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Research Paper

Applying medicines reconciliation indicators in two UK hospitals: a feasibility study

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Abstract

Objectives The aim of this study was to apply the Medicines reconciliation (MR) indicators and to assess their feasibility for use with patients on admission.

Methods This is a mixed-methods study conducted in two large teaching hospitals in the north-west of England. There were two phases: (1) a prospective direct non-participant observational study was conducted on a small sample of five pharmacists in each hospital, who were observed while they conducted the MR process without interference by the investigator and (2) pharmacy staff conducting MR were asked to complete the MR data collection form, comprising various clinical information during the working hours of a selected weekday for all MRs conducted for patients admitted to hospital during that day. SPSS V20 was used for data analysis.

Key findings In the first phase, five MR indicators were found not to be feasible and three not adequately assessed, while 33 indicators were considered feasible to be used in a hospital setting. In the second phase, 33 indicators were considered feasible to assess MR on admission to the hospital, 14 indicators were found feasible to assess main aspects of the MR process, and 18 indicators were found feasible to assess detailed aspects of the MR process. The majority of admissions were unplanned. Roughly half 45.4% of the patients admitted to hospital A were reconciled, while in hospital B 52% were reconciled.

Conclusion The use of different methods to collect data was effective in providing valuable information as well as overcoming the potential limitation of each method.

Keywords: quality of care; quality of life; patient satisfaction; health services research; pharmaceutical HSR

Introduction

The quality of healthcare services has been one of the most important concerns of governments, healthcare institutions and staff, as well as patients themselves.[1] Evaluating the quality of care is essential when considering redesigning, restructuring, modifying or improving practice by introducing new policies and procedures. In health care, indicators have been used to assess the quality of care provided to patients.[1, 2]

Medication errors, particularly prescribing errors (PEs) have been increasingly reported as a major health issue in healthcare.[3] In the Middle East, Derar H. Abdel-Qader *et al.* and Ahmad Z. Al Meslamani,[4–9] reported a higher incidence of medication errors with more clinically serious outcomes compared to other countries, such as the UK,[10] the USA and Canada.[11] Other studies found that incomplete documentation of medication history on admission and inappropriate communication between primary

and secondary care have significantly contributed to PEs on admission.[12, 13] Consequently, medicines reconciliation (MR) is considered an efficient tool to improve documentation, communication and history taking on admission to hospital.[14] Reports from the UK,[15] Canada,[16] Europe[17] and the UK[18] have shown that MR can efficiently minimize unintentional discrepancies on admission.

The quality of healthcare has been assessed by indicators.[19] An indicator is defined as 'a measurable element of practical performance developed by a valid and reliable method, where there was consequently evidence or consensus that it could be used to evaluate the quality of care'.[20] The latest National Institute for Health and Clinical Excellence/National Patient Safety Agency (NICE/NPSA) report has recommended that all healthcare organisations admitting adults should put policies in place for MR on admission.[21] It has further recommended that healthcare institutions use indicators, audit tools and patient safety incident reports to monitor these actions.

A feasibility study is a small-scale research study aiming to assess aspects of the efficacy or practicality of an instrument or set of indicators that could help in understanding, preparing or recommending further application.[22, 23] In other words, it is a pilot study, to be followed by a full-scale study.[23]

The aims of this study were: (1) to develop operational definitions of the MR indicators. This included defining the terms used, the numerators and denominators, writing instructions for data collection and developing a data collection form, (2) to assess the feasibility of the MR indicators in terms of the availability and accessibility of the data required and to assess the practicality and potential uses of the data and (3) to assess the feasibility of using the indicators to evaluate the MR process, by applying them in two hospitals using a data collection form completed by the pharmacy staff.

