Which patients benefit most from medicines reconciliation?

A collaborative evaluation of the outcomes of pharmacy-led medicines reconciliation in community health and mental health care settings

Executive Summary

Three community health services (CHS) trusts with bedded units and 4 mental health (MH) trusts across 4 SHAs submitted data for this collaborative service evaluation designed to inform prioritisation of staff resource with respect to delivery of pharmacy-led medicines reconciliation (MR) services in MH and CHS settings.

Care should be taken in interpreting and using all the findings set out below due to the small numbers of MRs audited. If local data are available these should be compared with the aggregated data.

Overall 50 CHS and 117 MH medicines reconciliations were reviewed. Admission prescribing error rates varied across the care areas as follows: MH adults (working age) 0.47/MR; MH older age 1.8/MR; MH Crisis resolution team 0.82/MR; CHS Rehabilitation/Intermediate care 1.02/MR.

Key findings: Clinical impact of pharmacy-led MR

- There was variation across care areas in the percentage of errors graded Level 3 *could have resulted in a moderate increase in treatment with significant or non-permanent harm to the patient.* Overall 15% of MH and 47% of CHS errors were classified as Level 3
- For MH patients Level 3 errors were predominantly for CNS drugs (BNF 4); for CHS patients they were predominantly CVS drugs (BNF 2)
- In this small sample only one prescribing error involved a high risk drug.

Key findings: Prioritisation of staff resource

- Older MH patients appeared more likely to benefit from pharmacy-led MR that the other MH patient groups
- For the MH and CHS patients reviewed, the majority had planned admissions. 74% of CHS patients were admitted with PODs. Both these scenarios offer opportunities to support more accurate MR at the time of admission
- Supporting nursing and medical staff to improve the Level 1 (admission) MR process may prove a more clinically and cost effective use of pharmacy time than provision of a pharmacy-led MR service and could permit pharmacy resource to be targeted or directed to areas of greater need

Cost avoidance to the NHS

For MH adult patients, when the cost avoidance associated with preventable adverse drug events was set against the cost of providing the service (estimated using B6 pharmacist time) the effect was cost neutral.

For CHS patients cost avoidance per MR was calculated as £53 (£31-75).

NB The accuracy of these calculations is limited by the small numbers of MRs reviewed

Which patients benefit most from medicines reconciliation?

A collaborative evaluation of the outcomes of pharmacy-led medicines reconciliation in community health and mental health care settings

Aim:

To evaluate the medicines reconciliation (MR) service carried out by pharmacy staff for various patient groups in order to inform prioritisation of staff resource for this activity

Objectives:

- To collect information on omitted and incorrectly prescribed medicines identified by pharmacy staff during MR in a variety of care areas
- To rank the clinical significance of each identified discrepancy
- To collect information for each prescribing discrepancy identified through MR on the following factors: planned or unplanned admission; number of admission drugs; availability of patient's own drugs (PODs); time-frame of MR
- To determine the time taken for MR in different care areas

Background

This work builds upon a collaborative audit undertaken across East and South East England in January 2010 (link) when data were collected by 5 CHS and 1 MH unit. The data collected by the CHS providers indicated that 0.25 unintentional discrepancies (errors) were identified per MR; 50% of these were omitted drugs and 27% wrong doses. However, the clinical implications of these omissions and errors were not quantified so it was not possible to establish with certainty the overall benefits of the service, in terms of patient outcomes.

Organisations are being asked to increase productivity and make staffing cuts. Although the NICE/NPSA safety solution and its associated evidence base clearly recognises the value of pharmacy input into the process, providing an MR service to all adult patients within 24h makes very high demands on available pharmacy staff resource. This service is also extremely difficult to deliver in community health and mental health organisations which frequently have bedded units scattered across a number of sites, often considerable distances apart, and cared for by a single small pharmacy team who might be sited at a different location to the beds. Ensuring MR is only delivered by pharmacy staff where it offers clear benefit in terms of patient safety and improved patient outcomes could help ensure the service represents best value for money and may allow staff resource to be redirected to the delivery of other services to which a high priority has also been allocated, such as providing medicines information to patients.

Methodology

Trusts within East of England, South East Coast, South Central and London SHAs were invited to participate. 7 CHS & MH trusts submitted data (Appendix 1).

A data collection form was designed and piloted. A nominated coordinator in each participating trust collated the data collected on the wards by pharmacy staff. Separate forms were used for each care area. Data were collected over a three-week period in September 2010. The collated data was emailed back to the SPS project coordinator (Linda Dodds) for entry onto master spreadsheets.

For each episode of medicines reconciliation data were collected on:

- the care area
- omitted medicines
- medicines prescribed at the wrong dose
- the time taken to carry out the MR.

For each prescribing omission or wrong dose identified during the reconciliation the following was recorded:

- BNF category
- Whether the admission was planned or unplanned
- Whether the MR was completed within 24 hours of the patient's admission
- Whether the patient had brought their medicines from home (PODs) into hospital with them
- Number of medicines taken in total, as established by MR (4 or less vs 5 or more)
- The estimated clinical impact of the prescribing omission or error.

Guidance was given on how the clinical impact of the omission/error should be rated (Appendix 2). These definitions were based on the definitions used by the National Reporting and Learning Centre (NRLS) for incident reporting. For each omission/error ranked by participants as 'moderate' or 'severe' (Level 3 or 4) further data were recorded:

- Name of medicine
- Whether omitted or wrong dose
- Detail that may explain the ranking of a clinical impact of 3 or 4.

