

e-Prescribing has the potential to improve patient safety and reduce provider costs. It has been identified by the NHS as a key plank in its digital transformation programme. But implementation is not without its pitfalls and healthtech companies will need to do more than produce sophisticated algorithms to get a foothold in the emerging market, explain Candesic's **Dr Joe Taylor** and **Seth Howes**



# The **art** of e-Prescribing



**A**t the heart of modern medicine is the ability to get the right drugs to the right people at the best time. As healthcare professionals and as patients, we know that this process does not always run smoothly. Failure often leads to frustration, but occasionally also results in significant clinical harm.

When I was in medical training, pharmacists would take their dreaded green pens to my drug charts – correcting spelling mistakes and recommending alternatives. I have no idea why pharmacists use green pens! Occasionally they would track me down for a good telling off for failing to prescribe the generic

rather than the named medicine, among the many other errors the young and inexperienced make.

The objective of e-prescribing is to deliver drugs in a way that is safer, cheaper, and more effective than the paper systems that cause so many prescribing headaches.

## **How can e-prescribing improve safety and support clinicians?**

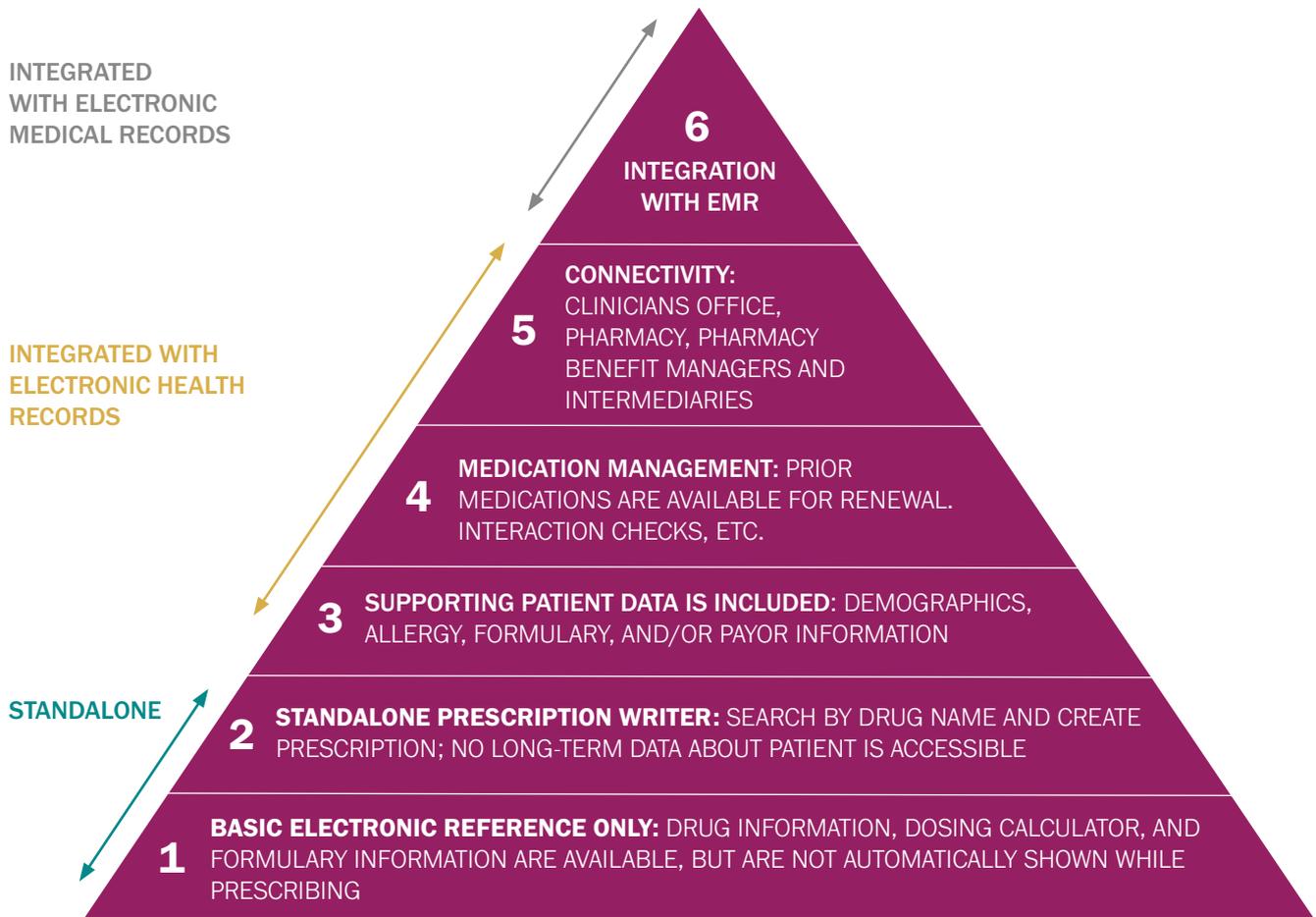
A medication error can be an error of commission or omission at any step from the time a patient registers their medical

history, to prescribing up to administration. E-prescribing systems outperform traditional paper-based systems by reducing the risk of prescription errors by up to 30%, increasing prescribing efficiency, and reducing medication costs.

