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Journal of Medicines Optimisation

Developing a patient-centred approach to get best outcomes and value from medicines

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In this issue:

AIM OF THE JoMO

Medicines optimisation is a person centred approach to safe and effective medicines use to ensure that people obtain the best possible outcomes from their medicines. The aim of the JoMO is to contribute to that process and play an influential and key part in shaping better patient care and the role that medicines can play. The JoMO provides a vehicle to enable healthcare professionals to stimulate ideas in colleagues and/or disseminate good practice that others can adapt or develop to suit their local circumstances.

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All material should be sent electronically to the Editor-in-Chief (alex.bower@pharman.co.uk).

Editorial

When the words 'medicine optimisation' are mentioned you will probably think 'patient'. You will probably then think about ensuring the patient is getting the right medicine at the right dose at the right time and in the right way, etc. The patient will be foremost in your mind. Where does dispensing, the supply of medicines and the disposal of unused medicines fit in to this? Many will regard those activities as being done outwith the medicines optimisation agenda – but it that right? The case is made in this edition that those processes should be clearly regarded as part of the medicines optimisation progress. The view is that there is much that can be learned from the audit and analysis of unused medicines that can provide information about prescribing practice and lead to improved patient care. It is suggested that Community Pharmacists can play a key part in obtaining such information. Whilst recognising their role in the collection and disposal of returned medicines, it is proposed that more can be done through such methods as harnessing the domestic refuse collection system and similar waste disposal schemes. The population is used to separating out their paper, bottle and garden waste – why not medicines? Food for thought!

Intravenous vancomycin therapy typically starts with a loading dose followed by a maintenance dose 12 to 24 hours later. This often means, however, that doses have to be administered in the middle of the night, which is impractical for both patients and staff. Results reported here indicate that the optimum time for patients to receive their first maintenance dose is 6-8 hours. As a result, new guidelines have been developed to reduce the risk of early sub-therapeutic vancomycin trough concentrations. This will be of particular interest to hospital pharmacists and those involved with optimising antimicrobial therapy.

Northern Ireland has launched a Medicines Optimisation Quality framework, which has three components:

- A Model for Medicines Optimisation describes what patients can expect when medicines are included in their treatment plans in the four main care settings of hospital, general practice, community pharmacy and social care.
- A set of Quality Standards to engage multi-professional teams to develop best practice and deliver high quality outcomes from medicines each occasion they are prescribed, dispensed or administered.
- An Innovation and Change Programme to support implementation of the framework through the identification, testing and scaling up of best practices.

The way this will be used to deliver a safer, more effective care and improved patient experience is clearly set out. The Framework provides a clear statement of the standards and processes that should apply in any setting, whether that be in a hospital, general practice, Community Pharmacy, nursing/residential/children's homes or domiciliary care. Things do not just rest there, however. A newly established Medicines Optimisation and Innovation Centre (MOIC) will provide a centre of expertise for research, service development, knowledge transfer and innovation in medicines optimisation. There can be no doubt that medicines optimisation is firmly 'on the map' in Northern Ireland. These are most splendid initiatives and there will be much interest in learning about developments within the MOIC.

HYPERLINKS

References and other resource material as appropriate can be accessed directly via hyperlinks in the Journal.

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Contents

Medicines Optimisation – extracting the last vestiges of value from your medicines

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Abstract

Title
Medicines Optimisation – extracting the last vestiges of value from your medicines

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Summary
The concept of waste and how it can be reduced, recycled, refurbished or reused in its current form has been widely discussed in industry. The importance of waste reduction from an environmental and economic perspective has also heightened in both industry and within the research arena. Thus said, stringent steps have been taken to facilitate the collection of waste medicines and capture their residual value. This article explores this premise in relation to medicines waste as part of the wider medicines optimisation agenda.

Keywords: returns, logistics, residual value, supply chain.

Medicines optimisation is about patients

We are all very aware of what medicines optimisation is and what it aims to achieve. Medicines optimisation is about 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 and improve medicines safety.[1]

The amount of medicines in the supply chain is increasing

Medicines optimisation aims to get the most from medicines for both patients and the NHS. It is becoming increasingly important as more people are taking more medicines.[2] Evidence would suggest that we are living longer and living better. We thus need more medication to sustain this, which leads to an increase in polypharmacy. The output of this is an increase in the demand for pharmaceutical products, which in turn increases the quantity of medicines in circulation; on manufacturer sites, wholesalers, pharmacies and in patients' homes.

As stipulated by the Royal Pharmaceutical Society, medicines optimisation aims to deliver to the following core principles:

1) *aim to understand the patient's experience*
2) *evidence based choice of medicines*
3) *ensure medicines use is as safe as possible*
4) *make medicines optimisation part of routine practice.*

If the principles are adopted and measurement and monitoring takes place then there should be improved patient outcomes.[3]

This short perspective piece will reflect on and offer an alternative perspective on the third aim of this agenda i.e. focusing on medicines use safety.

Medicine optimisation needs to encompass waste in the supply chain

A basic business definition of 'optimisation' is *'Finding an alternative with the most cost effective or highest achievable performance under the given constraints, by maximizing desired factors and minimizing undesired ones.'*[4] Medicines optimisation as currently practiced does not 'fit' with this definition. It does not seek to consider alternatives at the point of dispensing.

Pharmacists as experts in medicine, and in conjunction with learned professionals, seek to choose the right medicine for the right treatment to ensure efficacy, effectiveness and a positive clinical outcome and patient experience. To this end, the majority of activity and research in this area has considered the

optimisation of medicines for the patient and less of the total optimisation of the product itself. Yet there are recent studies focusing on medicines further downstream in the supply chain, e.g. waste management in pharmacies[5] and care homes,[6,7] which is warranted as there is evidence of the stockpiling of medicines. Greater vigilance should be paid to materials management/inventory control, the drivers of which are both cost reduction and risk removal/minimisation.

Medicines recovery – by hook or by crook, by truck or by foot?

When considering the current medicines optimisation focus and efforts the following questions can be posited:

- Where is the focus on the safety of the patient and risk to the patient once they have medication in their possession and do not use it?
- How actively does the NHS system facilitate the recovery of unused medications?

There is limited exploration of the recovery of unused and unwanted medications from patients, and even less into the mechanism by which they can be retrieved. Studies undertaken have examined why medicines recovery and analysis is undertaken in hospital pharmacies and have also highlighted deficiencies in the logistics infrastructure supporting medicines retrieval. For example, whilst there is a clear legal impetus for collecting batteries, the same driver does not exist for medicines.[8,9]

The question must therefore be asked as to why we need to retrieve medicines in the first place. Surely, once they are in the hands of the patients then the patient will know how to take them and how to dispose of them if they are surplus to requirements or they need to stop them as a course of treatment (due to side effects, efficacy issues, etc)?

