An innovative approach to integrated medicines management

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Abstract

Rationale, aims and objectives To determine whether an increased input by clinical pharmacists at each stage of the patient's hospital journey, from admission through discharge, resulted in an enhanced level of patient care as measured by a number of clinical and economic outcomes.

Methods This project was designed to address medicines management issues in patients deemed at risk of drug-related problems. During the project, these latter patients at the time of admission were randomly assigned to an integrated medicines management (IMM) service group ($n = 371$) or regular hospital care group ($n = 391$). The IMM service involved comprehensive pharmaceutical care provided by a pharmacy team throughout each of three stages: patient admission, inpatient monitoring and counselling, and patient discharge.

Results Patients who received the IMM service benefited from a reduced length of hospital stay [by 2 days ($P = 0.003$; independent samples t-test $\log_e$)]. IMM patients also had a decreased rate of readmission over a 12-month follow-up period (40.8% vs. 49.3%; p = 0.027; Fisher's exact test) and an increased time to readmission [20 days longer ($P = 0.0356$; log rank test)]. A numbers-needed-to-treat calculation indicated that for approximately every 12 patients receiving the IMM service, one readmission to hospital, within 12 months of discharge, would be prevented. The new service was welcomed by cognate health care professionals.

Conclusion The IMM service proved very effective and can be used as a template to support the implementation of comprehensive pharmaceutical care as a routine service across Northern Ireland and beyond.

Introduction

Pharmacy is the health profession that has the responsibility for ensuring the safe, effective and rational use of medicines and as such plays a vital role in the delivery of health care worldwide [1]. From a medicines management perspective, health care organizations face major challenges including suboptimal prescribing, poor patient adherence to prescribed medication regimens, adverse drug reactions and interactions, medication administration errors and inadequate communication across the primary/secondary care interface.

Furthermore, at a time of escalating health care costs, cost-effective drug use has become an imperative, especially as expenditure on drugs is the second largest cost in health care. In Northern Ireland, where the current project was undertaken, in the order of £400 million is being spent per annum on drugs by the Health and Personal Social Services, accounting for approximately 12% of the total health care budget.

Although there is access to privately funded health care within the UK, a socialized system of care predominates, that is, the National Health Service (NHS). Over recent years, strategic plans for health care have increasingly taken into account the valuable role that pharmacists can bring to health care delivery, in particular in relation to the safe and cost-effective use of medicines. In 2000, a challenge was set out for pharmacy in Northern Ireland, to meet the changing needs of patients, in the document 'Pharmacy in the Future – Implementing the NHS Plan' [2]. To meet this challenge, pharmacy staff (both in the primary and secondary care setting) need to take a much more active role in pharmaceutical care provision across the whole spectrum of patient groups. Although pharmaceutical care still remains the descriptive terminology for involvement of pharmacists in a more cognitive approach to

patient care, in regions of the UK (including Northern Ireland, but excluding Scotland), the official terminology has been changed to 'medicines management'.

Medicines management has been defined by the Department of Medicines Management, Keele University as a practice that seeks to maximize health through the optimal use of medicines. It encompasses all aspects of medicine use from the prescribing of medicines through the ways in which medicines are taken or not taken by patients [3]. Medicines management involves the systematic provision of medicines therapy through a partnership of effort between patients and professionals to deliver best patient outcomes at minimized cost [4,5].

Within the published literature, most of outcomes research involving enhanced pharmaceutical input has concentrated on either primary [6–9] or secondary care [10–12]. It is, however, widely recognized that accurate, and timely, exchange of information across the primary/secondary care interface is crucial to seamless pharmaceutical care [13–17]. It has been well documented that communication problems exist between the sectors because of difficulties in transferring information to all the relevant parties [18].

There are a number of areas in which clinical pharmacists within a hospital setting, both as team members and as individual practitioners can address medicines management issues in patients who are admitted to hospital [19]. Such services begin at the time of admission, where a critical role is ensuring that an accurate medication history is obtained for the admitted patient. This is particularly important, as admission data informs a range of diagnostic and therapeutic decisions made during the patient's hospital stay. Although medication history taking may appear to be a straightforward task that could be performed by a range of hospital staff members, research has shown that input from a clinical pharmacist can greatly improve the accuracy of such histories [20,21]. Assuming that a correct medication history is available, the clinical pharmacist has a role in ensuring that the admission medications, and medications prescribed during the patient's hospital stay are evidence based and appropriate for the patient [18].

