Accuracy of best possible medication history documentation by pharmacists at an Australian tertiary referral metropolitan hospital

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ABSTRACT

Aim To determine the quality of best possible medication history (BPMH) taking activities undertaken by pharmacists. To identify factors which impact upon erroneous documentation. To assess risks associated with erroneous documentation of BPMH by pharmacists.

Method A clinical pharmacist randomly selected patients across a tertiary referral, metropolitan hospital over an 9-day period and documented comparator medication histories (CMHs) using a structured interview. BPMH documented by pharmacists as part of routine care and CMH were compared, and erroneous documentation was classified according to previous definitions in the literature. Erroneous documentation was risk stratified.

Results 99 BPMH and CMH were compared. There were 14 medication omissions which occurred across 10 patients and 14 discrepancies across 12 patients. There was no association identified between erroneous documentation and pharmacist seniority/experience ($p=0.25$), where BPMH taken ($p=0.7$), day of week BPMH documented ($p=0.45$) or time since admission to when BPMH was documented ($p=1$). Patient age did not impact erroneous documentation rates ($p=0.22$). There was an association between the number of sources used to confirm a medication history and erroneous documentation incidence ($p=0.035$). The number of medications increased the rate of documentation error. While 85.19% ($n=115$) of erroneous documentation were deemed unlikely to cause patient discomfort or clinical deterioration, 1.48% ($n=2$) had the potential to result in severe discomfort or clinical deterioration.

Conclusion Six out of seven BPMH documented by pharmacists as part of usual clinical practice are accurate. Major influences on accuracy include the number of medications and sources used. There is a low possibility that erroneous documentation by pharmacists will cause harm.

BACKGROUND

Documentation of a best possible medication history (BPMH) and admission medication reconciliation is a core function of clinical pharmacists' daily activities and it has been shown to enhance patient safety.^{1,2} There is good evidence¹⁻⁶ to suggest that medication reconciliation at the transition of patient care leads to a reduction in medication errors and adverse events, enhanced communication and potential avoidance of medication-related admission to hospital.

Research has shown that there are high levels of error where medication reconciliation does not

occur.⁷ Furthermore, the omission of a medication for a patient during a hospital stay could have consequences such as withdrawal effects (eg, omission of a short-acting antidepressant) or under treatment (eg, omission of an antihypertensive). It may also lead to polypharmacy through the introduction of another new medicine unnecessarily.

A common patient safety issue is not having access to an accurate patient medication history on admission to hospital. One key aspect of medication reconciliation on admission to hospital is the documentation of a BPMH. The Australian Commission on Safety and Quality in Healthcare (ACSQHC) Standard 4: Medication Safety⁸ outlines that 'the clinical workforce accurately records a patient's medication history and this history is available throughout the episode of care'.

The use of a standardised approach to medication history taking has been considered for at least the last 30 years⁹ and it is one of the core skills taught to pharmacists commencing in clinical roles in Australia. Use of a competency-based framework for pharmacists has been shown to improve aspects of medication history taking from baseline.¹⁰ It is well known that BPMH documentation by pharmacists is more accurate than other healthcare professionals.¹¹⁻²⁰ The ACSQHC Safety and Quality Improvement Guide Standard 4: Medication Safety²¹ suggests clinical pharmacists be involved with the training of documentation of members of the workforce to obtain BPMH. Gordon *et al* suggest pharmacists document gold standard BPMH and are uniquely qualified to assume this role.²²

The Prince Charles Hospital (TPCH) has implemented multiple strategies to ensure that BPMH is documented as often as possible for as many patients as possible, as well as early as possible during a patient's inpatient stay. This has been achieved through the utilisation of pharmacy technicians for non-clinical tasks, implementation of an emergency department clinical pharmacy team, extended hours and weekend clinical pharmacy services. A team based pharmacy service model has also been introduced where a pharmacist is attached to a medical team (rather than a ward) to optimise the continuity of care and ongoing medication reconciliation and review.

Regular internal and external audits have consistently demonstrated that more than 90% of the patients have a BPMH documented within 24 hours of admission to TPCH. However, the accuracy of BPMH documentation by a pharmacist in a 'real world' setting and factors which may impact on erroneous documentation of a BPMH is not known.

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Hence, the aim of this study was to determine the quality of BPMH taking activities undertaken by pharmacists during the course of their usual clinical activities and to identify which factors may impact on erroneous documentation.