There are two key benefits to retrieving medicines from patients:

- Reduction of hazards within the domestic environment due to the stockpiling of medicines (these can be accessed and misused by children or the elderly leading to hospital admissions or worse).
- The information that can be gleaned from the medicines themselves (prescribing source, contents, quantity, patient information leaflet and outer packaging) and their use (from patient consultations during and post treatment) when returning medicines.

From a medicines optimisation perspective, much can be learned from and acted upon from returned products to improve patient care and the processing of medicines from GPs/doctors to pharmacy and on to patients.

What else can be done to improve recovery rates?

The current medicines recovery system only works effectively if patients return medicines to community pharmacies, so is innately flawed by design as some patients may never choose to do this.

As stated by the RPS, medicines optimisation can help encourage patients to take ownership of their treatment; but this doesn't automatically extend to ownership of, and responsibility for, product returns.

Medicines need to be removed from patients' homes and patients should have the option to: a) bring them back to a pharmacy or b) have them collected from their home/drop them at a collection point within their community. Both returns channels can be designed and executed to ensure that, optimally, medicines are returned to community pharmacies.

Option A: Patient education[10]

Medicines 'take back' schemes (e.g. disposal of unwanted medicinal products (DUMP)) and re-ordering schemes (e.g. Only Order What You Need,[7]) and pharmacist consultations can all play a strong role in developing 'green consciousness' to influence returns. The role of Community Pharmacy in facilitating this is tantamount to success and this is discussed in more detail below.

Option B: Collection

What can the NHS as a service do to improve recovery rates and move the emphasis from patient responsibility to system responsibility in recovering unwanted medications? Our American counterparts have, over the years, offered various solutions to increase the 'claw back' of unused medicines via street/domestic refuse collections and reduce the risk to animals and people who may access medications that have been put into domestic waste (advocating mixing of medicines with undesirable products such as strong coffee or cat litter). Is this practice something that could be adopted as an extension of medicines optimisation in the NHS (UK)? Having consulted with local recycling depots the answer, theoretically, is "Yes".

There is a well-established domestic refuse collection in place throughout the UK and strategically placed recycling centres so why can't these be utilised to accept medicines (if placed in appropriately secure containers) so they can be brought to recycling sites to be disposed of as per safety regulations or handed over to a 3rd party for incineration?

Collaborations of this ilk (NHS and local council waste management services) do exist but medicines are not included in this service.[12] There is, of course, a cost to this system but is the issue of medicines recovery and the risk to the patient of enough importance to warrant examining the feasibility of using such a system?

Medicines information – and no, not the dial up kind!

There is a wealth of data sources that can be accessed to support medicines optimisation from dashboards, to medication error reports, to thermometers through to data mining and BIG DATA analysis (which allows NHS professionals to analyse huge quantities of data, identify trends and patterns to support the case for change and development). However, important data is at our fingertips when medicines are returned but is barely ever accessed or used in an informed manner. Medications, once returned, are destroyed as per regulations. The assumption here is that, as an 'end of life' product, they have no further value to offer so incineration is the next step. This isn't so.

The data that can be retrieved from a product once returned can inform GPs, pharmacists, service improvement managers and commissioners, to name just a few parties, about the effective of prescribing. For example, how much has been prescribed but not used, to whom and when it was dispensed. This can offer excellent data for investigating medicines spend, medicines errors, counterfeit medications and system performance.

One has to ask, how often are audits undertaken on medicines returned to pharmacy so that this information can be used to inform improvement? Why do we not avail of this aspect of medicines optimisation? It is the final value-added contribution of any medicinal product - but it goes unnoticed. The information is out there but worthless if the medication is not recovered.

Community Pharmacy – can we do more?

Community Pharmacy has a pivotal role to play in supporting and delivering to the medicines optimisation agenda, due to their proximity to their patients. Their intervention can be twofold: medicines counselling and medicines auditing.

Medicines counselling

Community Pharmacists can work with patients or patient advocates and patient forums (e.g. GP surgery patient participation groups and Clinical Commissioning Group (CCG) health forum participants) to counsel and educate on medicines use and re-ordering but also to promote the retrieval of products. This practice can be supplemented by one-to-one discussions with patients to learn more about their experience with their medicines e.g. knowledge and comprehension of treatment, medicines compliance, storage, side effects, and disposal methods. This could be tied into Medicine Use Reviews (MURs) or be a separate consultation and could be especially beneficial to reduce unnecessary polypharmacy. The value of direct patient feedback can be extremely high if steps are taken to collate it in a manner which is user-friendly and accessible to the patient. Consultations in a community pharmacy setting would facilitate this.

Medicines auditing

Patients should also be encouraged by their pharmacist (hospital and community) to return any waste medicines (by displaying promotional information on televisions, computer screens, posters, leaflets, stamps/logos on paper bags or by 'word of mouth'). Once medicines are retrieved, pharmacy staff should take advantage of the residual information held by said products and undertake regular audits or returned goods to feedback to local prescribing networks and other relevant parties.

The introduction of such auditing practice can act as an early warning system for issues associated with poor prescribing practice, errors or counterfeit medication; some of which may not be picked up by patients until a red flag is triggered or illness/death occurs. Such analysis can also provide information to bodies such as the Medicines & Healthcare products Regulatory Agency (MHRA), NHS England, Department of Health and manufacturers on compliance issues, escalating returns of a specific product or serious 'near miss' issues with medicinal products.

Auditing practice can be cumulative when enough stock has been returned to warrant it (e.g. the bin is full) or cyclical (the stock is emptied and evaluated every day, week, etc). Research in hospital pharmacies has shown that the practice of medicines audits and associated analysis can vary in relation to the practice and resources deployed to undertake this, from individual members of staff to dedicated teams.[5] Community pharmacies should determine the most sustainable method of undertaking a regular auditing system and resource this accordingly.

Striding forward with purpose!

Medicines optimisation is optimisation to the end of life, not the end of use.

The focus currently seems to dwell on the optimal effectiveness of medicines dispensing and use but not on the whole life cycle of the product. Optimisation should consider the value of the pharmaceutical product once recovered from the patient and should encourage and facilitate this by enhanced retrieval systems.

Pharmacy within the NHS underpins the success of medicines optimisation and thus needs to be able to do this effectively. This will impact on system design, workload planning, skills development and operational strategy and ultimately influence the constitution of pharmacy contracts.

