

## Deontics CDSS Innovative Capability

### Introduction

Deontics is an Artificial Intelligence (AI) company with world-leading clinical pathway/workflow and clinical decision support technologies following 25 years academic development with Carnegie Mellon University, the Medical Research Council, Cancer Research UK, Oxford University and University College London. Our solution enables conventional knowledge including guidelines, quality measures and clinical trial inclusion/exclusion criteria to be encoded into a standard digital format for enterprise wide sharing and integration with individual patient data and patient preferences, to provide best quality care options for patients and the quickest most cost effective treatment for institutions. Improved compliance with clinically proven guidelines ensures better patient outcomes whilst reducing operational costs through efficiency, reduced admissions, reduced length of stay and reduced chance of readmission through effective post discharge support. Reduced risk to patients means reduced medical legal costs, and improved efficiency reduces potential imposed fines. Quick wins at low cost. A patient facing tool is also available, providing patients with valuable advice based on guidelines and their own preferences leading to more meaningful consultations. Use of such tools has already demonstrated potential savings of £77M in unnecessary treatments, 60% increase in trial enrolment and a considerable reduction in medical errors, resulting in reduced medical legal costs.

### The problem to address.

The NHS is currently experiencing difficult times with ever decreasing budgets and spiralling costs, reduced resources with increasing volumes of patients, imposition of pressurised Government targets to improve efficiency and quality, not to mention cultural changes with a move towards patient centred care.

Implementation of modern technologies enabling automation, improvements in workflow processes and monitoring of deadlines with alerts being provided to relevant individuals have all contributed to improving efficiency and quality of care to some extent.

However, most Clinical Decision Support solutions in use today are based off decision trees which are fine for process co-ordination pathways as used by many Electronic Patient Record and Clinical System solutions but not adaptive enough for clinical decision making. Decision trees are very linear in their approach and extremely inflexible. In reality a typical pathway requires dynamic, flexible and situation adaptive execution as patients can present at any stage of a pathway and their situation can change at any point.

Deontics CDSS has been designed to look at what decisions need to be made and why rather than just looking at how tasks should be achieved and by who.

## Deontics cognitive pathway CDSS - What & Why?

- What examinations to do?
  - What data to collect?
  - What are likely differential diagnosis and why?
  - What tests to order and why?
  - What medication to prescribe and why ?
  - Allergy and interaction check?
  - What follow up to implement?
- Involves knowledge representation
  - Directly based on clinical guidelines and evidence
  - Involves decision-making: applying evidence to individual patient data and preferences, to make optimal decisions
  - Largely organisation independent and follows natural history of the disease

## EPR Process co-ordination pathway - How?

- Booking appointments
- Producing relevant forms and reports
- Sending appropriate pharmacy requests
- Managing referrals and discharge summaries
- Managing follow up
- Managing e-prescription and repeat prescriptions

- Involves workflow and process representation
- Directly based on the process maps
- Involves making right requests at right time and utilizing right resources
- Tightly linked to the organisation and available resources

Interaction

## How Deontics CDSS has been evaluated.

Our innovative technology has been developed in conjunction with the following organisations over a 25 year period:

- Carnegie Mellon University
- Medical Research Council UK
- Cancer Research UK
- University of Oxford
- University College London

Deontics provides end-to-end CDSS solutions ranging from authoring tools and pathway tools to specific disease management applications. Our systems help standardise clinical performance and increase patient safety, by implementing personalised, evidence-based care across a population complete with compliance monitoring and comprehensive audit for accreditation purposes.

Deontics technologies are highly modular and can be used to configure applications for any clinical niche (primary, secondary and tertiary care)

Our technology suite enables modelling and execution of structured and unstructured knowledge in three principle use cases:

- **Highly sophisticated, dynamic, real time point of care Clinical Decision Support** - an analogy to this would be a "clinical sat nav" offering the best possible care to patients no matter what changes occur or decisions are made.
- **Clinical surveillance** – real time background tracking of clinical decision compliance. Each action is monitored and date and time stamped including decisions made and evidence sources used to make that decision. Alternative decisions can be made by clinicians but a reason must be provided as to why that decision strayed from the evidence. In short Deontics offers a real time clinical audit tool.

- **Analytics** – clinical performance and outcomes metrics can be analysed against treatment rationales and evidence compliance to contextualise and understand “why” and “what” identifying where clinical performance is inadequate or expensive or conversely, excellent and cheap.

In short Deontic's products help healthcare providers ensure that care is appropriate, optimal, and safely deliver.

## **Evidence of clinical effectiveness and cost savings to the NHS**

Clinical effectiveness and cost savings can be seen in the Deontics CDSS ROI Example document and the two brochures. In summary:

- Up to 90% ChemoRx cost savings in treatment of Stage II Colon Cancer – potential to save up to £77m in England\*
- 0% errors with Deontics treating childhood leukemia vs. 37% without Deontics AI\*\*
- Using Deontics to diagnose breast cancer – 1% critical errors with Deontics vs. 13% without Deontics AI\*\*
- 60% increase in patient recruitment for clinical trials\*\*
- Retrospective analysis using Deontics of actual live kidney donors showed that 41% of those who had undergone nephrectomy had major contraindications to nephrectomy\*\*

\* Derived from published study; savings results were extrapolated from study data. Details can be seen in the ROI document.

\*\* According to published study; data available upon request. Details can be seen in the ROI document.