Having ensured that patients are receiving appropriate medications, the clinical pharmacist has a role in patient education on their disease state, and importantly on their medications, devices, etc., and in monitoring patient outcomes. Research has shown the benefit, for example, in terms of medication adherence after discharge, of a patient being well informed about both their illness and its management [22]. Patient discharge from hospital carries similar risks to admission from the perspective of continuity of care. Again the clinical pharmacist has a role to ensure that such discharge is as seamless as possible, through working with the care team to ensure that discharge prescriptions are accurate and, through liaison with general practitioners (GPs) and community pharmacy staff, that any hospital initiated medications are available for the patient after discharge [23,24].

The aim of the present project was to develop an integrated medicines management (IMM) service, which incorporated the key elements referred to in the preceding paragraphs, and to examine the impact of its provision within a hospital in Northern Ireland using a number of clinical and economic outcomes. A further aim was to collect and classify data relating to the process of delivery of the IMM service, to allow the new service to be more fully described and to facilitate identification of areas which could be improved as part of the hospital Trust's continuous quality improvement process.

Methods

Design of integrated medicines management service

The IMM service was designed by a small group of researchers and practitioners, bringing together service elements which were either shown in their pilot work within Northern Ireland, or which had been shown in the published pharmaceutical literature, to be effective in dealing with medicine management issues. In developing the programme, all key local stakeholders (primary and secondary care decision makers) were kept fully informed and any issues raised were incorporated into the design of the new service. After a series of meetings of the team over a period of approximately 4 months, the service was deemed ready for introduction into a number of the wards in the Hospital Trust as part of their continuous quality improvement process. Funding for partial implementation was achieved through a service development grant from the Northern Ireland Department of Health and Social Services. All paperwork required for auditing the implementation of the service was designed and printed in readiness for its introduction.

The IMM process developed consisted of three phases covering the main stages of a patient's stay within the hospital, namely: admission, inpatient monitoring and counselling, and discharge from the hospital (see below).

IMM team and study site

The service development funding allowed the employment of additional staff (IMM team) which consisted of five pairs of clinical pharmacists and pharmacy technicians. Each pharmacist/technician pair were assigned to wards within the three general hospital sites of the United Hospitals Trust, that is, Antrim Area Hospital (426 beds), Mid-Ulster Hospital (194 beds) and Whiteabbey Hospital (176 beds). Four pairs were based in medical wards and one pair was based in the surgical directorate at the Antrim Area Hospital. Owing to the diverse background of the team members appointed, a programme of accelerated clinical training covering major therapeutic topics was implemented. This consisted of lectures and workshops provided by specialist staff (pharmacists, nurses and hospital physicians), and was complemented by study days provided by the Northern Ireland Centre for Postgraduate Pharmaceutical Education and Training (Table 1).

An audit of the capacity to deliver the IMM programme, and to collect the necessary data to allow evaluation of its impact, was performed. The outcome of this audit indicated that the service could be provided to approximately 50% of the targeted patients. To allow for a robust evaluation of the new process, taking account of the above limitation of staffing capacity, a pragmatic approach was taken to its delivery, that is, 50% of patients were randomly assigned to receive the new programme of care (IMM group) and 50% to receive traditional clinical pharmacy services which were in place across the participating hospitals (normal care group). The present report refers only to patients admitted to medical wards during the implementation of the programme.

Table 1 Clinical skills training programme

Training provided in-house
 Pharmacotherapy of endocrine disease (diabetes/thyroid)
 Antibiotic use
 Renal disease
 Heart failure and angina
 Pain management
 Gastrointestinal disease
 Complications of cancer management
 Therapeutic drug monitoring and pharmacokinetics
Training provided by NICPPET
 Basic clinical skills
 Depression and anxiety
 Dose adjustment in renal and hepatic disease
 Respiratory disease

NICPPET, Northern Ireland Centre for Postgraduate Pharmaceutical Education and Training.

