

The potential for interactive IT to improve medicines management in the future

Ian Nash, *Cluster (domiciliary) Pharmacist, Royal Devon and Exeter NHS Foundation Trust.*

Corresponding author: ian.nash@nhs.net

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It is estimated that 30-50% of medicines prescribed for long term conditions are not taken as anticipated, resulting in the loss in health gain of billions of pounds.

The experience of the Exeter Cluster Pharmacy team is that a high proportion of the elderly patients, together with a cohort of younger mental health patients, whom we visit at home are confused about their medicines. There remains room for improvement in providing visual information for the patients to help them understand their own medicines.

A fictional future scenario is outlined, in which a patient describes interacting with their health record via voice recognition technology and a 'smart' TV device to record their medicine taking and reordering. The patient could work with the healthcare team, in person or via a video link, to reconcile therapy so that the pharmacist can take responsibility for the accuracy of the therapeutic record. With formal monitoring of outcomes, the evolving therapeutic record represents the basis of a pharmaceutical care plan.

The discussion explores the benefits, challenges and limitations of both monitoring adherence and the use of voice recognition technology. The political will to achieve a change in the model of care is touched upon, together with a suggested alteration to the Community Pharmacy Contract as leverage to promote medicine optimisation. The Medicine Reminder Chart is considered in detail, including the possible risks of permitting patients to change their own records. Finally an example is provided of generating Medicine Administration Records from the IT record to empower skilled not registered staff to support patients at home with their medicines at the time of transfer of care.

Innovative IT solutions can bring about major changes in the management of medicines. Now is the time to explore how those changes could be implemented to maximise the potential benefits from medicine optimisation for patients in the future.

Keywords: medicine optimisation, reconciliation, care plans, IT, outcomes, voice recognition technology, medicine reminder chart.

Background

Global problem

It is estimated that 30-50% of medicines prescribed for long term conditions are not taken as anticipated, resulting in the loss in health gain of billions of pounds.¹

Medicines optimisation can help address these issues (of polypharmacy, underuse and misuse of medicines) by ensuring that the right patients get the right choice of medicine, at the right time. By focusing on patients and their experiences, the goal is to help patients to:

- improve their outcomes
- take their medicines correctly
- avoid taking unnecessary medicines
- reduce wastage of medicines
- improve safety of medicines.
- medicine optimisation can help encourage patients to take ownership of their treatment.²

Researchers at Ghent University, Belgium concluded that

polypharmacy, underuse and misuse was highly prevalent in adults, aged 80 years and older.³ Underuse and not misuse had strong associations with mortality and hospitalisation. This conclusion referred to patients receiving the correct medicines according to STOPP/START criteria⁴ but a similar logic could apply to poor adherence to 'optimised' medicine therapy.

Local experience

The Exeter Cluster Pharmacy Team provides domiciliary pharmacy services including reconciling⁵ the patient's actual therapy with the latest versions of all official health records available. Our experience is that a high proportion of our elderly clientele are confused about managing their medicines independently.⁶

Patients may not know why they are taking their medicines, how many to take or what time to take them. The patient may be unable to understand the principle behind blister packs and some do not know the day of the week.

Many patients complain that their tablets visibly change colour and shape with each supply as well as having packaging in a different livery. Consider the potential health risk of the supplies of medicines already in the home that the patient has been asked to stop taking. Does the patient agree with or understand the decision behind that alteration in therapy? On multiple occasions, the Cluster Pharmacy Team have witnessed patients failing to implement proposed changes of therapy or reverting to earlier supplies and dosages, for example following discharge from hospital.

Vulnerable patients in possession of months of stock are also not uncommon. In the UK, the problem of excess medicine stock in the patient's home is exacerbated by the Community Pharmacy Contract, which rewards the number of prescription items dispensed.

Individualised medicine data in existing therapeutic records are frequently inaccurate with regard to patients' actual medicine consumption at home, according to our experience as domiciliary pharmacists. These discrepancies represent some of the interventions that we refer back to our GPs to address our patients' on-going pharmaceutical needs. Considering the morbidity and mortality associated with poor adherence to medicines,⁷ then providing patients with visual information to help them understand their own medicines might go some way to address these system deficiencies.