Methods

Setting

This was a cross-sectional prospective study conducted in two large teaching hospitals in the north-west of England. There were two phases: (1) a prospective direct non-participant observational study conducted on a small sample of five pharmacists in each hospital, who were observed while they conducted the MR process without interference by the investigator and (2) the pharmacy staff conducting MR were asked to complete the MR data collection form during the working hours of a selected weekday for all MRs conducted for patients admitted to hospitals during that day. The study was conducted in two hospitals. Hospital A had 904 beds and cared for an average of 320 000 people a year, while hospital B had 959 beds and cared for an annual average of 350 000 patients. Hospital A employed more than 400 doctors, 52 pharmacists and 30 pharmacy technicians, while the respective figures for hospital B were 400, 43 and 42. In each, a comprehensive pharmaceutical care service was provided by the Pharmacy Department between 9:00 am and 5:00 pm on weekdays, with a limited pharmacy service during weekends. Hospital A provided two hours more for the admission wards. The average number of patient admissions to each hospital was ~150 per weekday and 70 at the weekend. The two hospitals were purposively selected because they applied different systems for patient records, prescribing, documentation and access to GP sources: hospital A operated an electronic system and hospital B a traditional paper system, both covering the patient records, prescribing, medication administration and MR documentation as part of patient medical notes. Ethical approval was sought by consulting the chairman of the research committee, who replied that this project did not require approval.

Developing operational definitions

To gather valid and reliable data for the MR quality indicators, operational definitions for the indicators and the data collection process were developed.[2] This involved defining the terms used and guidance on how to complete the MR data collection form. These detailed operational definitions were considered essential to collect useful data for the MR indicators, whose numerators and denominators were used as sources for designing the data collection form.

The MR data collection form was designed to include the data required for the MR indicators, in six sections: patient and admission details; a tick if the MR was conducted or the reason for not conducting it; drug allergy details; drug history details, including checking over-the-counter (OTC) and complementary medicines and sources used; checking drug history with the prescription, including checking adherence and intolerance; and details of discrepancies, including identifying, classifying and documenting unintentional discrepancies. To ensure clarity and practicality, the MR data collection form was piloted.

A medication discrepancy was defined as any difference between medication use history and the prescribed medication on admission.[24] Unintentional discrepancies were defined as any change or addition to or omission of a medication that the patient had been taking before admission, made by the prescriber without the prior plan or intention.[25]

Table 1 Demographic data

	Hospital A (%)	Hospital B (%)
Total patients admitted	141	143
Number of patients reconciled		
Total	64 (45.4)	75 (52)
Male	23 (36)	39 (52)
Female	41 (64)	36 (48)
Patient's age		
Range	20–94	19–93
Median	56	64
Admission type		
vPlanned	17 (27)	22 (29)
Unplanned	47 (73)	53 (71)
Number of pharmacist completing the MR data collection forms	16	26

Table 2 List of indicators that were found feasible to assess main aspects of MR process

Denominator		Indicator numerator	Indicator No.[1]	Hospital A		Hospital B		Total	
				N	%	*N*	%	*N*	%
Total number of patients admitted	1	Patients reconciled within 24 h	51	52	37	64	45	116	41
Total number of patients reconciled	2	Average time taken to complete MR	5	12.5 min		14 min		13.3 min	
	3	Checking drug allergy (DA)	21	59	92	69	92	128	92
	4	Checking OTC medication	16	52	81	48	64	100	72
	5	Checking complementary (herbal) products	17	51	80	25	33	76	55
	6	Checking medication adherence	19	58	91	29	39	87	63
	7	Checking intolerance	24	57	89	23	31	80	58
	8	Using more than one data source	15	46	72	46	61	92	66
	9	GP sources used	6,7 & 8	39	61	33	44	72	52
	10	Patient sources used	9,10 & 12	49	77	57	76	106	76
	11	Hospital sources	13	4	6	10	13	14	10
	12	Community pharmacy sources	14	5	8	3	4	8	6
	13	Identifying unintentional discrepancies (UD)	27	30	47	28	37	58	42
Total of unintentional discrepancies	14	Documenting UD	37	88	78	41	48	129	65

[1]Indicator(s) number as was given in step 6.

Data collection

In the first phase, a prospective direct non-participant observational study was conducted on a small sample of five pharmacists in each hospital, who were observed while they conducted the MR process without interference by the investigator. Observations were piloted to assess the data collecting form, the time needed, other requirements to collect these data and the effectiveness of the observation method used. A prospective non-participant observational design was considered appropriate to the aim of this study, which was to assess if the indicators could work. This feasibility study was intended to show whether the data required for the MR indicators were available and could be collected easily and practically. A feasibility study is, by definition, a small scale process using a small sample over a short period of time.[22] Ten pharmacists (five in each hospital) conducting MR in medical and surgical admission and other wards were included. The patients included were all those recently admitted to the adult medical or surgical admission wards for unplanned admissions and other wards for planned admissions and seen by a pharmacist to perform MR at the time of observations, which were conducted at the two hospitals during weekdays (Monday to Friday). The outcome measures at this stage were completing the MR data collection form by the researcher for each patient observed as part of the MR process. It also described the MR process, assessing the availability and accessibility of data on the MR indicators, the practicality of collecting these data and the method of documentation in the current MR system.