Table 2 High risk drugs

ACE I/ACE II inhibitors	*Methotrexate*
Amiodarone	Oral hypoglycaemics
Apomorphine	Phenytoin
Atenolol syrup	Quetiapine
Azathioprine	Theophylline
Antituberculosis drugs	Warfarin
Clozapine	Zotepine
Carbimazole	
Carbamazepine	
Cyclosporin	
Digoxin	
Diuretics	
Donezepil and Rivastigmine	
Erythropoietin for nondialysis patients	
Insulin	
Lanreotide and Octreotide for acromegaly	
Leflunomide	
Lithium	

ACE, angiotensin converting enzyme.

Patient selection

Based on our previous research [25], patients were eligible for the receipt of the new IMM service if they met any one of the following criteria on admission: were taking at least four regular medications, were taking a high risk drug(s) (Table 2), were taking antidepressants and were 65 years old or older, and/or had a previous hospital admission within the last 6 months. Patients who were prescribed intravenous antibiotics on day 1 of their admission were also eligible for inclusion. Scheduled admissions and patients admitted from private nursing homes were excluded.

Patients meeting the eligibility criteria were randomly assigned to the IMM group or normal care group, using block randomization coupled with a closed envelope technique [26]. Randomization was carried out in blocks of 20 (each block contained 10 IMM and 10 normal care allocations).

Table 3 Intervention grading*

Intervention	Score
Intervention which is detrimental to patient's well-being	1
Intervention is of no significance to patient care	2
Intervention is significant but does not lead to an improvement in patient care	3
Intervention is significant and results in an improvement in the standard of care	4
Intervention is very significant and prevents major organ failure or adverse reaction of similar importance	5
Intervention is potentially lifesaving	6

*Eadon.[27]

IMM implementation

Each IMM patient received, as time permitted, pharmaceutical care provided by a project pharmacist throughout each of the three IMM stages: admission, inpatient monitoring and counselling, and discharge, as follows.

Admission

Demographic details and previous medical history were collected using a patient registration form. The clinical pharmacist constructed an accurate medication history using a variety of sources which included the patient's admission prescription list (hospital kardex), the patient's GP, the patient's own drugs (PODs), information obtained from the patient or their carer, and finally from the patient's regular community pharmacist (CP, if utilized at least 75% of the time). Additional information on allergies, side-effects and adherence was also compiled as applicable at this stage. Any discrepancies with the hospital prescription list (kardex) were dealt with promptly and product standardizations were implemented. Product standardization is a joint initiative between the local health board and the hospital Trust to improve patient safety by promoting the continuity of medicines across the primary/secondary care interface. It therefore involved the substitution of a product with an agreed preferred brand of the same drug.

Project technicians used an algorithm at the time of admission to assess the safety and suitability of the PODs for return to the patient, if required, at discharge. Products judged suitable for return were stored on the ward while unsuitable products were destroyed with the patients' signed consent.

Inpatient monitoring and counselling

Patients received an intensive clinical pharmacy service throughout their hospital stay. Drug treatment was reviewed daily, taking into account therapeutic goals, relevant clinical chemistry and haematology results, and, where appropriate, therapeutic drug monitoring. As part of ongoing process control, all interventions made were graded according to the significance of the intervention (Table 3) [27]. The grading of all interventions was independently audited and reviewed by a non-project clinical pharmacist.

Counselling, tailored to suit the needs of each individual patient, was provided by the clinical pharmacists. This counselling focused on drugs which had been commenced or discontinued, high-risk drugs (Table 2), use of devices, and other situations

where pharmaceutical advice was deemed necessary. IMM pharmacy technicians were trained to provide a counselling service on inhaler techniques [28].

Project technicians implemented an enhanced management of stock on the wards which included: maintenance of stock levels (unit dose dispensing is not used within UK hospitals), daily kardex and drug trolley reviews to manage non-routine stock and transfer of medicines for patients moving between wards. This traditionally had been controlled by nurses. In addition, the technician highlighted kardex queries to their team pharmacist [29].

Discharge

At discharge, the IMM pharmacist generated and authorized a discharge prescription according to protocols agreed by the Trust's Drug and Therapeutics Committee. After discussion with the patient, the project technician assessed which drugs required dispensing, taking into account any PODs which were stored on admission.