As asserted in the opening statement of this article, medicines optimisation is about ensuring that the right patients get the right choice of medicine, at the right time. Pharmacy has made great strides to make this happen but can also use the strength and expertise of its staff to perfect and consistently optimise the use of medicines, and waste medicines, within our healthcare system. This is an opportunity to do just this.

Medicines optimisation needs to extend to the end of the pharmaceutical supply chain i.e. the final recovery and safe disposal of the product.

'Out of sight and out of mind' cannot be how medicines are regarded in patients' homes. The safety of medicines use is key - but the safety of the patient in the presence of medication is king.

Declaration of interests

Dr Breen has nothing to disclose.

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Timing of the first vancomycin maintenance dose in an acute adult hospital setting – room for improvement?

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Abstract

Title
Timing of the first vancomycin maintenance dose in an acute adult hospital setting – room for improvement?

Author list
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Introduction
Intravenous vancomycin therapy typically starts with a loading dose followed by a maintenance dose 12 to 24 hours later. In the acute hospital setting, this often results in doses being administered in the middle of the night, which is impractical for both patients and staff. This audit examined current practice and developed new guidelines to support greater flexibility in the timing of the first maintenance dose.

Methods
Data recording forms used by pharmacists to support the therapeutic drug monitoring of vancomycin were collected from two hospital sites over six weeks. Forms containing at least two vancomycin concentrations were selected and the time of administration of the first maintenance dose was recorded. Individual vancomycin pharmacokinetic parameter estimates were obtained using MAP Bayesian analysis then used to predict vancomycin concentrations 6, 8, 10, 12 and 14 hours after a banded loading dose and 20 mg/kg (capped at 3000 mg). Predicted concentrations were compared with a target range of 10 – 20 mg/L.

Results
Data were obtained from 49 patients with a mean (SD) age of 63.1 (16.7) years and weight 80.1 (27.6) kg. In all patients, creatinine clearance estimates were >40 mL/min and, according to current practice guidelines, all patients required 12 hourly maintenance dosing. The time recorded for the administration of the first maintenance dose was between 11 pm and 7 am in 30 (61%) of these patients. In 14 patients (29%), the first maintenance dose was administered >12 hours after loading. The target range was achieved with banded doses (20 mg/kg) in 65% (71%) of concentrations at 6 hours, 74% (84%) at 8 hours, 57% (67%) at 10 hours, 53% (55%) at 12 hours and 39% (43%) at 14 hours.

Conclusion
This audit has shown that current practice results in a high proportion of vancomycin maintenance doses being administered at impractical times. Allowing a more flexible time window of 6-12 hours after the loading dose for administration of the first vancomycin maintenance dose could help to alleviate this problem and reduce the risk of early subtherapeutic vancomycin trough concentrations.

Keywords: glycopeptides, therapeutic drug monitoring, dosage guidelines.

Introduction

Vancomycin is a glycopeptide antibiotic that is used in the treatment of serious infections, including methicillin-resistant *Staphylococcus aureus* (MRSA). Although studies have found that clinical and bacterial response to vancomycin is best related to the daily area under the curve to MIC ratio (AUC/MIC),[1] current practice is to monitor trough concentrations for efficacy and toxicity. The target range recommended by the Scottish Antimicrobial Prescribing Group (SAPG) is 10 – 20 mg/L, which is increased to 15 – 20 mg/L for patients with severe or deep-seated infections.[2]

Current SAPG vancomycin dosage guidelines recommend a banded loading dose based on weight (around 15 – 25 mg/kg) followed by a maintenance dose based on renal function.[2] As the guidelines state that the timing of the first maintenance dose should reflect the maintenance dosage interval, the majority of patients receive their first maintenance dose 12 or 24 hours after the start of their loading dose. Observational data and feedback comments from staff suggested that these guidelines, particularly for 12 hourly regimens, often led to dosage regimens that required vancomycin infusions to be set up overnight. This was challenging for staff and disturbing for patients. Furthermore, anecdotal observations from pharmacy and medical staff suggested that the first measured trough concentrations of vancomycin were often below the target range of 10 to 20 mg/L.

This study aimed to identify whether following current vancomycin guidelines resulted in a high proportion of maintenance doses being initiated at impractical times, to quantify the risk of low trough concentrations and to determine whether current guidance on the timing of the first maintenance dose could be modified to increase flexibility and the achievement of target trough concentrations.

Methods

Patients and data collection

A standardised data collection form was devised, piloted using data from five patients then finalised. Data were collected prospectively and retrospectively from medical and surgical wards across two hospital sites over a period of six weeks. Patients were selected for inclusion if their data were recorded on the local vancomycin prescribing and administration chart and at least two vancomycin concentration measurements were available. The following data were collected for each patient: age; weight; sex; creatinine concentration; vancomycin doses, duration of infusion and administration times; vancomycin concentration measurements and sampling times. In addition, the clock times when the loading dose and the first maintenance were administered were recorded.

Pharmacokinetic analysis

The clinical characteristics of each patient and their vancomycin dose and concentration data were entered into a MAP Bayesian pharmacokinetic package, OPT.[3] Initial estimates of vancomycin clearance (CL) and volume of distribution (V) were obtained using the Matzke equations[4] assuming a one-compartment model. Creatinine clearance was estimated using the Cockcroft Gault equation.[5] OPT was then used to generate individual estimates of vancomycin CL and V for each patient by combining these initial estimates with the observed concentration data. Any patient whose measured concentrations varied by more than 20% from those predicted using the individual parameter estimates was removed from further analysis. This was done to avoid confounding the results with data from patients with rapidly changing renal function or errors in dose or sample time. The individual pharmacokinetic parameter values were then used to predict vancomycin concentrations at the time the first maintenance dose was administered and at 6, 8, 10, 12 and 14 hours after the start of the correct banded loading dose and after a dose of 20 mg/kg (capped at 3000 mg). The percentages of predicted vancomycin concentrations within the 10 - 20 mg/L target range were then determined for each time point.

Results

A total of 59 patients were initially identified, of which 10 were removed due to poor fits of their data and uncertainty regarding the accuracy of the dose or sample times. The 49 patients included in the final data set comprised 27 males and 22 females. Patients had a mean (SD) age of 63.1 (16.7) years, weight 80.1 (27.6) kg and creatinine concentration 71 (18) µmol/L. Estimated creatinine clearance had a mean (SD) of 91.7 (42.7) mL/min and ranged from 40 to 240 mL/min. All patients received 12 hourly maintenance doses of vancomycin.