Medicines Reminder Charts

Medicine lists

The World Health Organisation has recommended that patients, family, and caregivers should be encouraged to keep and maintain an accurate list of all medicines, including prescription and non-prescription medicines, herbal and nutritional supplements, immunisation history and any allergic or adverse medicine reactions. These medicine lists should be updated and reviewed with the patient/family/caregiver at each care encounter.^{8,9}

In the UK, the repeat prescription slip initially printed alongside

the prescription is usually the only record of therapy that patients have in their homes. Is this the optimum support that can be offered to help patients understand and manage their own medicines?

Evidence

An MSc dissertation investigated whether elderly patients perceived benefit of having access to a personalised list of their own medicines as a Medicine Reminder Chart and whether adherence to their medicines was enhanced.¹⁰ In the study results, the frequency with which the cohort of 62 patients looked at their MRC achieved statistical significance regarding medicine adherence, when data was simplified to low, medium and high adherence. 73% of respondents in the study agreed that the Medicine Reminder Chart helps them to remain independent in their own home. The dissertation suggested that the co-production of the medicines record with the patient represents a promising and pragmatic option to address the national medicine optimisation agenda.⁸

Low cost option

Raynor et al described the Medicine Reminder Chart as a relatively low cost means of providing personalised patient medicines information.¹¹

Example

An example of a Medicines Reminder Chart for 'Dougal Duck' is shown in Figure 1.

Proposal for maintenance of the Medicines Reminder Chart supported by interactive IT

This paper offers a future vision of engaging patients to work with the pharmacy team via interactive IT access to enhance their medicine management. For a successful outcome, there should be a number of mechanisms to monitor the quantities of the medicines, to inform the patient and the Healthcare Professionals (HCPs) about adherence.

The proposal is that a digital algorithm calculates the patient's likely medicines stock and hence their adherence, in a way comparable to the estimated usage on utility bills. The GP computer systems already offer such a monitoring tool but, unless there is engagement with the patient, the results can misrepresent the patient's actual supplies.

The patient would be invited/prompted by the electronic record to count the remaining medicines before reordering, as the definitive means of monitoring adherence. Patients will require encouragement and support to count their medicines routinely. The algorithm which defines when the system will allow medicine reordering should have a degree of tolerance (overestimate or underestimate) to allow for human error.

An assumption is that when digital records are integrated across the different health systems and settings to provide a common health record, all prescribed medicines will be tracked in real time. For example, following an inpatient stay, allowance will have been made for the additional supplies of medicines

from the hospital. This information automatically updates the common medicine record and thus the latest version of the online Medicine Reminder Chart, including details of the medicines that have been stopped.

With formal monitoring of outcomes of therapy (e.g. reduction in blood pressure), the accurate Medicine Reminder Chart of treatment contributes to an evolving pharmaceutical care plan or care pathway.

Future scenario

Given the potential of innovative IT solutions, is the record of therapy in the patient's home adequate for medicine optimisation? The following fictional scenario describes a patient interacting with their health record via voice recognition technology and a Smart TV device to record their medicine taking and reordering. The patient would work with the healthcare team, in person or via a video link, to reconcile therapy, so that the HCP can take responsibility for the accuracy of the pharmaceutical record.¹²

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Dougal Duck
Organisational Logo