A medicines record sheet, outlining all medications and dosage instructions, was prepared by the IMM pharmacist for each patient prior to discharge. This was used with other relevant information including steroid cards, anticoagulation booklets and patient information leaflets during a final patient consultation and counselling session with the pharmacist. The medicines record sheet also outlined relevant information such as changes to the patient's medications and laboratory findings while in hospital. As there are no secure electronic links at present between secondary and primary care in Northern Ireland this information was faxed to the GP and to the CP using fax machines specifically installed for this purpose. In order to protect patient confidentiality, this information was faxed anonymously and a follow-up telephone call was made to the recipient to confirm the patient's identity.

Outcome measures

The primary outcome measure was the difference in the length of hospital stay between the IMM patients and normal care patients. As a secondary outcome measure, over a 12-month follow-up period, readmission data for the two groups were collected from the hospital computer system and included assessment of the time to a further hospital admission as well as the number of readmissions. Further outcomes included an assessment of health care practitioner satisfaction with the new model of care (using custom designed satisfaction questionnaires).

Project management

All team members attended monthly meetings for progress updates. From the design stage of the project, monthly communication among relevant key stake holders was also undertaken. A steering group met quarterly to ensure that key targets (e.g. patient throughput) were met.

Data collection and analysis

For each stage, standard operating procedures and customized data collection forms were used. All data collection forms were formulated to allow input into customized spreadsheets using a data

scanner. Data cleaning was carried out by double-checking of all entries. Once data cleaning was complete, the data were exported into SPSS for statistical analysis.

Outcomes for the IMM and normal care groups were compared as follows: length of hospital stay was compared using the logarithmic independent samples *t*-test ($\log_e$), the time to readmission was compared using the Kaplan–Meier survival analysis log-rank test and the number needed to treat approach [30] was utilized to identify the number of patients needed to receive the IMM service in order to prevent one readmission to hospital. In addition the chi-square test (or Fisher's exact test) was used to compare the frequency of readmissions over the 12-month follow-up period between the IMM and normal care groups. A *P*-value of <0.05 was considered statistically significant in all cases. Satisfaction questionnaires were analysed using Microsoft Excel software.

Results

Demographics and selection criteria

A total of 762 patients [391 (192 male; 199 female) normal care; 371 (167 male; 204 female) IMM] were involved in this service development project over a period of 1.5 years. There was no significant difference between the two groups with respect to gender ($P = 0.259$). The average age (±SD) of the population who received normal care was 69.9 ± 14.8, compared with an average age of 70.3 ± 13.8 for the IMM population ($P = 0.732$). The majority of patients enrolled in both groups were, therefore retired from work (78.0% normal care; 74.4% IMM). Other demographic statistics included alcohol status (33.2% of the normal care population drank alcohol; 32.6% IMM), smoking status (21.5% of the normal care population current smokers, 20.0% ex-smokers; 18.6% of IMM population current smokers, 17.5% ex-smokers).

Contact with health care professionals within the previous 6 months prior to hospital admission was noted for both sets of patients. Analysis of this information showed a comparable pattern between the two populations with 46.0% of the normal care group having visited their GP compared with 48.8% of the IMM group, 34.8% of normal care patients had been to see a hospital based consultant compared with 33.7% of IMM patients, and 4.1% of normal care patients had been to see an 'other' health care professional compared with 3.1% of IMM patients in the previous 6 months.

Process measures

Despite the intention to provide the full IMM service to all patients assigned to the IMM group, the staffing situation (e.g. pharmacy service only available from 8.30 AM to 5.00 PM, Monday through Friday) was such that not all eligible patients received the full IMM service. As with many audits of this type, it is strongly suspected that all aspects of care delivery were not fully recorded by the IMM team members. Data on interventions presented below refer to those that were clearly recorded by the project team.