Of the 49 patients, 35 (71%) were treated according to the SAPG vancomycin guidelines[2] and were prescribed appropriate loading doses, maintenance doses and maintenance dosage intervals. Loading doses ranged from 750 mg to 2000 mg, (8.1 – 28.8 mg/kg). Five patients (10%) received the wrong loading dose, which was too high in 4 patients and too low in one patient. The maintenance dose was incorrect for 11 patients (22%); 6 received a dose that was too low for their estimated renal function and 5 a dose that was too high. The dosage interval was incorrect for one patient, who was prescribed 24 hourly dosing instead of 12 hourly dosing. It was found that 30 patients (61%) had their first maintenance dose administered between the hours of 11 pm and 7 am. These dose administration times were generally continued for the duration of the vancomycin treatment.

The first maintenance dose was administered at a mean (SD) of 12.8 (1.7) hours after the loading dose. Figure 1 shows the predicted vancomycin concentrations at the actual times patients received their first maintenance dose after loading, based on their individual pharmacokinetic parameter estimates and their loading doses. In summary, 35 (71%) patients received their first vancomycin maintenance dose between 11 and 13 hours after the loading dose, 13 (29%) more 13 hours after loading and 1 less than 11 hours after loading. Predicted trough concentrations were within the target range in 27 patients (55%), above 20 mg/L in 2 (4.1%) patients and below 10 mg/L in 20 (41%) patients.

Figure 2 shows the predicted vancomycin concentrations at various times after the banded loading dose and Table 1 summarises the percentages of concentrations within the target range at these times based on both the banded loading dose and 20 mg/kg. The results show that the optimum time for patients to receive their first maintenance dose is 6-8 hours

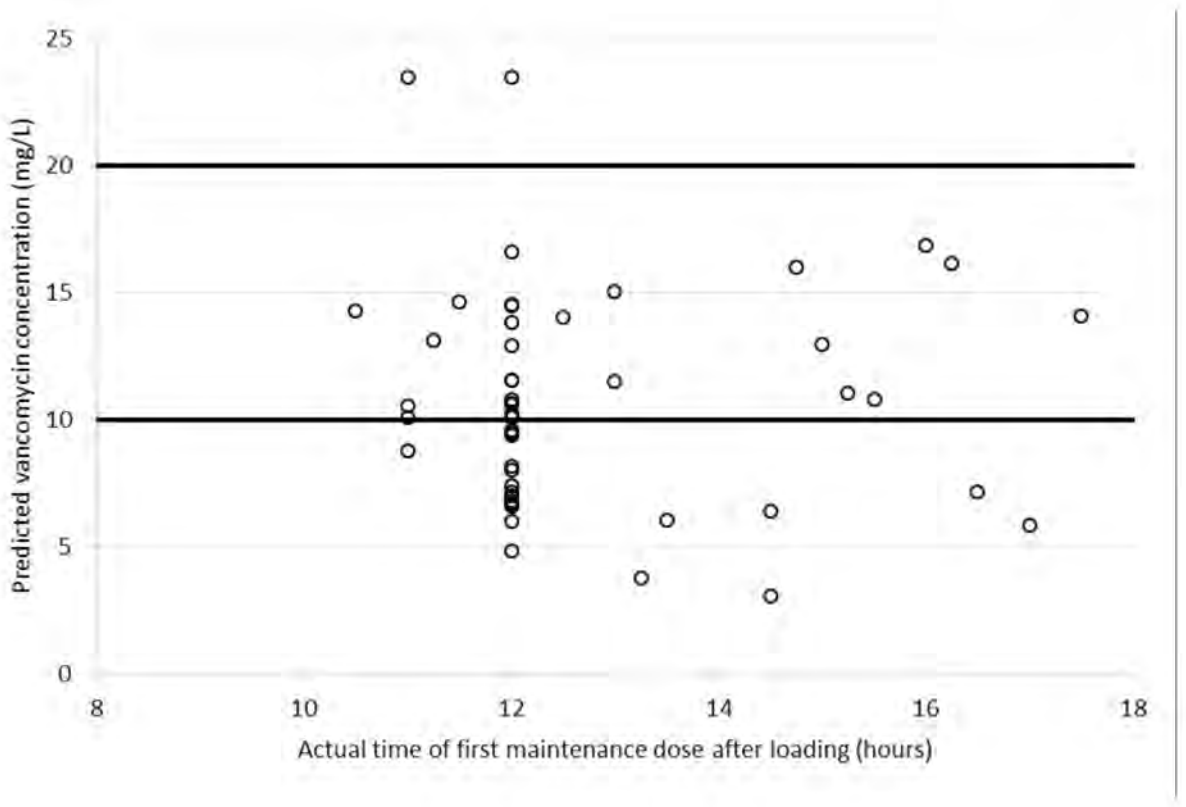

Figure 1: Predicted vancomycin trough concentrations at the times the first maintenance dose was administered. The solid lines indicate the target range of 10-20 mg/L.