The forms used during the audit can be found in Appendix 3.

The care areas defined for this service evaluation were:

Mental Health:

- Adults(Working age)
- Adults (Older)*
- Crisis Resolution team (CRT)*

*Data were collected at only one of the participating sites

Community Health Services

- Rehabilitation/Intermediate Care (Rehab/IC)

To aid differentiation of the data within the tables, the MH data is coloured **blue**, and the CHS data **pink**.

Results

Table 1 and Figure 1 describe the omitted drugs and wrong doses identified for each care area.

(a) Analysis of overall data

Table 1. Numbers of omitted drugs and wrong doses identified through MR by the 4 care areas

Care area	Number MRs reviewed	Number Omitted drugs	Number wrong dose	Total errors	Average Errors per MR
Adults	90	32	11	43	0.47
Older adults*	10	8	10	18	1.8
CRT*	17	12	2	14	0.82
Rehab/IC	50	43	8	51	1.02

** Data provided by only one of the participating trusts*

Figure 1. Omitted drugs and wrong doses identified through MR by care area

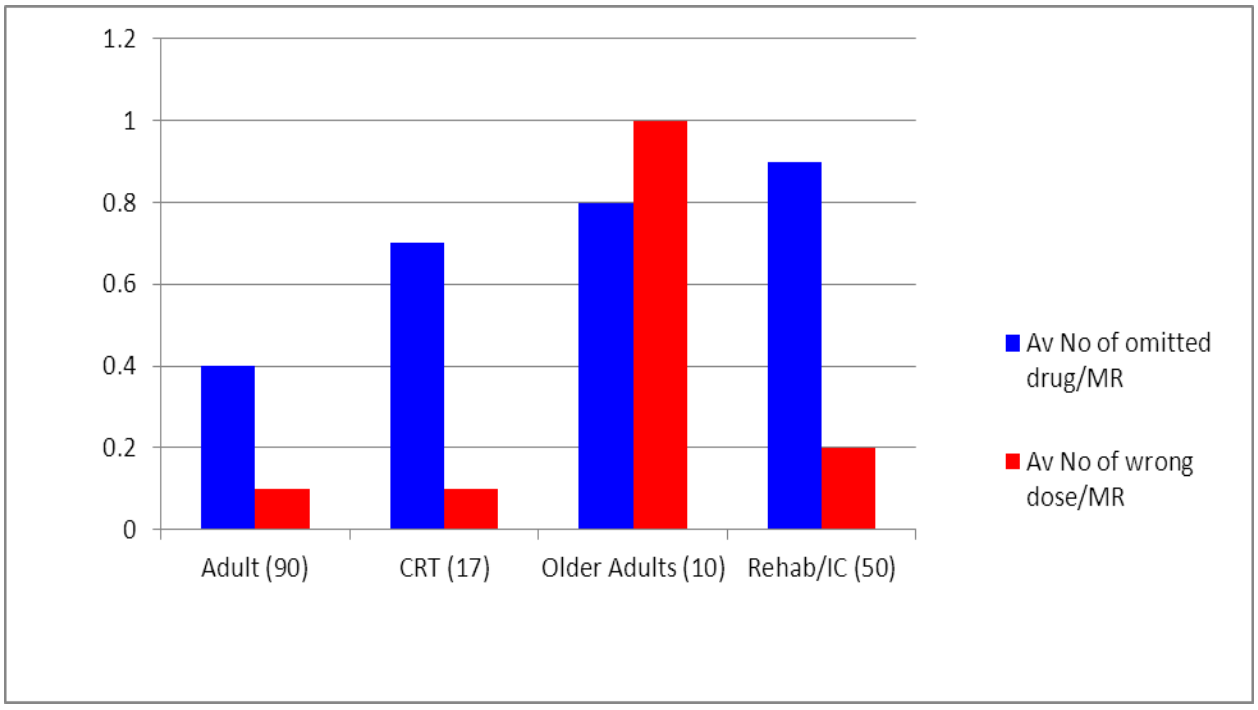