Accurate drug history on admission

Table 4 details the number of discrepancies between each of the sources used to compile the accurate drug history and the actual

Table 4 Number of discrepancies between accurate drug history and the various sources of information for IMM patients

	Kardex (*n* = 351)	GP (*n* = 348)	CP (*n* = 246)	Patients (*n* = 261)	PODs (*n* = 122)
Drug	871	433	429	565	326
Form	58	23	42	140	4
Strength	137	30	65	635	8
Dose	164	182	213	297	129
Frequency	159	241	253	262	135
Total	1389	909	1002	1629	602
Average per patient	3.96	2.61	4.07	6.24	4.93
Drug allergies	59	45	5	42	1
Known side-effects	3	14	4	24	1

IMM, integrated medicines management; GP, general practitioner; CP, community pharmacists; POD, patient's own drug.

accurate drug history produced by the clinical pharmacist. Across the five sources of information there were a total of 5531 discrepancies, 29.45% emanating from the patient or their carer, 25.11% from the hospital kardex (original kardex proposed by medical staff), 18.12% from the CP records, 16.43% from GP records and 10.89% from the PODs. The number of histories which were found to have zero discrepancies with the accurate drug history was further recorded as 12.8% of kardex histories, 25.3% of GP histories, 18.3% of CP histories, 22.2% of histories from the patient or their carer and 18.0% of POD histories.

The number of drug allergies and known side-effects noted by each of the sources is also recorded in Table 4.

Counselling

Specific medication counselling was recorded by the IMM team for 146 patients involving a total 525 medications while in hospital (mean of 3.6 per patient). During this counselling patients raised a total of 231 concerns regarding their current medications. Corresponding data at the time of discharge involved 213 patients on 1284 medicines (6.0 per patient). In addition, 60 patients received inhaler counselling on 126 devices during their hospital stay. During the course of this counselling 41 changes to the current inhaled therapy took place, a mean of 1.5 changes per patient. Additional information, other than the patient information leaflet, was supplied to patients on 128 occasions.

Use of patients' own drugs

The POD information was only available for 90 IMM patients who brought their medications with them on admission. A total of 434 PODs were judged to be eligible for reuse at the admission stage; a further 19 PODs were disposed of. On discharge 279 of these PODs were eligible for reuse and a further 119 PODs were disposed of owing to changes in prescribed medications during the patients' hospital stay. In addition, 44 PODs were used while the patient was in hospital.

Discharge prescriptions

The clinical pharmacist was available (i.e. during normal pharmacy service hours) to prepare the discharge prescription for 202 IMM patients when ready for discharge from hospital. There was
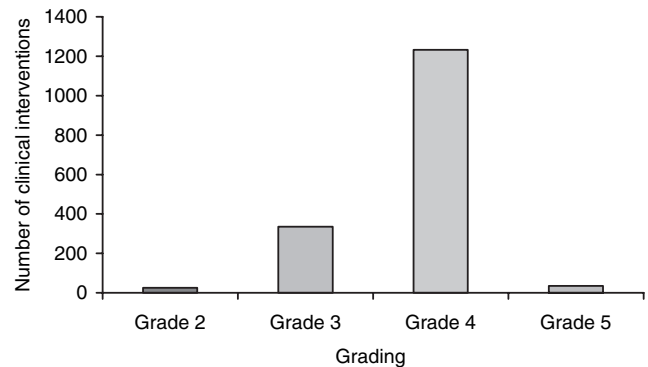

Figure 1 Number and grade of clinical interventions (grading system presented in Table 3).

a mean of 8.4 items per discharge prescription with an average of only 4.5 items actually being dispensed per patient, owing to the use of PODs.

Clinical interventions

Full records on the clinical interventions made for 294 IMM patients were available for analysis. A total of 1628 interventions were received by these patients, a mean of 5.5 interventions per patient. The majority of interventions received were of grade 4 standard (75%) as shown in Fig. 1.

Outcome measures

Length of hospital stay

A log transformation was performed on the length of hospital stay data sets owing to their skewed nature. The two samples were tested using the natural logarithm of LOS. The (geometric) mean LOS was reduced by 2.0 days ($P = 0.003$; independent samples *t*-test $\log_e$) for IMM patients when compared with normal care patients. The mean length of stay (LOS) was reduced from 9.8 days with 95% confidence intervals of 8.8 and 10.9 for normal care patients to 7.8 days with 95% confidence intervals of 7.1 and 8.6 for IMM patients.