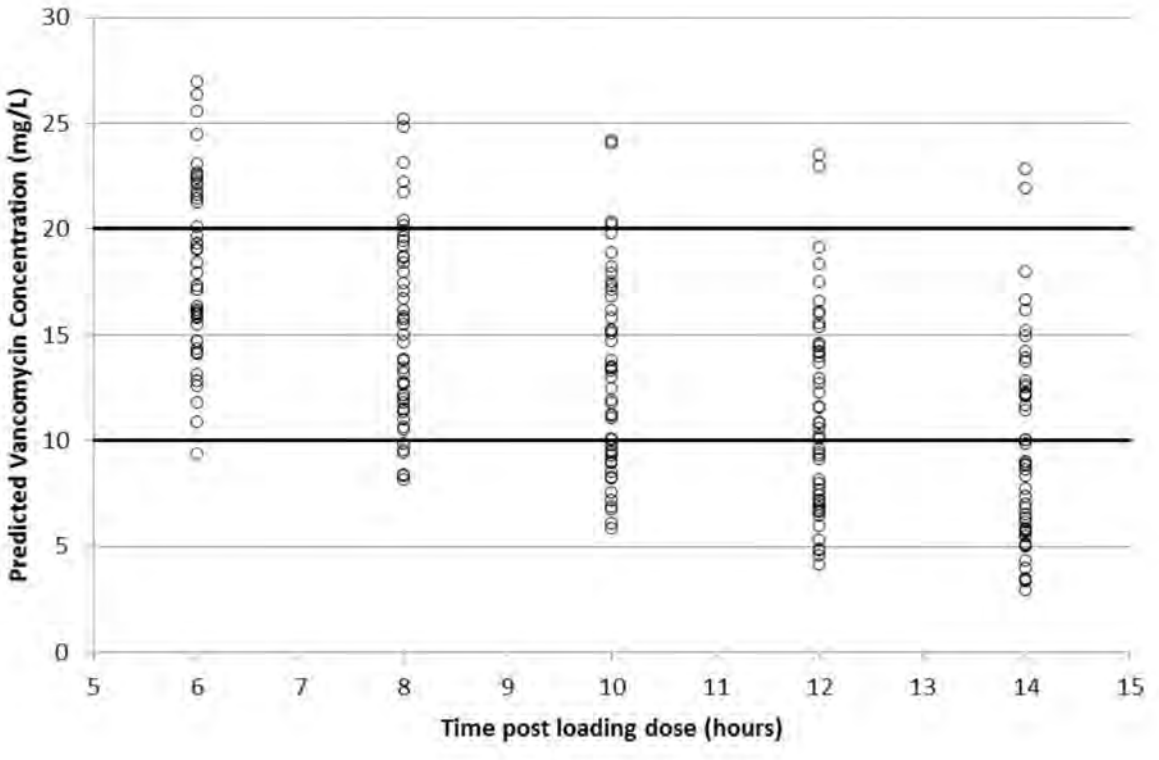

Figure 2: Predicted vancomycin concentrations at various times after a weight-banded loading dose.[2] The solid lines indicate the target range.

after the loading dose, which is associated with 65-74% of concentrations being within the target range with the banded loading dose and 71-84% with 20 mg/kg. Giving the first maintenance dose 14 hours after the loading dose was the worst option, with only 39% of patients within the target range and 57% below 10 mg/L.

Discussion

This audit was conducted to assess whether anecdotal concerns about vancomycin therapy were justified and, if so, whether guidelines could be modified to improve staff and patient convenience and reduce the risk of underdosing. Since almost two-thirds of patients (61%) received their first maintenance dose of vancomycin between the hours of 11pm and 7am, the study confirmed that patients often receive vancomycin doses at times that are inconvenient to staff and disturb patients overnight. These issues arise because decisions to start vancomycin are often made in the late morning or early afternoon and loading doses are therefore administered after midday. The SAPG guidelines[2] currently recommend giving the first maintenance dose at the normal dosage interval, which is typically 12 hours. Consequently, patients are routinely prescribed dosage regimens that require overnight dosing throughout the course of vancomycin therapy.

A second concern was that after loading, trough concentrations were often below the target minimum value. As trough concentrations are not routinely measured after a loading dose, for the purposes of this study, troughs were predicted using pharmacokinetic parameters derived from an individual analysis of data collected from each patient. To reduce the impact of the population model on these predictions, only patients who had at least two concentration measurements and a good fit of their data were included in the analysis. Consequently, higher variability is likely in routine clinical practice.

The results demonstrated that only 52% of patients were likely to have a satisfactory vancomycin trough at the actual time they received their first maintenance dose and even if the next dose had been given at exactly 12 hours after the correct loading dose, this value only increased to 53%. This may partly reflect the use of loading doses banded within weight ranges rather than a mg/kg approach, which was done to simplify the dose calculation and preparation of the infusion.[2] However, using a 20 mg/kg loading dose achieved similar results. Furthermore, a recent systemic review has shown that although starting vancomycin therapy with a weight related loading dose significantly increased the likelihood of achieving target trough concentrations, loading doses did not consistently achieve therapeutic concentrations.[6] A potential solution to this problem is to give a higher loading dose. Rosini et al[7] found that increasing the loading dose from 15 to 30 mg/kg increased the percentage of patients with initial 12 hour troughs above 10 mg/L from 15% to 80%. However, some clinicians expressed concerns that doses above 25 mg/kg might lead to a higher risk of nephrotoxicity. In any case, this approach would not solve the problem of overnight antibiotic administration.

An alternative approach would be to allow more flexibility in the time interval between administration of the loading and first maintenance doses. This is similar to the concept of "multiple loading doses" proposed by Denetclaw et al,[8] who suggested giving 15 mg/kg every 6, 8 or 12 hours over the first 24 hours of therapy, according to renal function. The present study used a higher initial loading dose and focused on the timing of the first maintenance dose only. The results demonstrated that troughs above 10 mg/L were more likely if the first maintenance dose is given 6 or 8 hours after the loading dose and that there was a low incidence of concentrations above 25 mg/L (6% at 6 hours post dose). Delaying the next dose beyond 12 hours after loading gave the worst results. Subsequent maintenance doses would then be given according to the guidelines (usually 12 or 24 hourly) until the dosage interval was confirmed or modified according to measured concentrations. The advantage of this approach is that it allows flexibility in dosing times. If a patient is given a loading dose at 2 pm, they can start regular maintenance therapy at 8 pm or 10 pm rather than having to wait till 2 am. It would be prudent to re-audit practice if any changes are made as a result of these findings. Further research would be welcome to confirm the findings and to assess any unintended consequences e.g. impact on nephrotoxicity or ototoxicity.

Time after loading	Percentage of vancomycin concentrations within range							
	< 10 mg/L		10 – 20 mg/L		20 – 25 mg/L		>25 mg/L	
Hours	Banded	20 mg/kg	Banded	20 mg/kg	Banded	20 mg/kg	Banded	20 mg/kg
6	2	0	65	71	27	27	6	2
8	12	6	74	84	12	10	2	0
10	35	27	57	67	8	6	0	0
12	43	39	53	55	4	6	0	0
14	57	51	39	43	4	6	0	0

Table 1: Percentage of patients whose predicted vancomycin concentrations were within various ranges at different times after the start of a banded or 20 mg/kg loading dose.

Conclusion

The predicted concentrations observed in this audit demonstrate that current practice within the acute hospital setting results in a high proportion of vancomycin maintenance doses being administered at impractical times and risks early subtherapeutic trough concentrations. To reduce this risk and to reduce disruption to patients and staff, vancomycin dosage guidelines could be modified to recommend that the first maintenance dose is administered 6 – 12 hours after the start of the loading infusion.

Declaration of interests

A. Carruthers has nothing to disclose.
Dr. Thomson has nothing to disclose.
Y. Semple has nothing to disclose.
Dr. Rodger has nothing to disclose.