Figure 2. Average time taken for pharmacy-led MR in different care areas

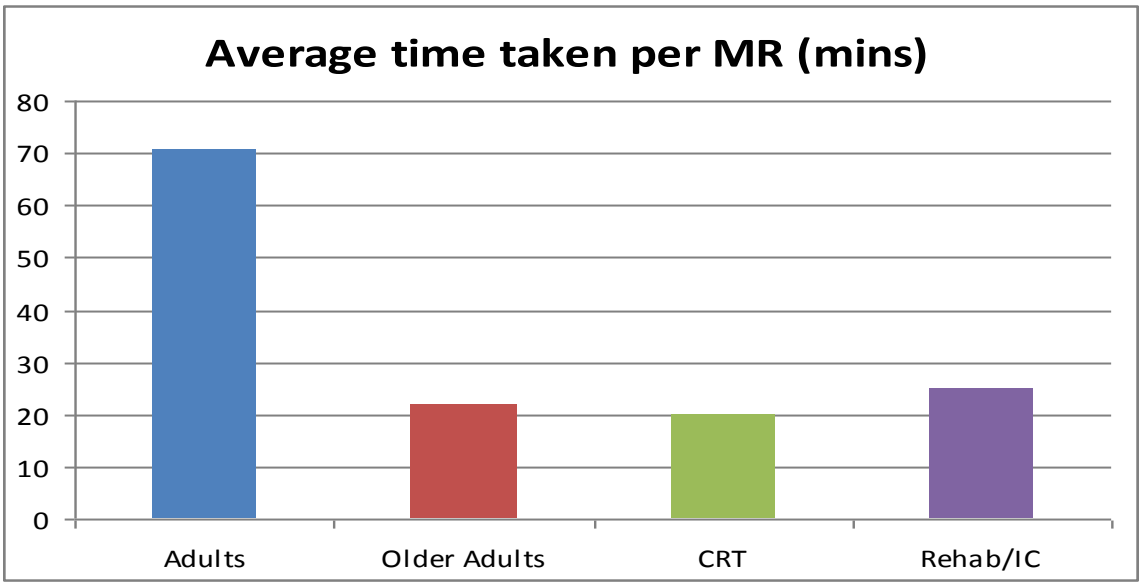


Figure 2 illustrates the average time reported as being taken to carry out an MR in different care areas. There were large variations between trusts in the average times reported to carry out an MR particularly for MH adult patients (23-78 mins) This may relate to the complexity of the patients but may also relate to how the time was calculated, i.e. from start of MR to resolution of problems or start of MR to identification of problems for resolution.

(b) BNF category of all identified prescribing errors

Table 2. Omitted and wrong drugs by BNF category for all care areas

BNF category	Adults	Older adults	CRT	MH overall	Rehab/IC
1	6	1	0	7	6
2	2	3	5	10	18
3	3	0	0	3	7
4	17	9	6	32	3
5	3	1	0	4	1
6	3	2	2	7	3
7	1	0	0	1	0
8	0	0	0	0	0
9	4	1	0	5	1
10	1	0	1	2	4
11	3	1	0	4	5
12	0	0	0	0	0
13	0	0	0	0	3
TOTAL	**43**	**18**	**14**	**75**	**51**

Figure 3. Omitted and wrong dose drugs by BNF category for overall MH care areas

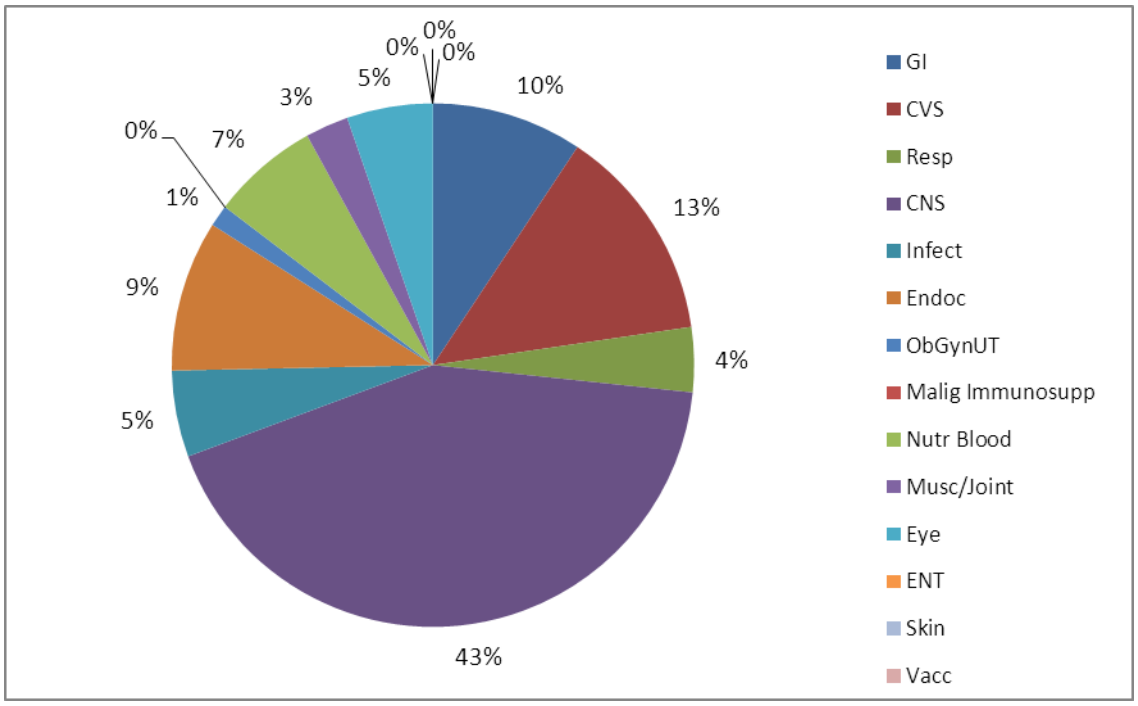
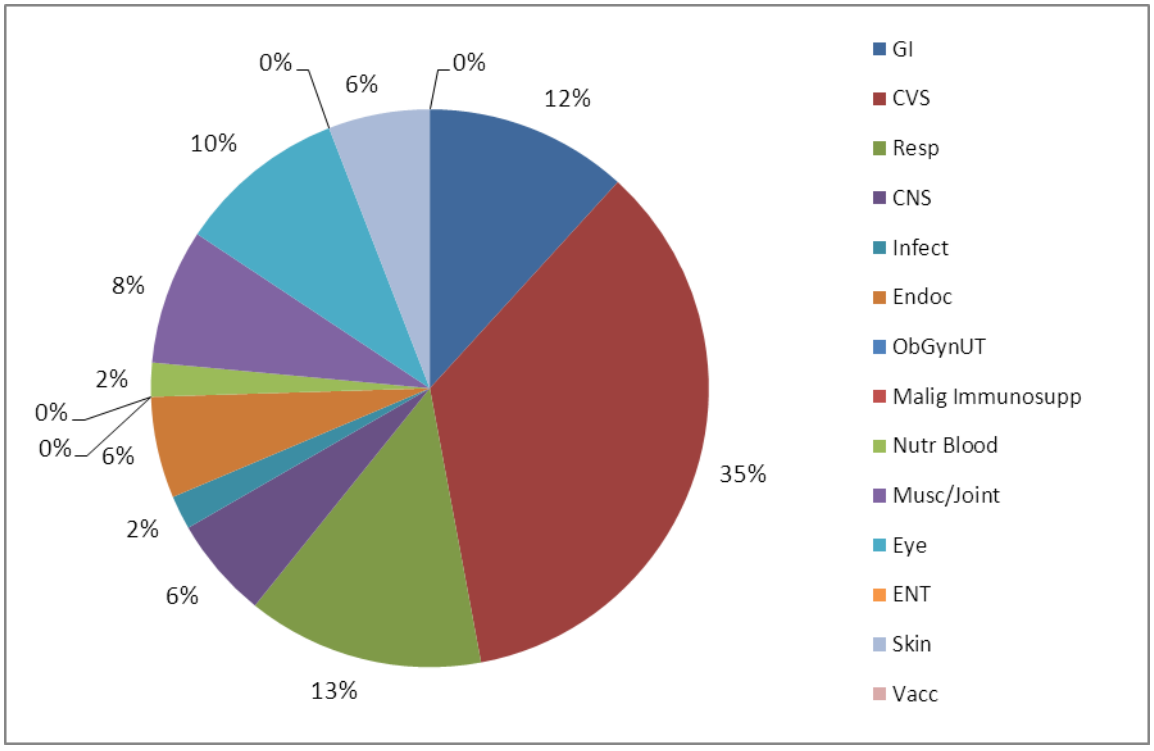


