (volumes, seasonality, and case mix); staff availability, or shortages due to sickness or attrition; streaming services; location capacities, and more. These forecasts highlight system weakness, and allow you to explore optimisation strategies, which can be used to strengthen business cases, shape new facility builds and create effective staff rotas with confidence.

### What kind of healthcare pathways can it represent?

With a suite of out-the-box components and fully configurable definition, EMPATH™ can be applied to any single pathway, speciality, or department, or to an integrated care system.

External dependencies can also be readily represented. For example: a single elective surgery pathway can be modelled with shared theatre space, shared ward allocation and emergency cases displacing elective patients; or an Urgent and Emergency Care department with community and hospital (specialist and inpatient ward) interfaces.

EMPATH™ is designed to model the complex interaction between patient needs, staffing, facilities, and external dependencies. Factors which can be represented, tailored, varied, and optimised include:

- ▶ Patient demand (rates, demographics, case mix and clinical priority).
- ▶ Staffing (availability, experience levels, specialisms, and rostering).
- ▶ Facilities (capacity, opening hours and suitability e.g. for specialisms).
- ▶ Complex interacting pathways.

External factors such as availability of specialists, community services and receiving ward availability.

### What kind of metrics or outputs can be interrogated?

EMPATH™ supports full customisation over metric definition, including standard NHS and local targets for common Key

Performance Indicators (KPIs), as well as additional configuration based on model data. Common examples include:

- ▶ Waiting list makeup over time, in terms of time since RTT clock start, clinical priority and case mix.
- ▶ 4- and 12-hour breaches in Urgent and Emergency Care (UEC).
- ▶ Ambulance handover and queuing times.
- ▶ Theatre and Ward utilisation or UEC department crowding.
- ▶ Average wait time following decision to admit (DTA).

### How does your approach reduce risk?

Our agile approach provides you with insight as quickly and efficiently as possible, reducing your risk and data burden.

Typically, this means focussing initially on a well-understood and -contained pathway and question. We will work closely with you to configure EMPATH™ to represent your system and set up the scenarios to investigate.

Following this, we can switch focus to alternative pathways, or increase complexity with additional breadth or depth, eventually building a full-scope model of your healthcare system as required.

This approach means that we can continually provide insight with increasing detail and ensures that the addition of model detail is focussed solely in areas which matter for answering your questions. We reduce risk with 'stress testing' and validation workshops early in the process, as well as starting with a visualisation to answer your question, building confidence, and significantly clarifying data and assumptions capture.

### Does it interface with other analysis tools?

EMPATH™ has a purpose-built, validated, and flexible analysis user interface for interrogating results, which can be deployed on a desktop or cloud-based system and hosted by us on your behalf if required.

All output results from EMPATH™ are in structured csv file format, for direct import into alternatives applications such as Power BI or Excel.

EMPATH™ scenarios can be defined in a number of ways, typically using Excel to collate all the required data and define a set of input files; this can be tailored to your requirements with solutions for automated input data processing.

### Does (or can) it use Artificial Intelligence?

Currently, EMPATH™ is intended for analysing pathway performance, with specific modified characteristics, to represent evolving demand and planned activities

(new/modified pathways, facilities, staffing model etc.) for comparing known strategies against baseline performance.

Frazer-Nash has several AI teams within our Data Science department, and incorporating AI is something we intend to explore in the future. Using AI to optimise pathways would allow users to specify target levels of metrics and explore a wider range of potential approaches. If you have ideas for how this could benefit you, please get in touch and we can discuss the best way to incorporate EMPATH™ into your workflow.

### What does EMPATH offer over alternative simulation tools?

EMPATH™ is more than just a Commercial-off-the-Shelf (COTS) product. In addition to being developed specifically for the healthcare sector and highly configurable, we further tailor the capability to fit your specific system and intended use case. We offer a wide range of consultancy and support options to ensure you get the best value. This can range anywhere from Frazer-Nash building models and undertaking analysis on your behalf, through to training your experts to tailor the capability, and anywhere in-between.

- ▶ Full customisation; tailoring to your exact problem.
- ▶ No 'one-size-fits-all' flexible operating model: we can undertake all the analysis for you transactionally, or we can provide the model and UI and train your analysts. Typically, we start with the former and work with you to build your baseline and tailor for your use cases, then work towards handover if desired.
- ▶ Flexible commercial options: fixed or long-term licensing, consulting/analysis, or support/enhancement contracts available, with cloud hosting also possible.
- ▶ Modelling individual patients means we have full flexibility over population characterisation for pathway decision-making, as well as the ability to validate against historic actuals based on patient IDs.
- ▶ Out-the-box representation of statistical factors in many ways, including automatic aggregation of results and the ability to apply confidence and risk levels. Can model low-probability, high-impact events (e.g. multi-vehicle collision).
- ▶ Out-the-box visuals for summary and scenario comparison as well as drill-down.
- ▶ Engineering rigour: we have decades of experience developing solutions and providing modelling and analysis consultancy across a vast range of industries. The underlying engine has been successfully applied in aviation and defence and is developed to international engineering quality standards.

### What kind of systems do I need to run EMPATH?

EMPATH™ is a desktop tool running offline on a single laptop, run as executables with packaged dependencies. It can be run in parallel, and for large parametric or statistical simulations,

can be batch-run overnight. If you'd like, we can instead host it on our cloud systems on your behalf, providing login access for your teams to directly run models and view results.

### Can it be integrated into live systems?

We intend to explore this in the future. Integrating into your systems would require a collaborative approach, so we can understand your current systems thoroughly, to then feed live data effectively from them into EMPATH™, allowing near term forecasts. If this capability is of interest to you, please contact us, so we can understand your requirements, and how we can help.

### How much does it cost?

We will always develop a custom approach tailored to solving your problem, working closely and collaboratively in an agile fashion, to ensure you're driving requirements. Typically, this involves a series of workshops, to capture these requirements, establish a baseline model and inputs, and define use cases. There are additional ways we can support you, such as undertaking and delivery analysis on your behalf, training your teams, hosting EMPATH™ using the cloud, and ongoing support contracts.

### How much and what kind input data do you need?

We can work anywhere on the spectrum from small amounts of data, up to lots of good quality data.

All model inputs can be defined based on a combination of interpreting real data, and expert judgement. The choice depends on the availability and quality of data, as well as the availability of your staff for engagement. If required, we can conduct a data capture on your behalf. Our typical approach is to build a representative model of your system, validate it against historic known performance, if this data is available then define the 'as-is' baseline to enable future forecasting scenarios.

If real data is available, we will use this, and use our data science expertise, or collaborate with your BI analysts to manipulate it for input into the model.

### How much clinician time/input is needed?

We can tailor the approach to ensure engagement is highly focussed and makes best use of your time. As above, we can work anywhere on the spectrum of no-low-rich data, to allow flexibility of input.