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Northern Ireland Medicines Optimisation - a Model for Innovation and Change

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Abstract

Title
Northern Ireland Medicines Optimisation - a Model for Innovation and Change

Author list
Timoney M, Harrison C

Summary
The Medicines Optimisation Quality Framework was developed in response to the need for safer, more effective care and improved patient experience aligned to prescribed treatments. The Framework has three components:

- A Model for Medicines Optimisation describes what patients can expect when medicines are included in their treatment plans in the four main care settings of hospital, general practice, community pharmacy and social care.
- A set of Quality Standards to engage multi-professional teams to develop best practice and deliver high quality outcomes from medicines each occasion they are prescribed, dispensed or administered.
- An Innovation and Change Programme to support implementation of the framework through the identification, testing and scaling up of best practices.

The newly established Medicines Optimisation and Innovation Centre (MOIC) provides a regional centre of expertise for research, service development, knowledge transfer and innovation in medicines optimisation.

Keywords: Quality, framework, MOIC, standards, programme

Introduction

In 2016 the Department of Health for Northern Ireland launched a Medicines Optimisation Quality Framework[1] and pledged support for its implementation as part of a major transformation programme for health and social care. In this article the authors outline how the Framework provides a model for innovation and change in medicines optimisation in Northern Ireland.

Background

Medicines are the most common medical intervention used in the Northern Ireland health service, with an annual expenditure of over £550m. In comparison with other UK countries the volume and cost of medicines used per head of population in Northern Ireland is high.[2] With an aging population and a rising number of people with long term conditions, pressures associated with demand for medicines, polypharmacy and complexity of care are increasing. In response, health and social care services are adapting by introducing integrated models of care delivered by multi-professional teams in order to improve productivity and sustainable services. However, evidence shows variance in the appropriate, safe and effective use of medicines and poor adherence is common, resulting in suboptimal health outcomes for patients, waste and pressure on health and social care services.

Medicines Optimisation Quality Framework

The Medicines Optimisation Quality Framework was developed in response to the need for safer, more effective care and improved patient experience aligned to prescribed treatments. The Framework represents a summation of a range of improvements involving professionals, industry, academia and patients. As a result, the Medicines Optimisation Quality Framework provides a roadmap aimed at delivering:

- better health outcomes for patients through the appropriate use of medicines
- better informed patients who are engaged and involved in decisions about their medicines
- improved medicines safety at transitions of care
- an active medicines safety culture within health and social care organisations
- reduced variance in medicines use through the consistent delivery of best practices
- improved professional collaboration and a workforce

who recognise their role in medicines optimisation and are trained and competent to deliver it as part of routine practice

- better use of resources through the consistent, evidence based and cost effective prescribing of medicines
- the development and implementation of best practice solutions to medicines optimisation deficiencies.

NICE Clinical Guideline 5 Medicines Optimisation recommends that organisations consider a multi-professional team approach to improve patient outcomes with the integration of pharmacists.[3] Historically, there has been insufficient integration of the unique clinical and technical skills of the pharmacy team. The Framework identifies opportunities to develop patient facing interventions by pharmacists at the stages in care where the patient is most likely to benefit.

The Framework has three components:

- A Model for Medicines Optimisation describes what patients can expect when medicines are included in their treatment plans in the four main care settings of hospital, general practice, community pharmacy and social care (See Figure 1 and Tables 1-4).
- A set of Quality Standards to engage multi-professional teams to develop best practice and deliver high quality outcomes from medicines each occasion they are prescribed, dispensed or administered.
- An Innovation and Change Programme to support implementation of the framework through the identification, testing and scaling up of best practices.

The model has evolved from medicines management strategies developed to deliver innovative clinical interventions which have reduced morbidity and mortality in addition to a reduction in healthcare resource utilisation through improvements in the selection and procurement of medicines. The model integrates patient facing clinical pharmacy services at specific points in the patient journey in hospital, general practice, community pharmacy and social care.

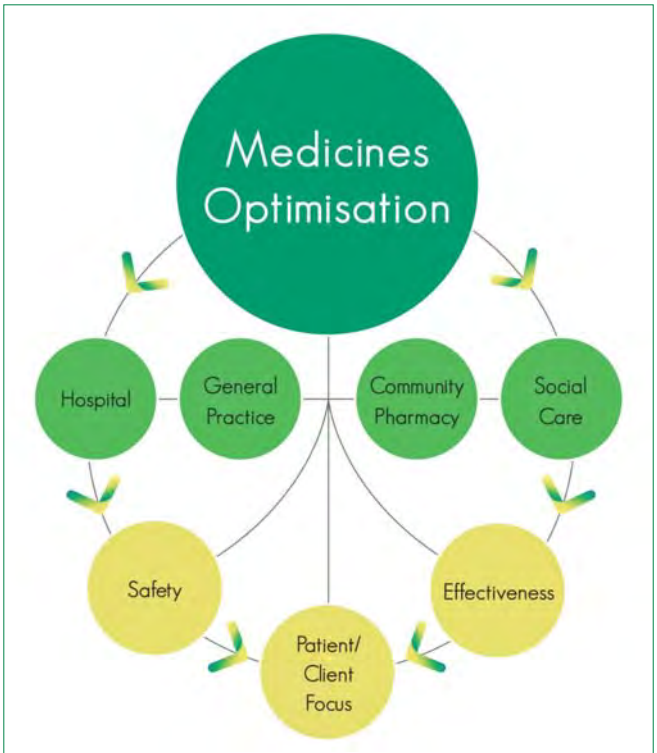

Figure 1: The Medicines Optimisation Model

The model promotes new roles for consultant and specialist pharmacists in hospitals linking with pharmacists in general practice and community pharmacy to provide a network of pharmacy support for patients and multi-professional teams. Implementation of the Framework provides an enhanced opportunity for multi professional and cross sectoral medicines processes to achieve sustainable health gain while addressing adverse events and waste. The activities described are adaptable and can be applied across different areas of practice in each setting.

Quality Standards for Medicines Optimisation

In support of the Medicines Optimisation Model new minimum quality standards address the priority issues for medicines optimisation within the three overarching quality domains of safety, effectiveness and patient/client focus. Compatible with NICE guidance, the quality standards support delivery of best practices which should be developed and implemented in partnership with patients on an ongoing basis, actively seeking their views and listening to their experiences.

Standard 1 - Safer prescribing with patient involvement
Prescribing is carried out in a manner which promotes safety and optimal health outcomes, with patients involved in decisions about their treatment.

Standard 2 – Better information about medicines
Patients/carers receive the information they need to take their medicines safely and effectively.

Standard 3 – Supporting adherence and independence
People are helped to remain independent and self manage their medicines where possible but receive support with adherence when needed.