Figure 4. Omitted and wrong dose drugs for CHS



(c) BNF category of prescribing errors ranked as Grade 3 or 4 clinical impact

Table 4. Level 3 & 4 prescribing errors by care area

Care area	Number of MRs	Total number of errors	Errors ranked clinical severity 3 & 4*	3/4 errors as % all errors	3/4 errors per MR
Adults	**90**	**43**	**9**	**21**	**0.1**
Older Adults	**10**	**18**	**1**	**6**	**0.1**
CRT	**17**	**14**	**1**	**7**	**0.06**
TOTALS MH	**117**	**75**	**11**	**9.4**	**0.09**
Rehab/IC	**50**	**51**	**24**	**47**	**0.5**

*****_None of the Level 3 & 4 errors for Rehab/IC involved the following high risk drugs: warfarin, methotrexate, insulin, antiepileptics, anti-parkinson agents, steroids & immunosuppressants_
One of the level 3 & 4 errors for MH involved an antiepileptic. No other high risk drugs were involved.

Table 5. Level 3 & 4 prescribing errors by BNF category for MH & CHS services

BNF category	Adults	Older adults	CRT	MH overall	Rehab/IC
1	2			2	1
2		1		1	15
3	1			1	2
4	4			4	2
5					
6	2		1	3	2
7					
8					
9					1
10					
11					1
12					
13					
TOTAL	**9**	**1**	**1**	**11**	**24**

(d) Factors associated with prescribing errors

For each of the omitted drug and wrong dose errors identified the following information was recorded: MR timeframe; planned or unplanned admission; availability of patient's own drugs; number of admission drugs (as established by MR)

Table 6 Factors associated with admission prescribing errors

Care area	Number of MRs	Number of errors	Unplanned admissions*	Number with PODs*	On 5 or > drugs*	Timescale <24h*	% completed within 24h*
Adults	**90**	**43**	**28**	**6**	**14**	**17**	**19**
Older Adults	**10**	**18**	**10**	**7**	**13****	**12****	
CRT	**17**	**14**	**8**	**8**	**9**	**2**	**12**
TOTALS MH	**117**	**75**	**46**	**21**	**23/107**	**19/107**	**18**
Rehab/IC	**50**	**51**	**6**	**37**	**38**	**20**	**40**

*****Data were incomplete for all starred sections, so results should be taken as a guide only*
****** Data as reported (i.e. exceeds number of MRs undertaken) so excluded*

Discussion

This report will focus on practical suggestions of how the data could be used:

- To support decisions around service prioritisation and use of staff resource
- To demonstrate the added value associated with pharmacy services at ward level.