In the second phase, the assessment focussed on evaluating how the MR indicators could be used in practice. The use of routinely documented data was not considered here, due to the lack of data required to populate the MR indicators, because the data were either not documented or found to be very difficult to retrieve. Therefore, pharmacy staff conducting MR were asked to complete the MR data collection form during the working hours of a selected weekday for all MRs conducted for patients admitted to the hospital during that day. The form and instruction on how to complete it were provided to four senior pharmacists (two in each hospital) to assess their clarity and feasibility. Collecting the data for a longer time was considered impractical, due to the amount of extra work for the participating pharmacists. All MRs completed for patients admitted to the adult hospital wards during the selected weekday were included. All patients admitted to staying more than 24 h during working hours were eligible to be included. All pharmacists conducting MR process were asked to complete the MR data collection form for all patients seen on the selected day.

To comply with NICE/NPSA guidance, it was decided to include adult patients recently admitted to hospital wards and seen by pharmacy staff during working hours. Pharmacists were asked to complete the MR data collection form while they were conducting MR. The data required for the denominator were part of the data collection form, except two: total number of patients admitted and the total number of patients reconciled on the day of data collection. The source of the former was the hospital coordinator. There was no intention to evaluate the effect of potential changes, interventions or any other factor that could affect MR. Therefore, a small-scale cross-sectional design (MRs conducted during one working day) was adopted. One day's data would provide a sample that was expected to be within the range of those used in the MR studies and audits. The data collection form was provided to all pharmacy staff, with instructions to help in collecting the data and to define some of the terms used.

Data analysis

All the data collected were entered on a Microsoft Excel spreadsheet and then SPSS. Frequencies were presented, based on data required for each indicator. The method of conducting and documenting the

MR process was described. Other issues directly related to the data required for MR indicators were discussed with hospital coordinators and the pharmacists observed, to clarify what data needed to be collected. Data analysis was performed using SPSS 16.0. All the data collected were entered into the programme and analysed as frequencies according to the numerators and denominators of the indicators. Any unobserved MR processes or missed data were omitted from the analysis. The quality of data entry was double-checked by a person other than the researcher by checking the data entered for five and 10 forms for each hospital.

Results

Sixteen and 26 pharmacists completed the MR data collection form for 64 and 75 patients in Hospitals A and B respectively. The average number of patients reconciled by pharmacists was four in hospital A and three in hospital B. Thirty-four and 52% respectively of patients were male. The median patient age was 56 years in hospital A and 64 years in hospital B. Table 1 shows a comparison of the demographic data in the two hospitals.

The majority of admissions (73.4% in hospital A and 69.3% in hospital B) were unplanned. Based on the completed data collection forms, 45.4% of the patients admitted to hospital A were reconciled, while in hospital B 52% were reconciled. All of the patients reconciled had their drug history taken on admission and compared with the prescription. Discrepancies were identified in the MR data collection form.

Fourteen indicators were selected to provide information about the main aspects of the MR process on admission. Table 2 shows the results for the MR indicators considered feasible to assess the main aspects of MR. Of the patients admitted to hospitals A and B respectively, 52 (36.88%) and 64 (44.76%) were reconciled within 24 h, while 12 (9%) and 7 (5%) were reconciled in the next 48 h of admission, making the respective total numbers of patients reconciled within 48 h 64 (45.4%) and 71 (49.7%).

There were no apparent differences in checking drug allergy, adherence and intolerance in hospital A, which was about 60% of the MR performed. Hospital B had a higher percentage (69%) for checking drug allergy; however, less than 30% of patients had their medicines checked for adherence and intolerance. Unintentional discrepancies were identified in 46.9% and 37.3% of the patients reconciled in hospitals A and B respectively. Of these, 77.9% and 48.2% respectively were documented.