## **The likely impact of Deontics CDSS in terms of patient impact and health economy impact.**

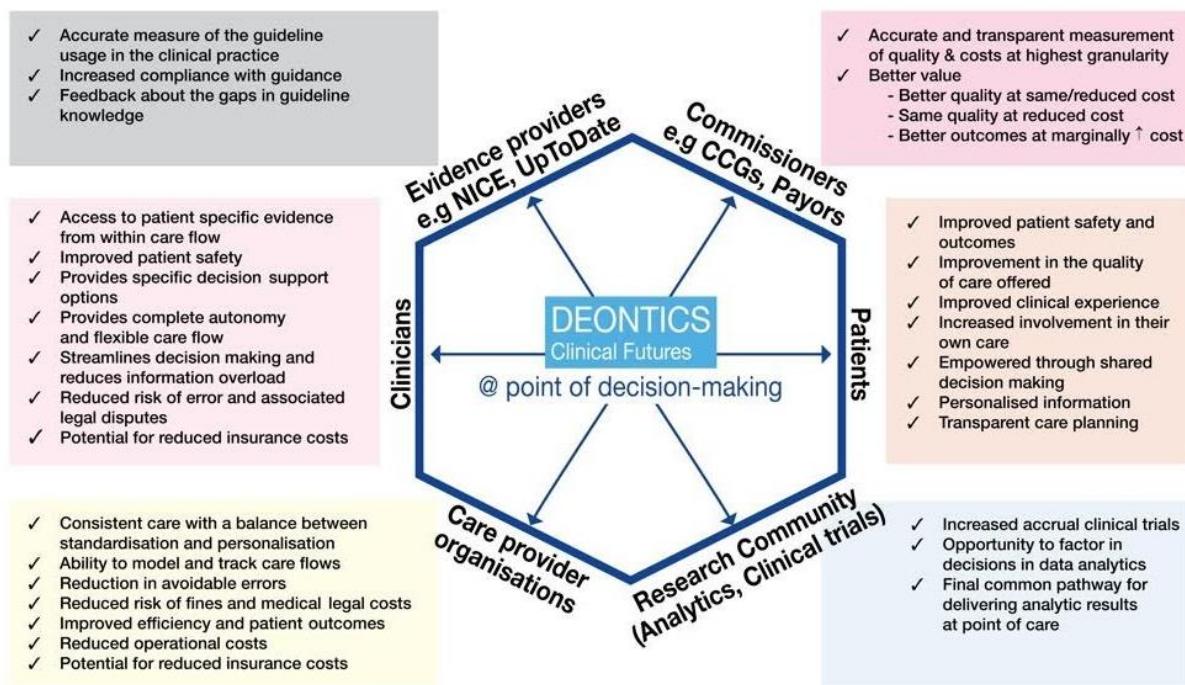
The likely impact of Deontics CDSS in terms of patient impact and health economy impact can be seen in the Deontics CDSS ROI Example document and the two brochures as well as in the text below:

Value of Deontics CDSS includes:

- Retrospective analysis of data to identify previous areas of concern re patient outcomes and compliance to guidelines enabling comparison of this to patient mortality, patient turnaround times, increased admissions and readmission's, missed government targets, operational cost and medical legal costs. This enables immediate bench marking and quick wins through improved compliance.
- More effective triage of patients to reduce unnecessary admissions and ensure the right patients get priority. Improvements in perceived quality of care whilst streamlining throughput to maximise bed space and resources.
- Improvement in the quality of treatment and the efficiency of throughput of patients once admitted – from a clinical perspective with task management from EPR's. Maximise throughput and improve patient outcomes
- Reduction in re-admissions through improved quality of care across acute and community.
- Patient empowerment and guidance to make their own decisions as an enhancement
- Potential for revenue generation from suitable selection of patients meeting certain criteria for clinical trials
- Improvements in conventional knowledge through analysis and feedback of data regarding guidelines, pathways, outcomes and quality measures.
- Quick authoring capability to standardise format and capture electronically clinical guidelines, research data, clinical trials and quality measures - days instead of months and years

- EPR providers utilise linear pathways and task management approaches to efficiency improvements. Whilst this task management is important in speeding up throughput they are missing the key component - improvement in the quality of care and all the knock on effects that ensue as mentioned above. With Deontics and an EPR end users will get the best of both.

## Benefits by Stakeholder



## Ease of Implementation

Our authoring technology enables rapid encoding of clinical guidelines and other evidence based documentation into a standardised, executable format in days and weeks depending on complexity, without the need of programming skills. SNOMED and ICD codes are all added as part of the process. The main time spent in collating pathways is not the authoring but the analysis workshops determining the preferred pathway approach and mapping this to the workflow in the third party system e.g. EPR, followed by the testing for clinical integrity, quality and risk purposes. Such work usually takes a couple of months depending on availability of each organisations staff and state of readiness. If off the shelf pathways and evidence sources are utilised then this time frame can be greatly reduced.

Our decision engine sits behind an existing clinical system or EPR system UI and presents treatment options from this executable evidenced based information and individual patient data from the patients' medical record. Deontics engine features a large set of integration and communication options. The UI is web based and straightforward to launch from other software or embed inside some other UI. There are many options for data connectivity, ranging from full standard support such as FHIR, CDS Hooks, SMART to custom web based APIs. It supports the major coding standards (SNOMED-CT, ICD9/11, LOINC, RxNorm) and can encode proprietary coding easily to facilitate data mappings effortlessly. It is cloud based but can also be made available on-premises.

Once our standard core platform is integrated into each organisations infrastructure then additional pathways can be added at will.

In certain cases where integration can prove difficult Deontics CDSS can be used as a standalone solution with the required patient data entered manually.

## **What support can Deontics provide to the implementation process**

Deontics has extremely experienced clinical, commercial, project management, implementation and support teams to deal with all eventualities and can provide analysis, implementation, testing, training, project management, change management, maintenance and support services as required.