First the limitations of this collaborative evaluation need to be recognised:

- Relatively small amounts of data were submitted for analysis, which limits the conclusions, that can be drawn. In addition there were some variations in the quality of submitted data. For example, not all fields were completed in every return.
- If local data were collected to submit to the collaborative evaluation, it is important to review the local data in the context of the overall analysis to look for similarities and variation in results
- The clinical impact of identified omitted drugs and wrong doses were identified subjectively which could be criticised. However this is addressed to some extent in **Q & A 6**

The discussion will draw comparisons between the data analysed for acute care patients collected simultaneously using the same methodology, but analysed separately (link).

Use of the data to guide decisions around service prioritisation

1. Do prescribing errors at admission happen more often in particular care areas?

There was a clear difference noted between the care areas reviewed in this report and also between these data and the data collected for acute services.

The errors per reconciliation varied considerably across the MH care areas (0.47-1.8) but the error rate for the majority of MH MRs (adult/working age) was low (0.47/MR)

The data also showed variance from that collected in 2010 (see **Table 7**)

Care area (all data)	No of MRs reviewed in 2010	2010 error rate/MR	No of MRs reviewed in 2011	2011 error rate
MH	**120**	**1.1**	**117**	**0.6**
CHS	**163**	**0.25**	**50**	**1.02**

The reasons for the discrepancies noted are unclear but may be related to issues specific to the participating trusts and to the relatively small number of MRs reviewed during both audits.

2. Does the type of prescribing error vary between care areas?

Differences were apparent. The proportion of omitted drugs to wrong doses were similar for MH adults, CHS and acute services patients. The data for MH older adults and CRT varied considerably but may have been a result of the small numbers of MRs reviewed in these areas.

The most striking difference was with respect to BNF category of the reported errors. The patients in MH care areas recorded errors predominantly in BNF 4 (CNS) area, whereas for acute and CHS services most errors were recorded for BNF 2 (CVS) drugs.

3. Does the number of co-prescribed medicines impact on the error rate?

The majority of the patients admitted to MH care areas were on less than 5 drugs overall, whilst most of the CHS (and acute services) patients were on more than 5 drugs. The lack of data precludes further analysis.

This finding is interesting and worthy of further investigation. Factors such as patient age, who takes responsibility for management of long term conditions, impact of known issues with respect to patient adherence could all influence the numbers of long-term drugs initiated for physical health problems in mental health care settings.

4. Are unplanned admissions more likely to give rise to prescribing errors?

The data relating the errors to planned or unplanned admissions were incomplete. However, it appeared that only 30% of reviewed admissions to adult MH units, and 12% of admissions to CHS units were unplanned. In contrast, the evaluation for acute services patients indicated that most admissions were unplanned (93% for admission units)

The high numbers of planned admissions to both MH and CHS care areas may have been the reason for the lower error rate noted at medicines reconciliation. Planned admissions offer the opportunity for carers or transport services to gather medicines and bring them into hospital, and for clinicians to liaise more easily between primary and secondary care providers to confirm the patient's previous medication history

5. Are errors less likely if the patient is accompanied by the medicines they take regularly at home?

Although many adult MH admissions were recorded as planned, few patients seemed to be admitted with PODs. This may be because few were on long term medications before their admission; however, it may also indicate an opportunity lost to ensure continuity of care for any physical health conditions. Nevertheless this factor did not appear to impact adversely on the accuracy of the admission medication history.

74% of CHS patients presented with PODs. It was not recorded in this evaluation whether they were admitted primarily from home or from acute hospitals. Yet despite the fact that PODs were available for most patients, a high error rate of 1.02 items/MR was still noted. Further work is needed to understand this finding. Possible reasons are:

- PODs were incomplete or not being used to inform the admission history and medication related decisions
- Poor or incomplete discharge communication when patients are transferred from acute to rehabilitative/intermediate care
- Transcribing errors as patients move between care settings

6. Does the clinical impact of identified errors vary between care areas?

Table 2 and Figures 3 & 4 display numerically and graphically the overall admission prescribing errors recorded by BNF category. The differences in BNF category between MH and CHS can be clearly seen. In MH care areas errors in CNS drug prescribing predominated (42%), followed by errors in CVS (13%) and endocrine drugs (9%); while in CHS care areas errors in CVS prescribing predominated (35%), followed by respiratory (14%) and GI drugs (12%). In acute services four key BNF categories predominated: CVS (28%); CNS (17%); respiratory (12%) and endocrine (14%).

Table 5 indicates numerically the proportion of errors identified as level 3 & 4. 15% of overall MH errors were in this category. In contrast 47% of CHS and between 31-52% of care areas in acute services were defined as Level 3 & 4.

Level 3&4 errors involved predominately CVS drugs for acute (40%) and CHS (29%) services, but CNS drugs for MH services (36%).

Only one of the Level 3 and 4 errors recorded in MH and CHS care areas involved high risk drugs, defined as drugs subject to NPSA alerts or where short term omission could lead to destabilisation of the patient's clinical condition (warfarin, insulin; methotrexate, antiepileptics, anti-parkinson drugs, steroids & immunosuppressants). The one error was in an antiepileptic drug dose in an older adult MH patient.

Although the grading of the interventions was a subjective decision of the practitioner, guided by the NPSA definitions, there is published evidence which supports the data and the classifications.