Chart Prepared: 20th June 2017
Date of birth: 12/05/1936

Name of medicine		What it looks like <small>(NB. Appearance may change if different make is supplied)</small>	What it is for	How much to take and when				Comments/ Other information
				Breakfast 	Lunch 	Teatime 	Bedtime 	
Lansoprazole 30mg capsule		Can be white capsule	To prevent excess acid	ONE				
Digoxin tablet 125micrograms		Small white tablets	To control heart rate	ONE				
Ramipril 1.25mg capsules		Two-tone capsule	To protect heart	ONE				
Atorvastatin 10mg tablets		White tablets	To lower cholesterol				ONE	
Warfarin 1mg tablets		Brown tablets	To prevent blood clotting			Dose as directed		Take dose at same time each day
Fluoxetine 20mg capsules		Can be caps green/yellow	To prevent low mood	ONE				
<small>Patient details: Dougal Duck; Date of birth: 12/05/1936; NHS No: xxx xxx xxx; Date of preparation: 20 June 2014</small> <small>This chart is designed to remind you when to take your medicines and how much to take. Please show this chart to anyone who provides care for you. This list of the regular medications is not a prescription, in the legal sense. The list was an interpretation of the medicines by the patient and the named Health Care Professional (HCP) below and was considered correct at the time when the chart was prepared. If the patient or their carers would like to discuss any further changes to the medicines or this document or have any other queries then please phone <<Named HCP>> on <<given telephone number>></small>				<small>GP's name: Dr Doctor</small> <small>GP's phone number:</small> <small>Cluster, Exeter, Devon</small>				

Name of medicine		What it looks like <small>(NB. Appearance may change if different make is supplied)</small>	What it is for	How much to take and when				Comments/ Other information
				Breakfast 	Lunch 	Teatime 	Bedtime 	
<small>Drugs in alphabetical order by BNF chapter</small>		<small>Photo, pre-populate for common brands, free text option</small>	<small>Default to usual indication, free text option</small>	<small>Default usual dosage, free text option</small>				
Paracetamol 500mg tablets		White tablets	To control pain	1-2 if needed	1-2 if needed	1-2 if needed	1-2 if needed	Not more than eight in 24 hours
Beclometasone 100microgram/puff inhaler		Brown QVAR® cfc free inhaler	To prevent breathlessness	ONE puff		ONE puff		USE REGULARLY
Salbutamol 100mcg CFC free inhaler		Blue inhaler	To relieve breathlessness	2 puffs if needed	2 puffs if needed	2 puffs if needed	2 puffs if needed	
Macrogol Cmpd oral pwr 13.7g sachets		Movicol® or Laxido®	To prevent constipation				1-2 if needed	<small>dissolve contents in half a glass of water (125ML) and take by mouth</small>
Doublebase gel		Apply freely	For dry skin					
<small>Patient details: Dougal Duck; Date of birth: 12/05/1936; NHS No: xxx xxx xxx; Date of preparation: 20 June 2014</small> <small>This chart is designed to remind you when to take your medicines and how much to take. Please show this chart to anyone who provides care for you. This list of the regular medications is not a prescription, in the legal sense. The list was an interpretation of the medicines by the patient and the named Health Care Professional (HCP) below and was considered correct at the time when the chart was prepared. If the patient or their carers would like to discuss any further changes to the medicines or this document or have any other queries then please phone <<Named HCP>> on <<given telephone number>></small>				<small>GP's name: Dr Doctor</small> <small>GP's phone number:</small> <small>Cluster, Exeter, Devon</small>				

Do not use this chart after 20th September 2017

KEEP ALL MEDICINES OUT OF THE REACH OF CHILDREN

Documented allergies/intolerances: PENICILLIN (causes rash)

Figure 1: Medicines Reminder Chart for 'Dougal Duck'

January 2025

It is January 2025 and patient Jean Smith aged 78 years, is thinking of reordering her medicines. Jean has Parkinson's disease, mild heart failure, COPD and is housebound.

Access to the record

In her living room there is a flat screen 'Smart' television, supplied by Health and Social Care 'Telecare' to give Jean access to a virtual day care centre via a video link. She can thus engage with her new friends, to participate in the armchair exercise class.

The display boldly names the day of the week and the time of day. The TV device represents a two-way link for monitoring the frail elderly, for example to identify falls via a range of the Telecare technologies.

Interactive IT solutions will include voice recognition technology,¹³ to permit interface with the TV/device through verbal instructions.

Jean either speaks to the device by saying 'Medicines' or uses her TV remote to highlight and click on the Medicines icon on the desktop screen. This instruction displays the Medicine Reminder Chart of her complete therapy.