Eighteen indicators were selected to assess the different steps of the MR process. Table 3 shows the indicators that could be used to assess detailed aspects of MR process and the results of the data collected in both hospitals. A total of 113 unintentional discrepancies were identified in hospital A and 85 in hospital B, resulting respectively in 1.8 and 1.1 unintentional discrepancies for each patient admitted. Of these discrepancies, 44.3% and 10.6% respectively were confirmed as having reached patients. Figure 1 shows the unintentional discrepancies identified and documented in the two hospitals.

The types of unintentional discrepancy are summarised in Table 4. The main type was an omission, followed by a change in dose. The least common were addition and incorrect formulation. Change in route was not reported in either hospital.

Discussion

The aim of this study was to apply the MR indicators to evaluate their feasibility as a means to assess the MR process on admission

Table 3 Indicators of the detailed MR process

Denominator		Indicator numerator	Indicator no.[1]	Hospital A		Hospital B		Total	
				N	%	*N*	%	*N*	%
Total patients admitted	1	Patients reconciled within 48 h	52	64	45.4	71	49.7	135	47.5
	2	Patients reconciled within 72 h	53	64	45.4	75	52.4	139	48.9
Patients reconciled with identified allergies	3	Documenting DA name(s)	22	25	86.2	16	69.6	41	78.9
	4	Documenting DA reaction	23	23	79.3	10	43.5	33	63.5
Total patients reconciled	5	GP Phone call	6	11	17.2	16	21.3	27	19.4
	6	GP fax	7	3	4.7	14	18.7	17	12.2
	7	GP letter	8	2	3.1	4	5.3	6	4.3
	8	GP electronic patient record	N/A	25	39.1	0	0	25	18
	9	Patient interview	9	47	73.4	50	66.7	97	69.8
	10	Patient's own drugs (POD)	10	21	32.8	29	38.7	50	36
Patients who could not be communicated	11	Patient's carer/family interview	12	2	16.7	1	6.7	3	11.1
	12	Number of UD identified	29	113	1.8 per patient admitted	85	1.1 per patient admitted	198	1.4 per patient admitted
Total unintentional discrepancies	13	UD reached patients	41	50	44.3	9	10.6	59	29.8
	14	Omitted UD	32	90	79.7	52	61.2	142	71.7
	15	Added UD	33	0	0	6	7.1	6	3
	16	Dose change UD	34	16	14.2	16	18.8	32	16.2
	17	Prescriber was contacted	30	18	15.9	9	10.6	27	13.6
	18	Changed UD	36	84	74.3	45	52.9	129	65.2

[1]Indicator(s) number as was given in step 6.

to the hospital. To achieve this aim, operational definitions were first developed for the MR indicators. These included defining the terms used, deciding the indicators' numerators and denominators, writing instructions for data collection and developing the data collection form. Three indicators were added to summarise and give a general idea of the total number of patients reconciled, the GP sources used and the patients' sources used.

The second objective was to assess the feasibility of the MR indicators in terms of the availability and accessibility of the data required for the indicators. This was achieved by conducting a prospective direct non-participant observation study, which provided an understanding of how MR was conducted and identified practicality issues related to the indicators related to the numbers of patients not reconciled and the reasons for not reconciling them were not properly tested because they could not be accurate, as data collection forms were not completed for all patients admitted. A third indicator which was excluded related to the number of times that adherence issues were communicated to the prescriber. The small number of patients included and the small number of those with adherence issues made the assessment of this indicator difficult. Thirty-three indicators were considered feasible. Three groups of MR indicators were suggested to evaluate respectively the adherence to the MR definition, the main aspects and the details of the MR process. Indicators related to drug history being started and completed on admission by pharmacy staff showed that this was achieved for all patients reconciled. Implementation of telepharmacy model may enhance MR documentation.[26, 27]

There was a lack of comprehensive documentation of the MR process and the documented data were dispersed across different documents. Therefore, collecting data from patient records would provide limited information and would be labour intensive. Collecting data by direct observation was also slow and labour intensive; however, it provided a valuable insight into the MR procedures. Using direct observation to assess the MR process was not feasible for routine use, as it allowed data to be collected for a small sample only, not necessarily representing current practice. However, it might be useful for training purposes, as it was found very informative.