E-prescribing has been identified as a key component of the 'digital transformation' of the NHS. The 2019 NHS *Long Term Plan* specified that all NHS service providers should transition to digital prescribing systems by 2024. In line with this objective, the UK government has earmarked £78m in funding for NHS trusts to implement these systems.

Another key element of the digital transformation has been the widespread

**FIGURE ONE  
THE LEVEL OF SOPHISTICATION OF E-PRESCRIBING SYSTEMS**



SOURCE CANDECIS RESEARCH AND ANALYSIS

adoption of Electronic Health Records (EHRs), which provide a wealth of digital, patient-specific datasets. The value of these datasets is being increasingly realised through the burgeoning field of machine learning. Machine learning techniques have advantages over legacy analytical techniques at spotting patterns in large and complex datasets, and can offer insights into this data that can be used to reduce prescribing costs.

Through the combination of EHR data and e-prescribing platforms medications are more likely to be effective. Machine learning algorithms have been created to suggest appropriate medications for a given patient in their clinical context. Google Health and the University of California San Francisco recently collaborated to create a clinical decision support tool that uses patient EHR data, including demographic profiles, vital signs, clinical diagnoses, and clinical environment. The

tool is designed to predict the most likely medications appropriate for the person. During testing, in 93% of cases, at least one medication prescribed to the patient in the following 24 hours by physicians was present in the top ten medications suggested by the model.

**SOFTWARE MODELS WILL NOT SOON REPLACE PHYSICIANS IN THE PRESCRIPTION PROCESS**

## Whose decision is it anyway?

Do you entirely trust autocorrect when writing a text? What if the equivalent was used to suggest the medication you took to keep you alive? The responsibility for prescribing still lies with the named clinician, but humans do make mistakes and software supporting decision making carries with it both opportunities and risks.

Software models will not soon replace physicians in the prescription process. However, they are already helping to reduce the time taken for a clinician to select medications. The objective of e-prescription software is to weaken the link between increased speed and the correlating increase in errors.

Tools to help improve antibiotic prescribing are being added to hospital e-prescribing systems. WellSky currently provides software to more than 50 NHS

trusts. Alongside input from NHSX, it is developing the Antibiotic Review Kit Decision Support system.

The system leverages AI to assess whether an antibiotic choice is appropriate based upon the drug's indication and patient data. If a medication is deemed inappropriate, the system will suggest a pharmacist conduct a medication review.

Better choices of antibiotics help to reduce the emergence of resistance, and the costs associated with treating prolonged and severe infections.

## Will machine learning further limit prescription errors?

According to NICE, the harm caused by avoidable prescription errors costs the NHS an estimated £550m a year. Most current algorithms for identifying medication errors operate according to fixed rules.

When a prescription is issued that contravenes these rules an alert is issued to the prescriber. The issue with fixed rule-based systems is that they commonly raise false-positive alerts, contributing to decision fatigue. Repeated false-positive alerts cause prescribers to ignore these warnings entirely, negating the value of the system.

A new generation of innovators have created machine learning-based tools that more accurately predict whether patients may have avoidable medication errors when compared to traditional systems. Perhaps more interestingly, Lumio Medical has developed an algorithm mixing researcher-specified rules alongside machine-learning methods to predict the likelihood that a patient will have at least one medication error in their prescription.

Testing of this model has shown it outperforms existing fixed rule-based systems in identifying patients with medication errors.

Israeli-based start-up MedAware offers a similar system, which alerts clinicians when they prescribe medications that are judged not to fit with a patient's demographics and clinical environment. For example, the system would generate an alert if a contraceptive pill was prescribed for a baby boy.

---

## HALF OF PEOPLE WITH A CHRONIC DISEASE ARE NOT COMPLIANT WITH THEIR PRESCRIBED MEDICATIONS

---

### Could e-prescribing reduce the need for costly medication reviews?

Alongside spotting medication errors at the time of prescription, medication error prediction tools built using machine learning methods can increase efficiency and therefore reduce costs of medication reviews.