The presentation of the medicine data can be flexible. Jean often chooses to just display the list of the medicines to be taken at a given time of day. The device provides a visual and sound alarm when it is time to take medicines and provides verbal instructions for the actual medicines that she is to take. There should be the means to monitor when the administration of medicines has not occurred, for example when the container has not been opened, which can be brought to the attention of the carers. Consider the existing Telecare carousel of oral medicines, which links non-compliance with a given dose to a telephone call-centre so that the patient's carers can be informed.

Monitoring adherence

The IT system maintains a virtual tablet count, reducing the total remaining quantity each day, assuming 100% compliance. There is an electronic monitoring device in the lid of each dispensing container that records when the product is open, assuming subsequent consumption of the correct dose. The carers, who visit Jean twice daily to provide social care, scan the bar code on each medicine product after they have prompted Jean to take that medicine. This action updates the Medicine Administration Record that is one presentation on the screen of the Medicine Record. Jean can also record her own self-administration by saying 'medicines taken' (at the specified dose time) or by scanning the bar codes herself.

So, Jean will have several ways to determine the number (of doses) of each medicine that she would expect to have left at any time. Emma at the pharmacy has asked Jean to actively count the number of tablets remaining each month and to enter this data onto the screen, verbally or via the remote, before she reorders the medicines. Jean discovers that she has 21 of one of her daily tablets remaining, which informs her and the HCP that she must have missed taking them on up to seven days of that month. Jean feels a bit guilty, but she is happy to talk this through with Emma.

Jean has relatively few doses of one of her medicines and she knows Emma will encourage her to look for it around the flat. So she goes hunting and discovers a quantity of this product in a dispensing bag that has been put down beside the kitchen table, together with some other items. There is yet another item she can't find anywhere and she thinks that she may have lost this product, which she will have to talk to Emma about.

Access to medicine information

When the prescriber initiated a particular medicine for Jean, a range of information was provided, some of which she has forgotten. On the visual display, by saying the medicine name, Jean can access a lot of written text in plain English about this particular product e.g. what it looks like and what it is for? There are also some interesting 'Cates plots' of smiley faces that give her a sense of the relative risk about the side effects. She has not had any problems so far.

Regarding the inhalers that she takes for her COPD, there is a link to a YouTube video clip of how to use the inhalers as well as how to use her eye-drops. This instils confidence in Jean to know that there are always these reminders available to look at if she has any doubts about how to use these products.

Patient updating the record

Jean also takes the opportunity to vocally update the Medicine Reminder Chart about her perception of what this new medicine is for. The existing MRC describes the gabapentin for preventing seizures, whereas her GP had said that it was to prevent nerve pain, which was the reason why she had gone to the surgery.

Reordering medicines

With the Medicine Reminder Chart on display in ordering mode, Jean can voice the name of the medicine, or point and click on the listed medicines with the TV remote, that she believes she needs to reorder.

When Jean is ready to send the completed order she links to the 'shopping basket' page and submits the requested order on-line. This is the third month since Jean spoke to the pharmacy and the device prompts Jean to make contact by video link. Jean and Emma can work together to update the full Medicine Reminder Chart so that the pharmacist can take responsibility for the 'accuracy' of the record.

Discussion with the pharmacy

During the conversation, Jean can confirm the change that she made to the gabapentin indication. She can discuss the tablet that she has been forgetting to take and the ones she can't find. Jean has also stopped taking one medicine this month, agreed with the GP over the phone, because she was having side effects. Emma can check whether this side effect has been recorded on the common IT system. If not, Emma may need to talk to the GP or make an informed judgement of whether to record the drug as an allergy/intolerance.

Discussion

Online medicine ordering

Online medicine ordering software is already available and will become the standard means of re-ordering medicines within the next decade. This regular interaction with their own record of medicines, should give the patient ample opportunity to find out more information about their medicines. However, there has to be the political will to create the means to provide a high level of on-line medicine support, with tools such as the Medicine Reminder Chart.

If this proposed method of reordering medicines via the Medicine Reminder Chart is implemented for patients while they are still cognitively sound, then later they will have familiarity with the skills required to continue this method of reordering as they grow older.