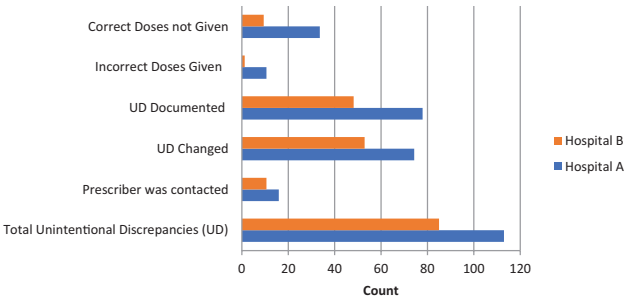

Figure 1 Unintentional discrepancies identification and documentation.

There was a need for a comprehensive standardised MR form, which would allow other professionals to contribute. This practice was observed in the different applications of MR worldwide.[28–30]

This study was the first in the UK to collect comprehensive data about MR using MR indicators. Most published studies reported the UD rates with or without categorising these discrepancies. This part of the programme of work provided a range of indicators that were assessed in practice and found feasible for assessing adherence to national or local policy, assessing the effect of potential changes in the service and as a training tool for new pharmacists, pharmacy students or even other professions or their students. Few studies have assessed the MR process by comparing different professions; however, no studies were assessing different professions who gained a similar equal level of training and similar procedures to follow.

For example, Beckett *et al.*,[18] assessed the feasibility of pharmacist-led admission MR for geriatric patients. The comparison was between pharmacist-led MR and a control condition consisting of the routine work medical resident or intern taking the drug history, which was then reviewed by pharmacy staff. This study used the number of discrepancies identified rather than a range of indicators that could provide a comprehensive figure, as the pharmacist already knew about the purpose of the study and this might affect the time spent during the MR, the sources used and the time spent during the patient interview. If the interview was a second one, this might introduce a recall bias. The use of a range of indicators could provide a more reliable outcome by addressing the strengths and weaknesses of the system. McFadzean *et al.*[31] report that the average time taken by pharmacists to obtain a drug history and to write a drug chart was 32 min. This might be considered long enough to gather more data, given that time spent with each patient in other research studies ranged from 12 to 17 min.

Applying MR indicators in two hospitals using different systems informed this feasibility study as it addressed the potential time taken in hospital B to contact the patient's GP and it was noticed that GP sources were used less frequently than in hospital A. These issues emerged although there was no intention to assess differences, but rather to discover how these new indicators could be beneficial in practice. A study conducted in the UK found that electronic healthcare records (EHR) could help to identify errors and reduce the risk of harm.[32] However, 36% of these EHRs contained errors, which supported the finding of Green and his colleagues that all lists could contain errors. The authors of both studies recommended combining different sources to obtain an accurate drug history.[32, 33]

This study had several limitations that should be discussed. First, the indicators were applied in only two hospitals in north-west England; therefore, generalisability could not be guaranteed to all UK hospitals, although the systems used in most UK hospitals and the sources available were similar, to large extent, to those hospitals included in this feasibility study. This was a small study over a short period of time. The sample was of a size similar to those

Table 4 Types of unintentional discrepancies

	Hospital A (%)	Hospital B (%)	Total (%)
Total UD	113	85	198
Omission	90 (79.7)	52 (61.2)	142 (71.7)
Addition	0	6 (7.1)	6 (3)
Wrong drug	4 (3.5)	2 (2.4)	6 (3)
Change in dose	16 (14.2)	16 (18.8)	32 (16.2)
Incorrect frequency	0	8 (9.4)	8 (4)
Change in route	0	0	0
Incorrect formulation	3 (2.7)	1 (1.2)	4 (2)

of several studies related to MR on admission to hospital,[31, 33] but should be considered small and therefore to share the limitations of such samples. The most relevant limitation was the difficulty of assessing three of the indicators because the incidences were rare. Other limitations arose from the methods used, such as the potential for missing data in the data collection form or the selection of a less busy day to conduct the study. All these issues should be considered when interpreting the data. The purpose of this study, however, was to assess the feasibility of the indicators, so these issues should be considered of less importance than if the study had been to assess the process or the effects of a factor or a change.

Conclusion

The use of standard procedures including a standard data collection form was very useful in gathering informative data. The use of different methods to collect data was effective in providing valuable information as well as overcoming the potential limitation of each method. There is a need for further applications of the MR indicators.

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Author contributions

MSJ: concept design, data collection, data analysis, manuscript drafting, proofreading. DAQ and AZM: data analysis, drafting of the manuscript, and study design development.

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Conflict of Interest

None.

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