One method of spotting medication errors is through review of the entirety of a patient's medications. As increasing numbers of patients take many medications, the workload of the pharmacists conducting these reviews is increasing dramatically. Machine-learning based methods provide a way to prioritise reviewing those patients who are most likely to have errors in their prescriptions. These tools increase the efficiency of the review process, removing the necessity to train and employ pharmacists at the rapid rate that would otherwise be required to cope with the increasing number of required reviews.

### Can e-prescribing support reduction of drug abuse?

The opioid epidemic continues to represent an ongoing public health crisis, with the CDC estimating the costs of lost productivity and healthcare provision to be over \$1tn annually. A team of academics at the University of Florida developed a machine learning tool to help predict the likelihood that a medicated person would overdose on a prescribed opioid within three months of the prescription being issued. The machine learning tool outperformed all other available computational tools in predicting which individuals would overdose within that short time.

Bamboo Health recently worked with

Michigan's Department of Licensing and Regulatory Affairs (LARA) to develop a machine learning model that uses patient data from the state's prescription drug monitoring programme to generate an 'overdose risk score'. The score is being used to target interventions to those individuals at greatest risk of opioid-related overdose, therefore helping to reduce the occurrence of overdose and subsequent treatment costs.

Overdose-prediction tools ensure scarce interventional support programmes are allocated to those who are most likely to need support. With increasing access to data, these can not only identify individuals who are at risk but also provide insights into geographical regions where the incidence of opioid abuse is increasing. This combination of both targeted individual and public health campaigns can massively reduce the costs associated with managing the ongoing opioid epidemic.

### Can e-prescribing support medication adherence for those with chronic disease?

Half of people with a chronic disease are not compliant with their prescribed medications. Non-compliance is a major cause of reduced drug efficacy, and subsequently increases disease burden and associated healthcare costs. MedTech company Inovalon developed a machine learning tool that accurately predicts the likelihood that individuals will adhere to their medication regimen.

Individuals judged to be at high risk of not taking their medications were sent an automated text reminder and were subsequently much more likely to take their medications regularly, improving the management of chronic health conditions, and reducing the likelihood and costs of additional treatment.

### Are there issues with implementation of e-prescribing?

Implementing software across the healthcare system is not an easy task, especially when it involves overhauling

long-established processes.

Candesic has learnt that a recent implementation of e-Prescribing at a major NHS hospital resulted in every member of pharmacy staff being able to prescribe irrespective of their rights to do so. This salutary lesson should remind providers that there must be appropriate safety and compliance checks when these systems are implemented.

In addition, there is evidence that prescribers become over reliant on e-Pre-prescribing decision support. Christian Lous Lange, a Norwegian historian and Nobel Prize winner, once said: 'Technology is a useful servant but a dangerous master'. Prednisone and prednisolone could be easily mixed up with scruffy handwriting and glazed morning eyes at the best of times, but we're so used to autofill forms that they are easy to conflate in e-prescribing systems.

A 2016 US study reviewed how often prescribers attempted to include additional information in an e-prescription in free text form rather than in structured data entry fields. The study reviewed more than

## REQUIRING PRESCRIBERS TO COMPLETE INFORMATION IN FIXED FIELDS AIDS COMMUNICATION, ANALYSIS OF PRACTICE AND REDUCES ERRORS

26,000 free text notes included in prescriptions and found that more than 66% contained inappropriate content for the prescription, 29% contained appropriate content, and 5% contained information considered unnecessary.

Requiring prescribers to complete infor-

mation in fixed fields aids communication, analysis of practice and reduces errors. There is a likelihood that natural linguistic programming can help with this problem, but we are not there yet.

### Conclusions

E-prescribing technology is empowered by dosage and drug-interaction decision support systems. It has already changed medical practice, but not without some problems.

We expect the e-Pre-prescribing software market to be consolidated. Many systems with different interfaces are dangerous as prescribers work with different physical and digital patient pools. In addition, the need for integration with consolidating EPRs will benefit a pseudo-monopolistic market model.

Those who prove successful in this market will not only have to gain very high market shares but also become part of medical education and standardised clinical protocols.

# Private Acute Healthcare Conference



12 October  
2022

etc.venues  
County Hall  
London

Early Bird  
Tickets:  
£445

LaingBuisson  
EVENTS

Premium Sponsor

Bevan Brittan 

Executive Sponsors

STREETS  
HEAVER  
HEALTHCARE  
COMPUTING

PHARMACIERGE  
WIMPOLE STREET LONDON

olympic  
ELECTRONIC PRIVATE PRESCRIPTIONS

**Register now**

laingbuissonevents.com  
sales@laingbuisson.com  
+44 (0)20 7841 0045