Monitoring medicine adherence

In terms of monitoring medicine adherence within the proposed model, there would have to be judicious triangulation within the re-ordering algorithm. For example, when using electronic devices in the medicine container lid that records the opening of the container, there is the risk of the patient opening the pack just to count the tablets, rather than consuming a dose. There is also the risk of patients or carers, when they come to re-ordering, simply miscounting the stock or the wholesale misplacing of any one of the various bags of dispensed medicines.

Indeed, unless there is regular contact with the patient, including access to their home either by visiting or a video link, it is almost impossible to be certain that the apparent adherence is in fact true. The obverse is that if the algorithm mechanism highlights doubt about the patient's adherence then referral for domiciliary pharmacy support should include an investigation of stock levels.

Voice recognition technology

The interactive IT solution of the near future will include voice recognition technology. This should make access to the proposed healthcare model far more realistic, for the frail elderly both present and in the near future. There remain challenges about security of access via voice recognition to sensitive medical data, but ideas such as a pin number or a 'catch phrase' could address the issue. HCPs would also need access to the patient's record.

There will be debate about whether patients should be able to access their own record and potentially make changes. For example, in the scenario the information that Jean will send about the change of purpose of the gabapentin influences the Medicines Management System. The drop-down menu for selecting the drug indication¹⁴ has the most popular choice at the top of the list. This represents an important mechanism for populating the indications directory for the less usual drugs, which would be informed by the users themselves for personal, cultural or linguistic reasons.

However, there remains the risk of patients writing clinically inaccurate information on their own record or changing records that they don't like. The system will require confirmation of who made any changes, which will remain highlighted until the next

HCP takes responsibility for the accuracy of the record or prescribes a further supply of medicines.

The Medicine Reminder Chart is not a prescription and belongs to the patient. It will have to be assessed judiciously by the HCP before authorising further supplies of medicines. The authorised prescribing record would be informed by, but firewalled from the Medicine Reminder Chart.

Professional opportunity

Pharmacists working in busy dispensaries may dismiss these thoughts as speculation; however, the implementation of electronic prescribing represents a significant shift of prescription management from the surgery to the pharmacy. The wider pharmacy team are skilled in handling medicine data and there is an opportunity to engage with patients to develop the enhanced services described above.

The professional opportunity for community pharmacists, as yet unfulfilled, is the chance to reconcile patient's therapy holistically during a medicine review, to inform the IT record, hence the wider health care community.

Remuneration

In order to facilitate the proposed model of care, the Community Pharmacy Contract would need to be changed to promote a greater emphasis on medicine optimisation. Research would be required about the optimum number of daily prescriptions managed by an average pharmacist in an average pharmacy. The agreed optimum number may need to be lower than in the existing dispensing model, if the pharmacist and their team were to manage reconciliation of therapy as well as the supply of the medicines.

Routine reconciliation of therapy with the patient would be anticipated to reduce the overall number of prescription items, given the levels of excess medicine stock that the Cluster Pharmacy Team have found in people's homes. An audit from the Community Pharmacies on the Isle of Wight 2010/2011 recorded items included on prescriptions that were identified as not required by the patient.¹⁵ The results of the audit, if extrapolated to the whole population, suggest the potential for considerable cost savings from the medicines that would not need to be supplied.

Baumber suggested a model for Community Pharmacy remuneration that included a multi-tiered payment fee.¹⁶ The proposed optimum number of items could attract the maximum dispensing fee, with tapering remuneration for lower or higher numbers of items.

Support for skilled not registered staff

All health and social care workers should find the Medicine Reminder Chart or related medication records to be useful tools for working with the patient. A recent local initiative is for the acute hospital to generate Medicine Administration Records for the discharge of complex patients to empower skilled but not registered support workers to assist/prompt patients with medication taking in the community (home setting).¹⁷ The principle behind this decision justifies the argument for an improved and shared presentation of the medicine record.

Conclusion

The maintenance of the Medicine Reminder Chart and interactive IT working in combination could improve adherence for some patients. This could potentially have significant consequence across the whole population, in terms of morbidity and mortality.⁹

Innovative IT solutions can bring about major changes in the management of medicines. Now is the time to explore how those changes could be implemented to maximise the potential benefits from medicine optimisation for patients in the future.

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Declaration of interests

The author has nothing to disclose.

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