In economic terms this reduction in the mean LOS created a substantial saving to the Trust in terms of opportunity costs. The cost of a medical bed in the Trust is currently £212 per day and as such means a potential cost saving of £424 per patient. When extrapolated across the Trust, with an average of 64.5% of admissions being eligible for the IMM service (separate audit), the potential annual opportunity cost saving is £3.3 m.

Frequency of readmissions and time to readmission

Frequency of readmission data in the 12 months post discharge are presented in Table 5 which details that 172 normal care patients were readmitted at least once within 12 months of discharge compared with 141 IMM patients. Data were unavailable for eight patients (seven normal care; one IMM). The number of readmissions to hospital was shown to be significantly different between the two groups using Fisher's exact test ($P = 0.027$) with 59.2% of the IMM group not being readmitted within 12 months compared with 50.7% of the normal care population.

The average number of readmissions to hospital within 12 months for normal care patients was 1.0 compared with 0.8 for the IMM patients. The average LOS for all readmissions during the 12 month follow-up was reduced from 13.1 ± 31.5 days for the normal care population to 9.7 ± 24.3 days for the IMM population. This reduction in the LOS for readmissions approached statistical significance ($P = 0.068$). Therefore, through implementation of IMM, the difference in the mean LOS for readmissions over the 12 month follow-up period was 3.4 days. Economically for the Trust, this yields a further potential opportunity cost saving of £2.8 million per annum.

A numbers-needed-to-treat approach was adopted to determine how many patients needed to receive the IMM service in order to prevent one readmission to hospital. This yielded a figure of 11.7 patients.

The Kaplan–Meier test showed that IMM patients took significantly longer time (262 days) to be readmitted to hospital than the normal care patients (242 days; $P = 0.0356$; log rank test; Fig. 2).

At the 12 month follow-up the mortality status of the two populations were also analysed. Over the course of the project 76 (19.79%) normal care patients and 67 (18.11%) IMM patients died either at first admission to hospital, while re-admitted to hospital or while being cared for within primary care ($P = 0.578$).

Table 5 Frequency of readmissions to hospital (12-month follow-up)

Frequency of readmissions	Normal care	IMM
1	91	73
2	35	36
3	23	9
4	14	11
5	3	7
6	2	2
7	1	1
8	0	2
9	2	0
10	0	0
11	1	0
Total patients readmitted ≥ 1	172	141

IMM, integrated medicines management.

User satisfaction

The results from satisfaction questionnaires, distributed to health care professionals involved with patients who received the IMM service, that is, junior doctors (JHOs), nursing staff, GPs and CPs, presented a favourable view of the new IMM service.

Junior doctors (JHOs, junior house officers)
A total of 23 JHOs completed the questionnaire which was designed to ascertain their opinion regarding the clinical pharmacy input into the patients' care. All responses proved to be positive about the IMM service with particular regard being paid to the reduction in errors and omission on 'In Patient' kardexes, pharmacists' monitoring of patient drug therapy and that the pharmacy carrying out patient counselling on medication. Finally 87% of the JHOs agreed that pharmacist discharge planning saves JHO time.

General practitioners
A total of 34 GPs responded to the questionnaire which gauged their opinions on the IMM service. The majority (94%) of them were satisfied with the new procedures and 97% of GPs felt that the pharmacist liaison with the GP to obtain a drug history was beneficial to the hospitalized patient. Regarding the exchange of information, 82% of GPs agreed that the faxing of the discharge prescription improved information exchange between primary and secondary care. Furthermore, 97% of GPs found the information regarding medication changes in hospital and information on the reasons for these changes to be helpful to them in further care of the patient.