Standard 4 – Safer transitions of care
Checks occur at each transition of care to ensure that the transfer of medicines and medicines information between patients, carers and health and social care workers is safe, accurate and timely.

Standard 5 – Risk stratification of medicines
Patients who may be at risk because of the medicines that they use receive the appropriate help to take their medicines safely.

Standard 6 – Safety/reporting and learning culture
Organisations promote an open and transparent culture with evidence of processes for the reporting, prevention, detection, communication and cascade of learning from medication incidents and adverse drug reactions.

Standard 7 – Access to medicines you need
Patients have appropriate, equitable and timely access to quality assured, evidence-based and cost-effective medicines.

Hospital

On Admission

- Patients bring their medicines to hospital so that they can be checked and used where possible.
- Within 24 hours of admission, or sooner if clinically necessary, patients have their medicines reconciled by a trained and competent healthcare professional, ideally by a pharmacist. Medicines reconciliation* involves collecting information about current medicines, checking for omissions, duplications and other discrepancies and then documenting and communicating any changes. Patients, family members or carers should be involved in this process.
- Within 24 hours of admission, a clinical management plan is developed which includes discharge planning to help prevent delays on discharge.
- If patients move from one ward to another within a hospital, medicines reconciliation may need to occur again.

Following Medical Assessment/Accurate Diagnosis

- Patients are involved in decisions about their current and any new medicines, their needs, preferences and values taken into account and receive appropriate, tailored information about new medicines and the expected health outcomes.
- Patients have the opportunity to speak to a healthcare professional and ask questions about their medicines.
- During the inpatient stay, prescription charts are monitored by a pharmacist and reviewed in conjunction with medical notes and relevant medical laboratory results.
- Patient responses to medication therapy are monitored and best practices relating to 'high risk medicines' are followed.

Administration of medicines

- On some wards patients may be able to administer their own medicines. However, if this is not possible, medicines are administered on time following a check that the direction to administer is appropriate and other related factors are taken into consideration.

On discharge

- Prior to discharge the medicines reconciliation process is repeated.
- Patients receive an appropriate supply of their prescribed medicines which may be a combination of inpatient and discharge medicines dispensed as a single supply labelled for discharge. They are provided with accurate, up-to-date information about their ongoing treatment where necessary.
- Patients are educated to ensure that they can use their medicines and devices, for example using inhalers appropriately.
- Patients know who to contact if they have a query about their medicines after discharge.
- Accurate and up-to-date information about medicines is communicated in the most effective and secure way such as electronically, ideally within 24 hours of discharge.
- Following discharge from hospital, patients are followed up to ensure that they are completely clear about their medicine regimens.

Other Hospital/Trust Services

- Patients attending outpatient clinics should expect:
  - to be involved in decisions about their medicines with their needs, preferences and values taken into account
  - their response to medicines to be reviewed
  - to have the opportunity to speak to a healthcare professional and ask questions about their medicines
  - to receive appropriate, tailored information about new medicines and the expected health outcomes.
- Patients in Intermediate Care settings (i.e. step up/step down beds) should have the same quality of care as in hospital.
- Patients receiving specialist outreach services and other services at the interface should expect:
  - links to be established between specialist secondary care clinical teams and primary care
  - to be followed up in primary care
  - to have clinical medication reviews carried out.
- Patients in nursing, residential and children's homes
  - see Table 4

* Medicines reconciliation, as defined by the Institute for Healthcare Improvement, is the process of identifying an accurate list of a person's current medicines and comparing them with the current list in use, recognising any discrepancies, and documenting any changes, thereby resulting in a complete list of medicines, accurately communicated. The term 'medicines' also includes over-the-counter or complementary medicines, and any discrepancies should be resolved. The medicines reconciliation process will vary depending on the care setting that the person has just moved into – for example, from primary care into hospital, or from hospital to a care home.

Table 1: What you should expect when you are admitted to hospital as routine practice

General Practice

- Patients registering with the practice for the first time have a medicines reconciliation check.
- During consultations, patients are involved in decisions about their current and any new medicines, their needs, preferences and values taken into account and receive appropriate, tailored information about new medicines and the expected health outcomes.
- Patients taking multiple medicines or taking 'high risk medicines' are identified and, where appropriate, receive additional information and advice to help take their medicines safely and effectively.
- Patients on repeat medications have checks carried out before issue of prescriptions to reduce the risk of waste.
- All patients on repeat medication have an annual clinical medication review with a GP or pharmacist. (This may be more frequent depending on the individual's care plan or type of medication).
- Patient responses to medication therapy are monitored. Medicines that are not beneficial and not evidence based are not continued.
- Patients with problems taking their medicines as prescribed (non-adherent) are referred for an adherence assessment.
- Patients are involved in decisions about their medicines and are encouraged to ask questions about their treatment and to be open about stopping medication.
- Patients discharged from hospital/other care setting have their medicines reconciled by a trained and competent healthcare professional as soon as possible, before a prescription or new supply of medicines is issued and within one week of the GP practice receiving the information. Patients, family members or carers should be involved in this process and any changes documented.
- Prescribers have up to date information to support clinically appropriate and safe prescribing.
- Prescribers have access to a pharmacist for information and advice about polypharmacy and patients taking multiple medicines.
- Practices provide information about prescribed medicines to hospitals and other appropriately authorised health and social care professionals to assist medicines safety during transitions of care.

Table 2: What you should expect from general practice as routine practice

Community Pharmacy

- On presentation of a prescription the pharmacist will carry out a clinical check of the prescription using the patient's medication record before it is dispensed. This will inform the level of information and advice that is needed for the patient to take their medicines safely and effectively.
- High quality medicines are dispensed safely.
- Patients receive appropriate information and advice with the supply of medicines, particularly if a new medicine or a 'high risk medicine' is supplied.
- If the presentation of a repeat medicine changes, the patient is advised of this change and reassured of continued efficacy.
- Patients are offered a medicines use review after a significant change in their medication. For example, following discharge from hospital or after starting a new treatment regimen.
- Patients having problems taking their medicines as prescribed have their adherence needs assessed and appropriate support provided.
- Patients are asked if they need all their repeat medicines before they are supplied to reduce the risk of waste.
- Pharmacists work closely with other health and social care professionals to ensure patients are on the most appropriate medication and have contact with pharmacists working in local GP practices and hospitals.
- To support safe transitions, pharmacies provide information about medicines supplies to the pharmacist or pharmacy technician conducting a medicines reconciliation check after admission to hospital or to appropriately authorised health and social care professionals in a nursing or residential home.
- On discharge from hospital the community pharmacy accesses information on the patient's current medication and medication changes and community pharmacy is alerted to support safe transfer.
- Pharmacies may provide other services such as clinical medication reviews and monitor health outcomes from medicines to support medicines optimisation.