The EQUIP study (link) was commissioned by the General Medical Council to provide an in depth investigation into causes of prescribing errors by foundation trainees in relation to their medical education. Its scope included three systematic reviews of the literature relating to this topic and a large prospective study of prescribing errors. In this prospective study 11,077 errors were detected in 124,260 medication orders checked on 7 'census days' in 19 trusts in NW England. This was a mean error rate of 8.9 errors per 100 medication orders. Errors were made by all grade of doctor and were most often made at the time of the patient's admission to hospital (13.4%). Indeed, it was noted in the discussion that medication orders at the time of admission were 70% more likely to be associated with a prescribing error compared to drug use during a hospital stay. This finding has been substantiated by some as yet unpublished work within East & SE England. The classes of drugs most often involved in prescribing errors in the EQUIP study were analgesics, antibacterials, bronchodilators and antianginals. Incorrect dosage was the commonest error.

The EQUIP study peer reviewed every identified error against a 4 point severity rating scale: potentially lethal, serious, significant, minor (see EQUIP report, Appendix D pp208-9). Using this scale an error of omission was classed as significant and a wrong dose as significant or serious (more detailed criteria for when it was serious or significant were defined). The 11077 errors reviewed were categorised as follows:

- Minor 40%
- Significant 53%
- Serious 5.48%
- Potentially lethal 1.74%

In the E&SE England service evaluation of 4041 non peer-reviewed errors in acute services, classification by front-line practitioners was as follows:

- Minor 60%
- Significant 36%
- Serious 4%

For MH errors, classification of 75 errors by front-line practitioners was as follows:

- Minor 84%
- Significant 15%
- Serious 1%

For CHS errors, classification of 51 MRs by front line practitioners was as follows

- Minor 53%
- Significant 47%
- Serious 0%

From these data it can be seen that MH practitioners rated the errors they uncovered as less significant than colleagues in other care areas.

For the E & SE England service evaluations, the errors associated with high risk drugs were the only errors categorised as 'serious'. It thus can be surmised that there was a reasonably similar assessment of the potential severity of the errors uncovered by the practitioners involved in the service evaluations. Indeed, if the EQUIP criteria had been used more of the errors identified might have been defined as significant or serious.

EQUIP also categorised the prescribing errors identified by BNF category, allowing a further comparison with the data collected in the acute services evaluation (Table 8). Again the proportion of errors by BNF chapter is similar across all BNF areas in both EQUIP and the acute services evaluation. As EQUIP did not include data from MH and CHS settings, the data from the MH and CHS evaluations have not been compared in the same way, although similarities can be seen between the data in Table 8 and the data collected for CHS services.

Table 8 Percentage of errors by BNF Category for EQUIP and E&SE England acute service evaluation

BNF Cat	1	2	3	4	5	6	7	8	9	10	11-13
EQUIP	7.8	24.3	11.6	21.1	6.6	8.3	0.9	0.4	8.4	3.1	4.7
E&SE England data (acute services)	10.8	28.2	12	16.8	1.6	8.7	1.4	1.1	8.7	3.8	6.5

The systematic review by Campbell et al (link) of medication errors which underpinned the NPSA/NICE safety solution on medicines reconciliation also considered the severity of identified errors in the context of the probability that they might cause harm. Using the published literature up to July 2007, 12 studies (approx 1800 patients overall) were included. Using these data the authors set the probabilities of harm as follows:

- Errors of omission 0.1-1%
- Error of commission (to include wrong dose) 1-5%

Monetary values were assigned to each category and formed the basis of costings shared following the first collaborative audit. However, the published evidence used in the systematic review by Campbell et al had largely looked at errors and preventable adverse events occurring during a hospital stay rather than at the time of admission. As a result, errors of omission comprised only 3.4% of total errors while errors of commission comprised 89%.

7. Does the time taken to carry out an MR vary across care areas?

There was wide variation across the MH areas (20-70 min) whilst the CHS average time was 25 min. In contrast the average time for an MR in acute services was 15 min. Data collection problems may have been a problem in some areas and organisations should look to their local data to capture this more accurately.

8. Are pharmacy teams carrying out MR in a timely fashion?

From the small amount of data available it appears that around 18% of MH patients and 40% of CHS patients received a pharmacy-led medicines reconciliation within 24h of admission.

There are many valid reasons why patients in these care settings cannot access this service promptly following an admission; nevertheless, if a Level 3 or 4 error is identified later in the patient's admission, patient safety may already have been compromised, leading to the need for additional monitoring or treatment, or resulting in a longer inpatient stay because medicine-related errors at admission have remained uncorrected for a significant period.

9. What other issues may affect interpretation of the data?

This evaluation did not review the identified errors for appropriateness, either of their designation as an error of omission or wrong dose or of their assigned clinical significance, nor did it investigate whether the problems identified were resolved in an appropriate time frame.

Clinical screening of the omissions in particular is vital. Advising a doctor that medicines have been omitted without offering advice on the clinical appropriateness around whether or not they should be continued both during the admission or after discharge, may also lead to patient harm.

The time frame for offering advice is also relevant to the patient outcome. The initial E & SE England SPS audit of 8621 MRs in January 2010 identified 11366 unintentional discrepancies. Data collection indicated that although 65% of discrepancies were reported to have been resolved, for 35% (approx 4000 discrepancies) the outcome was unknown. Only errors which are resolved appropriately in a timely fashion can be assured of contributing to improved patient outcomes, such as averting preventable adverse events, reducing the length of inpatient stay and ensuring information transfer at discharge is accurate.