TPCH is a 630-bed tertiary referral hospital which provides emergency medicine, general medicine, oncology, cardiology, respiratory, general surgery, orthopaedic surgery, cardiothoracic surgery, rehabilitation, geriatrics, mental health and palliative care services. The hospital also provides specialist services such as heart and lung transplantation, an Adult Cystic Fibrosis Unit, as well as caring for patients with adult congenital heart disease. The pharmacy department services all clinical areas throughout the hospital and thus cares for complex patients with extensive medication use.

METHODS

Ethics exemption was granted from the hospital's human research ethics committee for a clinical pharmacist (lead author) to document comparator medication histories (CMHs) for patients across TPCH over a 9-day period (12 January 2015 to 15 January 2015 and 19 January 2015 to 23 January 2015). The pharmacist auditor identified patients from acute medical and surgical ward lists who had been admitted to hospital within the previous 24–48 hours. A name was chosen at random, and if they were available for a medication history interview, they were approached to be included in the study. Verbal consent was obtained and a CMH was documented using a structured interview, checklist and any available information sources. The CMH was then compared with the BPMH which had already been documented by team pharmacists as part of the patient's usual clinical care within the first 24–48 hours of patient admission. Patients were excluded if a BPMH had not already been documented, the team pharmacist had not completed the BPMH or an external party (eg, general practitioner or community pharmacy) was required to be contacted to confirm the CMH. The decision to not re-contact an external party was made so primary healthcare providers were not inconvenienced through provision of information already provided for clinical care, solely for the purposes of a quality activity assessment. The BPMH and CMH were compared and any erroneous documentation was noted. In order to ensure that the CMH was the gold standard and most accurate list of medications a patient was taking, any discrepancies noted were confirmed with the patient or available sources to ensure that the CMH did not contain an error. Feedback was also provided to pharmacists who had documented BPMH containing clinically relevant erroneous documentation.

Erroneous documentation was classified according to historical 'errors' used to compare pharmacist BPMH documentation and medical officer medication history documentation²³ (table 1). Erroneous documentation was risk stratified according to definition of Cornish *et al*²⁴ independently by three pharmacists (study authors). The three pharmacists consisted of two assistant directors of pharmacy with more than 12 years of experience each and one senior pharmacist with 9 years of clinical pharmacy experience. Risk was then assigned where

two or three out of three pharmacists agreed. In order to ensure accurate risk comparison, erroneous documentation was also classified according to Cornish *et al*.²⁴ The authors also defined their own erroneous documentation 'error' definition (see Discussion section).

Factors that may impact on erroneous documentation were analysed including pharmacist rank, day of week BPMH taken, where BPMH taken, time since admission, number of information sources used to obtain BPMH, patient age and number of medications. Pearson's χ^2 (or Fisher's exact test, where appropriate) was used to test associations between categorical variables. An independent samples t-test was used to test for differences in age between two groups, or when there were three groups (such as in total errors), a one-way analysis of variance was used. To test for differences in the total number of medications used between the groups, either a Mann-Whitney U (two groups) or a Kruskal-Wallis (three groups) was performed. If the test resulted in a significant finding (ie, $p < 0.05$), the number of medications was broken down in to its respective components (ie, regular medications, when required medications, and complementary medications) and further statistical analysis was performed. All analysis was performed in SPSS V22.

RESULTS

Over the 9-day period, 102 patients had BPMH and CMH documented. Two patients were excluded as the team pharmacist who documented the BPMH still needed to confirm the BPMH and one was excluded as an external party was required to confirm the CMH. This resulted in 99 CMH being documented. Across the 99 patients included, BPMH was documented by 28 different pharmacists which represents on average 3.5 CMH per pharmacist. There was a range of pharmacist experience including rotational ($n=18$), senior ($n=5$) and team leader pharmacists ($n=5$).

There were 14 omissions of a prescription medication identified (average 0.14 per patient) across 10 patients and 14 discrepancies in dose or dose interval of a prescription medication (average 0.14 per patient) across 12 patients. This resulted in 78 out of 99 patients having an accurate BPMH documented. Ten of the 14 prescription medication omissions were deemed clinically significant as assessed by the pharmacist panel (table 2).

There was no statistically significant association identified between error in BPMH and clinical unit, seniority/experience of pharmacist, where or when medication history was taken and time since admission to when medication history was taken (table 3). Patient factors such as age being greater than 65 years and taking more than five medications did not appear to impact on erroneous documentation rates; however, there was an association between the number of sources used to confirm a medication history and the incidence of erroneous documentation. It was observed an increase in erroneous documentation when more information sources were used to confirm the medication history.