Table 3: What you should expect from your community pharmacy as routine practice

Nursing homes

- When individuals first move into a nursing home and at each transition of care thereafter their medicines are checked with their GP Practice and Community Pharmacy.
- Adequate supplies of medicines are always available and prescription ordering systems in homes are carefully managed and monitored to avoid over-ordering and waste.
- Individuals with specific medication needs, such as Parkinson's Disease or diabetes, or those taking multiple or 'high risk medicines' are identified and receive the appropriate care in line with best practice.
- Individuals who take their own medicines are monitored to ensure they are taking them as prescribed.
- Medicines are administered on time following a check that the direction to administer is appropriate.
- Individuals taking repeat medication have an annual clinical medication review; the frequency of the review may vary depending on the care plan.
- Staff in nursing homes have contact with pharmacists in the community to assist with queries about medication.

Residential homes

- When individuals first move into a residential home and at each transition of care thereafter their medicines are checked with their GP Practice and Community Pharmacy.
- Adequate supplies of medicines are always available and prescription ordering systems in homes are carefully managed and monitored to avoid over-ordering and waste.
- Residential care home staff who manage medicines are trained and competent.
- Residents self-administer their own medicines where the risks have been assessed and the competence of the resident to self-administer is confirmed. Any changes to the risk assessment are recorded and the arrangements for self-administering medicines are kept under review.
- Residential care home staff receive training on 'high risk medicines' and have easy access to information about all medicines.
- Staff have contact with pharmacists in the community to assist with queries about medication.

Children's homes

- When a child/young person first moves into a children's home and at each transition of care thereafter their medicines are checked with their GP Practice and Community Pharmacy.
- Adequate supplies of medicines are always available and prescription ordering systems in homes are carefully managed and monitored to avoid over-ordering and waste.
- The management of medicines is undertaken by trained and competent staff and systems are in place to review staff competency.
- Robust systems are in place for the management of self-administered medicines.
- Prior written consent is obtained from a person holding parental responsibility for each child or young person for the administration of any prescribed or non-prescribed medicine.
- Staff receive training on 'high risk medicines' and have easy access to information about all medicines.
- Staff have contact with pharmacists in the community to assist with queries about medication.

Domiciliary care

- Nurses and care workers have clearly defined roles in helping with medicines taking.
- Administration of, or assistance with, medication is facilitated when requested in situations where an individual is unable to self-administer.
- Administration or assistance with medication is detailed in a care plan and forms part of a risk assessment.
- Policies and procedures identify the parameters and circumstances for care workers administering or assisting with medication. They identify the limits and tasks that may not be undertaken without additional training.
- Care workers who administer medicines are trained and competent. A record is kept of all medicines management training completed by care workers and retained for inspection
- When necessary, training in specific techniques (e.g. the administration of eye/ear drops or the application of prescribed creams/lotions) is provided for named care workers by a qualified healthcare professional.
- The care worker documents, on each occasion, the administration or assistance with medication.
- Care workers involved in the management of an individual's medication agree the arrangements for the safe storage within the individual's home. Appropriate information is available about the individual's current medication and staff are aware of any changes following a transition of care, such as discharge from hospital.
- Training on 'high risk medicines' is provided and staff have easy access to information about all medicines.
- Staff have contact with pharmacists in the community to assist with queries about medication.
- If an individual is having difficulties in managing their medicines, staff can refer them to the community pharmacist for assistance.

Table 4: What you should expect from social care as routine practice

Standard 8 - Clinical and cost-effective use of medicines and reduced waste
Within organisations a culture exists promoting a shared responsibility for the appropriate, clinical and cost effective use of medicines supported by systems for avoiding unnecessary waste.

Standard 9 – Clinical medication review
Clinical medication reviews are carried out with the patient and occur on a regular basis, at least annually.

Standard 10 – Administration
Following an initial check that the direction to administer a medicine is appropriate, patients who have their medicines administered receive them on time and as prescribed.

Innovation and Change Programme

Implementation of the Framework will involve an Innovation and Change Programme to drive improvements in medicines use by implementing and scaling up best practice and supporting the development of new solutions to address identified gaps in medicines processes.

During 2016/17, the Programme will deliver initiatives at both local and regional level to prioritise the implementation of a range of service development, translation and innovation projects. To accelerate improvement a number of roles and services will be scaled up that have already been piloted and demonstrated benefits in optimising patient outcomes, safety, cost-effectiveness, reducing pressure on Health and Social Care (HSC) services or minimising waste. These include the roll-out across all Trusts of a new consultant pharmacist-led service for medicines optimisation in older people[4] and a specialist mental health pharmacist role. In addition, a new Medicines Optimisation and Innovation Centre (MOIC) will lead an innovation work plan seeking new service and technology solutions to address gaps in best practice which, if proven, can be prioritised and scaled up. Regional workstreams will also establish baseline/benchmarking arrangements for medicines optimisation and deliver a personal and public involvement work plan. Links will be established between the Programme and the Regional e-Health and Care Strategy implementation programme to support the improvements in connectivity and e-health in primary and secondary care needed to support the Framework.

Medicines Optimisation and Innovation Centre (MOIC)

The newly established Medicines Optimisation and Innovation Centre (MOIC) provides a regional centre of expertise for research, service development, knowledge transfer and innovation in medicines optimisation.

The MOIC is part of the Northern Ireland European Innovation Partnership on Active and Healthy Aging Reference Site which recently achieved the highest recognition of 4 Star Status. The Reference Site status is granted to organisations that have demonstrated excellence in the development, adoption and scaling up of innovative practices for active and healthy ageing, in line with the strategic objectives of the European Innovation Partnership on Active and Healthy Ageing (EIP on AHA) and particularly the European Scaling Up Strategy for Innovation in Active and Healthy Ageing. Part of the MOIC's work in this area involves working in partnership with the Scottish Government and organisations from seven other countries on a European Union (EU) funded project titled Stimulating Innovative Management of Polypharmacy and Adherence in the Elderly (SIMPATHY). This project aims to stimulate, promote and support innovation across the EU in the management of appropriate polypharmacy and adherence in the elderly.

The Medicines Optimisation Quality Framework will be reviewed in 2021.

Declaration of interests

The authors have nothing to disclose.

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MATERIAL WITHDRAWN

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