SUMMARY: Prioritisation of pharmacy-led MR in MH and CHS care settings

The data indicate that significant numbers of admission prescribing errors are identified for patients admitted to CHS care settings (1.02/MR) and for older adult patients in MH care settings (1.8/MR) but that less errors are found for adult (working age) MH patients (0.47/MR). **However, these findings should be interpreted with caution as the sample size was small.**

Although the sample size was small, Level 3 & 4 errors also appeared to be fewer for MH adult patients (15%) compared with the other care areas evaluated in CHS and acute care settings (respectively 47% and between 31-52%). More data are probably needed to establish whether this is a feature of the small amounts of data reviewed, or of the type of adult patient admitted to MH units.

It appears that the majority of admissions are planned in CHS and MH care settings, which can offer better opportunities for the admitting team to get the medicines right first time. However, as the error rate is still high, particularly in CHS settings, these results may offer pharmacy teams the opportunity to review and perhaps improve the admissions process in their bedded units in order to improve accuracy of admission prescribing if pharmacy-led reconciliation is unavailable. This could be achieved by developing policies and checklists to support staff admitting patients and offering training to medical and nursing staff as appropriate.

If MH pharmacy services are compromised by low staffing levels or large travelling distances, these limited data indicate the priority would be to provide a service to older adults in MH. However, this decision may need to be balanced against the fact that such admissions may be for a considerable period of time, and that any errors of omission and wrong dose may have more significant sequelae in terms of patient care than for an admission of a couple of days.

CHS organisations may need to review the types and sources of their admissions to determine how to prioritise their pharmacy services. Using the acute services data, unplanned admissions, particularly when PODs are missing, appear to have the highest risk of admission prescribing errors.

The cost-effectiveness as well as the clinical effectiveness of a pharmacy-led reconciliation service in settings where pharmacy staff resource is limited may need to be integrated into decisions on whether to focus on providing the service itself or training other health care professionals to provide a timely service with clear referrals for pharmacy expertise when problems are identified.

Use of the data to calculate the cost avoidance associated with pharmacy-led MR

The audit conducted in January 2010 used data from the University of Sheffield systematic review which underpinned the NICE/NPSA guidance to calculate that a pharmacy-led MR service would avert between 18-118 adverse drug events per 100 beds offered the service over a one year period (link to report).

At the time the limitations to this conclusion were summarised as:

- Are the omitted drugs significant or not?
- What proportion of omitted drugs are a high risk for ADEs?
- Do some care areas benefit more than others from this service?

This service evaluation has attempted to address these questions.

Although the data has not identified clearly priority areas for pharmacy led services, as the benefits can be seen to various degrees for patients in all care areas, the data collected on the significance of the omitted drugs and wrong doses has enabled the calculation of the cost avoidance associated with the service.

Campbell et al (2007) (link) used the data collected for their systematic review to allocate costings to preventable adverse events. These figures have been utilised for the data collected in MH and CHS settings as follows. **Please take into account the fact that the data collected to inform these calculations was limited. Locally collected data may prove more powerful.**:

(a) Mental Health Services

Type of error*	**Cost per error (Campbell review)**	**Number identified during service evaluation**	**Total cost range (£)**	**Av Cost per MR N=117 (£)**
Detected *Level 1 & 2*	£0-6	63	0-378	0-3
Significant Does not increase length of stay *Level 3*	£65-150	11	715-1650	6-14
Serious Potential to increase length of stay *High risk drugs*	£713-1484	1	713-1484	6-13
TOTAL COST			**1428-3512**	**12-30**

*Cambell classification in normal print; Service evaluation classification in italics

The average cost avoidance per MR is thus £21 (range £12-30)

However, the cost of MR provision must be factored in. If the average time to conduct an MR is taken as 71 min (using adult data which comprised most MH MRs reviewed) and this cost is calculated based on a B6 mid-point salary plus 30% cost, this suggests an average cost of £23 to carry out an MR. If the time for MR is 20 min, then the cost for the service is £7.

For MH adult patients requiring a significant amount of time to carry out a reconciliation service, the overall cost avoidance may be negated by the resource required to provide the service; for other MH patients the cost avoidance per MR may be calculated as £5-13 per MR.

Limitations: Small numbers of patients reviewed and prescribing error implications may be underestimated as no comparators are available

(b) CHS settings

Type of error*	Cost per error (Campbell review)	Number identified during service evaluation	Total cost range (£)	Av Cost per MR N=50 (£)
Detected *Level 1 & 2*	£0-6	27	0-162	0-3
Significant Does not increase length of stay *Level 3*	£65-150	24	1560-3600	31-72
Serious Potential to increase length of stay *High risk drugs*	£713-1484	0	0	0
TOTAL COST			**1560-376275**	**31-75**

If the average time for service provision is 20 min then the average cost to provide it is £7 (see above).

For CHS patients the average cost avoidance per pharmacy-led MR may be calculated as £53 (£31-75).

Limitations: very small numbers of patients reviewed

Other costs

There are also other costs that could be factored into a discussion about the added value of this service

- **Litigation avoidance**

In 2009/10 claims to the value of £787m were reported, with an average per clinical claim of £6.6k

See www.nhsla.com

This could be coupled to ‘damage to reputation’- a key issue as patient choice extends.