The most commonly used information sources to obtain a BPMH were the patient or carer and the patient's own medications. There were no specific information sources which

Table 1 Comparator error definitions and their use in this study

Author	Error definition	Comparison use
Stowasser ²³	Omission: omission of a prescription medication Discrepancy: discrepancy in dose or dose interval of a prescription medication	Used to compare occurrence of omission and discrepancies
Cornish ²⁴	Discrepancy: any difference between the medication use history and the admission medication orders	Used to compare risk associated with discrepancies

Table 2 Omitted regular prescription medications and their clinical relevance

Omission	Clinically significant?
Ondansetron 4mg tablets 1 three times per day	Yes
Metoclopramide 10mg tablets 1 three times per day	Yes
Pregabalin 75mg capsules 1 two times daily	Yes
Hexamine hippurate 1g tablets 1 two times daily	Yes
Ranibizumab 2.3mg intraocular into left eye due tomorrow	Yes
Temazepam 10mg tablets 1 night PRN	Yes
Thyroxine 50 µg tablets 1 morning	Yes
Irbesartan 300mg daily documented when patient taking irbesartan 300mg with hydrochlorothiazide 12.5mg morning	Yes
Fluticasone and salmeterol inhaler 125 µg/25 µg metered dose inhaler 2 puffs three times per day	Yes
Tiotropium 18 µg inhaled 1 capsule morning	Yes
Hydroxocobalamin 1mg intramuscular injection every 3 months (due in 2 months)	No
Triamcinolone 0.1%, neomycin 0.25%, gramicidin 0.025%, nystatin 100 000 units/g ear ointment PRN to umbilicus	No
Testosterone undecanoate 250mg intramuscular every 4 months (due in 2 weeks)	No
Olopatadine 0.1% eye drops 1 drop at night	No

conferred a statistically significant difference between error rates (table 4). The more medications a patient was taking increased the rate of documentation error ($p=0.001$) (table 5). An increased number of regular and as required medications was observed in patients who had at least one error.

There were no variables which influenced omission of a prescription medication (table 3).

Of the 14 omissions using Stowasser's²³ definition, six were deemed to be unlikely to cause patient discomfort or clinical deterioration, and eight were deemed to have potential to cause moderate discomfort or clinical deterioration.

Table 6 outlines risk stratification using a broader erroneous documentation definition by Cornish *et al.*²⁴ There were a total of 135 erroneous documentations based on Cornish's²⁴ definition. The two Class III errors were both related to warfarin documentation. In one case, the pharmacist did not document warfarin frequency, and in another, the time of dosing was documented incorrectly. Table 7 outlines examples of other selected erroneous documentation and resultant risk stratification outcomes.

DISCUSSION

To our knowledge, this is the first study to determine the quality and accuracy of pharmacist-documented BPMH as part of usual clinical care. Other studies^{11–19} often compare pharmacist-documented BPMH with other health professionals but these studies assume that the BPMH acquired by pharmacists in a study or trial setting is accurate. What we have determined is the quality and accuracy of BPMH documentation by pharmacists as part of usual care after integration of a clinical pharmacy service within multidisciplinary teams through utilisation and comparison of BPMH documented by an independent pharmacist. Pharmacist-reconciled BPMH is an integral part of quality patient care and thus measuring the accuracy of pharmacist-documented BPMH and which factors may influence accurate documentation is important. It is also our professional obligation to demonstrate that the clinical pharmacy service provided to our patients is of exceptional quality.

A recent literature review⁷ supported early studies²³ that, on average, there is an omission of one medication for every two patients when medicine reconciliation does not occur. Stowasser²³ identified the incidence of omissions (0.5 per patient) and discrepancies (0.3 per patient) within medication histories undertaken and documented by medical officers. When compared with this historical work, it is observed that pharmacist BPMH has fewer omissions (0.14 per patient) and discrepancies (0.14 per patient) compared with medical officers. This comparison also reflects the collective effort of a busy pharmacy department encompassing all ranks of staff from rotational to senior and team leader pharmacists and not solely the work of a senior pharmacist in a controlled project environment with limited patient numbers.

One factor which seemed to influence the accuracy of a medication history was the total number of medications taken by a patient. The evidence suggests that the more medications a person is on, the more likely there will be an error.^{25 26} Vergas *et al* found that polypharmacy increases the risk of medication reconciliation error by 20% for each additional drug and that patients with medication reconciliation errors took significantly more medications than those without.²⁶ In our study, this erroneous BPMH documentation was largely driven by the number of regular medications the patient is on.