Community pharmacists
All of the 27 CPs who completed the satisfaction questionnaire felt that the faxing of the discharge details to the CP improved the information exchange between the health care sectors. A minority of CPs (31%) felt that the new procedures increased the number of queries to GP surgeries, however, 92% of CPs believed the process to be beneficial to the care delivery to their patients.
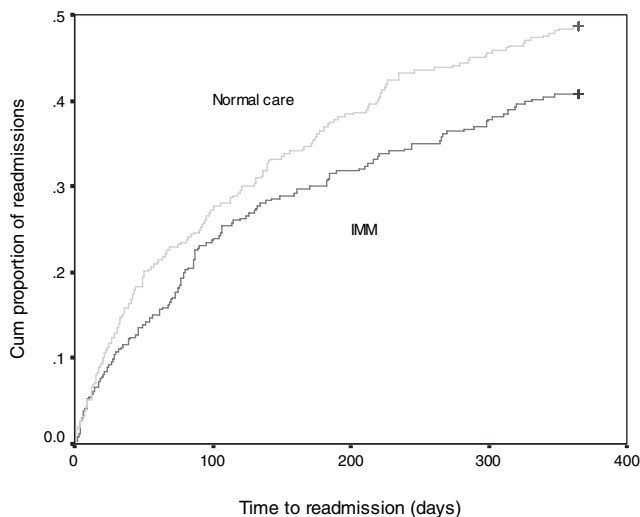

Figure 2 Survival function of time to readmission.

Nurses

A total of 45 nursing staff completed a questionnaire with regard to the input of the pharmacy technicians, 84% of nursing staff agreed that it resulted in a more organized drug trolley which had the knock-on effects of decreasing the time spent in drug administration rounds, decreasing the nursing time spent ordering drugs and reduced the chances of missed or delayed doses. Seventy-eight per cent of nursing staff believed the input by the project pharmacist reduced the number of prescription/transcription errors on the patient's kardex, with 73% also agreeing that it clarified the administration instructions for them. In terms of medication counselling, 72% agreed that it saved time for nursing staff when the pharmacist was available to carry out the counselling and 62% found that the pharmacy input expedited the patient discharge process.

Discussion

Medicines management encompasses a range of activities which are intended to improve the way that medicines are used, both by patients and by the NHS [31,32].

Patient safety continues to be a driving force in health care [33]. One study has reported that unintentional medication discrepancies can occur both at hospital entry and exit, and 46% of the changes made after discharge are unintentional. These could be avoided by effective discharge communication about medicines needs to the patient and the appropriate health care professionals in primary care [34]. Results from the present study support these findings, certainly on entry to the hospital, where a large number of discrepancies (5531) between each of the sources used to compile the accurate drug history and the actual accurate drug history produced by the clinical pharmacist were identified. Health care professionals from the primary care environment felt the addition of communication of the discharge information to GPs (97%) and CPs (92%) within the new service was helpful to them in the future care of the patient.

Length of hospital stay makes up a major element of the total cost of care for a patient while hospitalized and further provides some measure of the efficiency of the hospital [35]. The length of hospital stay was significantly reduced for those patients who received the new service. Reductions in hospital stay results in beds being freed to allow the treatment of other patients and ultimately to the reduction of hospital waiting lists for elective treatments which can be particularly problematic in the nationalized health service in the UK. This reduction in the duration of hospital stay was possibly due to a number of factors including: the more accurate medication history on the patient's admission to hospital, improved management of their medicines throughout the duration of their hospital stay, and more rapid discharge by the pharmacy team. These findings are backed up by a US study which linked two pharmacy services to a reduction in length of hospital stay: drug protocol management and pharmacist participation on medical rounds [35]. In addition to a reduced length of hospital stay, the IMM service also resulted in a reduction in the number of readmissions to hospital as well as a longer time to readmission. Again this has major cost-efficiency and therapeutic outcome implications.

The majority of the health care providers involved with this novel service were satisfied with it. Most health needs require the collaboration of a group of health professionals [36]. A key benefit of this service was the intra- and inter-sectoral partnership established between patients, their carers and a number of health care professionals. For effective seamless care, secondary care needs to communicate a clear management plan in a timely fashion and primary care needs to have robust systems in place to ensure the continuation and monitoring of medication [37].

There is no doubt that the IMM service provided by the pharmacy team has resulted in a range of patient benefits. However, further work to be carried out will include identification of those aspects of the service provided which are essential to the process and those aspects which could be improved, as well as a full economic appraisal of the service.

The IMM service could act as a service template, and has the potential to be replicated within other hospital trusts within the UK. To this end the service has since been extended to two other major hospital trusts in Northern Ireland and is soon to be introduced in some Swedish hospitals.

Acknowledgements

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