- **Reduced readmissions**

Improved information at transfer of care (admission and then at discharge) may reduce readmissions of patients resulting from inadvertent omission of long term medications which primary care providers assume have been intentionally stopped. Discussions with clinical coders or interrogation of local data collected on readmissions may be of use. The national data can be found at www.hesonline.nhs.uk (this is the statistical database for the NHS on admissions to acute care).

- **Reduced redispensing**

Increased and optimised use of PODs has the potential to bring about savings in medicines and staff resource in ordering and dispensing medicines for long term conditions and comorbidities not directly associated with the admission. This may be particularly relevant to elective (non-urgent) admissions.

These advantages supplement the **safety benefits** of:

- Preventing adverse drug events through administering the wrong dose or omitting necessary therapy
- Reducing delayed and omitted doses of required medicines
- Ensuring clinicians treating the patient are fully aware of all the medicines the patient has been taking prior to admission

Appendix 1. List of participating Trusts

Participating Organisations

Berkshire Healthcare Trust
Central and North West London NHS Foundation Trust
South London and Maudsley NHS Foundation Trust
Suffolk Mental Health Partnership NHS Trust

Medway Community Healthcare
NHS East Sussex Community Health Services
Tower Hamlets Community Health Services NHS Trust

Acknowledgements

Christine Masterson for her expert help in collating the data into spreadsheets and preparing the graphs.

Appendix 2

Ranking of clinical impact: Guidance offered to participants

This will be subjective and should aim to reflect the impact if **NO** MR had been carried out (ie drugs could have been omitted for the whole of the patient stay and possibly after discharge). The person(s) who complete this field should be agreed locally. The definitions are adapted from those proposed by the NRLS for incident reporting. It is appreciated that the assignment of a code may cause problems to less experienced staff, and it may be helpful if a senior pharmacist rather than the person collecting the data completes this field if there is any doubt.

***1. None/Insignificant*: No harm would have occurred to the patient.** Examples might be:

- Complementary or OTC medicines that have could not have contributed to the admission
- Prn medicines that have not been required since admission
- Once weekly drugs that have not been due since the patients admission & could not have contributed to the admission
- Topical preparations for minor conditions unrelated to the admission
- Inhalers where patients have been started on nebulisers

***2. Low/Minor*: Would have caused minimal harm. May have required extra observation or minor treatment.** Examples might be:

- Regular topical preparations for conditions unrelated to the admission
- Prn medicines for conditions unrelated to the admission but that might be needed

***3. Moderate*: Could have resulted in a moderate increase in treatment with significant but not permanent harm to the patient.** Examples might include:

- Omitted regular prescribed medicine for condition related or unrelated to the admission eg CV meds, eye drops (particularly if could have been omitted for whole of patient stay)
- Wrong dose of medicine related or unrelated to admission
- Error/omission of insulin
- Error/omission related to anticoagulant therapy
- Error/omission related to drug with narrow therapeutic index such as lithium, MTX
- Error/omission of immunosuppressive or anticancer drug

***4. Severe/Major*: Could have resulted in permanent harm**

Appendix 3. Form A Data collection at ward level

Ward:	Date	Care area category:	Number MRs completed	Total time taken for MRs	Data collected by:

Medicine (and patient identifier if useful for local analysis)	BNF cat	Omitted	Wrong dose	P or U*	<24h**	>24h**	PODs? Y or N	Total drugs 4 or<	Total drugs 5 or >	Clinical impact	Comments

USE CROSS OR TICK TO INDICATE ANSWERS WHEN APPROPRIATE
***P= planned , U= unplanned admission** ****Timescale:** Time to discovery of problem by pharmacy staff
Total no of drugs: Number patient taking prior to admission as established by Level 2 MR
Clinical impact: 1=None/insignificant; 2=Low/minor; 3=moderate; 4=Severe/major (see additional instructions)
BNF Categories: 1=GI; 2=CV(includes anticoags, antiplatelets); 3=Respiratory; 4=CNS; 5=Infections; 6=Endocrine; 7=Obs,Gyn,UTI; 8=Malignant dis & immunosuppression; 9=Nutrition&blood; 10=Musculoskeletal&joint; 11=eye; 12=ENT; 13=Skin; 14=Immunological products&vaccines

Appendix 3. **Form B Data aggregation by care area**

Trust:	**Care area**	**Number MRs completed overall**	**Average time taken per MR (mins)**

BNF category	Number omitted	Number wrong dose	Timescale <24h	Timescale > 24	Planned	Unplanned	No with PODs	4 or less drugs	5 or more drugs	CI=1	CI=2	CI=3	CI=4
1 GI													
2 CVS													
3 Resp													
4 CNS													
5 Infect													
6 Endoc													
7 ObGynUT													
8 Malig Immunosupp													
9 Nutr Blood													
10 Musc/Joint													
11 Eye													
12 ENT													
13 Skin													
14 Vacc													

P=planned admission; U=unplanned admission; CI= Clinical impact rating (see methodology)

Appendix 3. **Form C Description of all moderate (3) or severe (4) clinical impact rated incidents**

TRUST:

Care area	Medicine	O or D	BNF Cat*	Level 3 or 4	Detail of incident

O=omitted medicine; D=wrong dose
BNF category: Please give subcategory here eg, if budesonide : 1.5.2
Detail: Please add any known problems resulting from omission/wrong dose, or reasons for classifying incident as moderate or severe