Another factor which seems to influence the accuracy of a BPMH is the number of information sources a pharmacist uses to document the medication history. It would stand to reason that the more sources used to document a BPMH, the more accurate a medication list would be obtained. However, this was not observed in this study. On the contrary, there were more errors when three or more sources were used as opposed to one or two. Some patients have very complex medication environments (multiple healthcare providers, multiple co-morbidities, multiple medications, complex regimens and adherence, knowledge or self-management issues). In these circumstances, obtaining a BPMH can be challenging and pharmacists may try to use a greater number of sources as they are not confident with the history they have obtained. The observation of increased number of sources with reduced BPMH accuracy is more likely a surrogate for a complicated patient rather than cause and effect. There is not one source which could be singled out in this study as 'error producing'; however, the study is probably underpowered to detect a difference if it exists.

There were no factors which statistically influenced the omission of a prescription medication, but a potential trend was observed with the pharmacist rank ($p=0.06$). The general assumption would be that junior pharmacists would have increased error rates due to inexperience, but in fact, team leader pharmacists were found to have more omission of prescription medications (table 3). Team leader pharmacists are advanced practitioners who have significant clinical experience in their field of practice as well as non-clinical responsibilities for team management, performance appraisal and development and quality auditing. They are relied on heavily by their pharmacy team for clinical advice as well as medical and nursing staff. Anecdotally, interruptions are frequent for team leader pharmacists and potentially this is one factor which impacts on erroneous documentation by this group. This phenomenon has been demonstrated in the pharmacy context previously where Flynn *et al*²⁷ showed that interruptions and distractions contributed to dispensing errors. Another factor that could explain this unexpected finding could be competing interests between clinical workload, management responsibilities, meeting attendance and quality auditing. Furthermore, often team leader pharmacists are

Table 3 Association between total errors, omissions and discrepancies and categorical variables

	Total errors			Omission			Discrepancy		
	0 (N=78)	≥1 (N=21)	p Value	0 (N=89)	≥1 (N=10)	p Value	0 (N=87)	≥1 (N=12)	p Value
Clinical unit									
A	25 (83.3%)	5 (16.7%)	0.65	27 (90%)	3 (10%)	0.75	27 (90%)	3 (10%)	0.81
B	16 (72.7%)	6 (27.3%)		20 (90.9%)	2 (9.1%)		18 (81.8%)	4 (18.2%)	
C	24 (82.8%)	5 (17.2%)		27 (93.1%)	2 (6.9%)		26 (89.7%)	3 (10.3%)	
D	13 (72.2%)	5 (27.8%)		15 (83.3%)	3 (16.7%)		16 (88.9%)	2 (11.1%)	
Pharmacist rank									
Rotational	48 (82.8%)	10 (17.2%)	0.25	54 (93.1%)	4 (6.9%)	0.06	52 (89.7%)	6 (10.3%)	0.76
Senior	17 (81%)	4 (19%)		20 (95.2%)	1 (4.8%)		18 (85.7%)	3 (14.3%)	
Team leader	13 (65%)	7 (35%)		15 (75%)	5 (25%)		17 (85%)	3 (15%)	
When history taken									
Monday to Friday	67 (77%)	20 (23%)	0.45	77 (88.5%)	10 (11.5%)	0.61	76 (87.4%)	11 (12.6%)	1
Saturday or Sunday	11 (91.7%)	1 (8.3%)		12 (100%)	0 (0%)		11 (91.7%)	1 (8.3%)	
Where history taken									
ED or ACU	18 (78.3%)	5 (21.7%)	0.70	21 (91.3%)	2 (8.7%)	0.77	20 (87%)	3 (13%)	1
EPAC	10 (90.9%)	1 (9.1%)		11 (100%)	0 (0%)		10 (90.9%)	1 (9.1%)	
Home or outlier ward	50 (76.9%)	15 (23.1%)		57 (87.7%)	8 (12.3%)		57 (87.7%)	8 (12.3%)	
Time from admission									
0 days (<24 hours)	32 (80%)	8 (20%)	1	36 (90%)	4 (10%)	1	36 (90%)	4 (10%)	0.76
1+ days (>24 hours)	46 (78%)	13 (22%)		53 (89.8%)	6 (10.2%)		51 (86.4%)	8 (13.6%)	
Total number of sources									
1	18 (100%)	0 (0%)	0.035	18 (100%)	0 (0%)	0.11	18 (100%)	0 (0%)	0.15
2	24 (75%)	8 (25%)		26 (81.3%)	6 (18.8%)		29 (90.6%)	3 (9.4%)	
3+	34 (73.9%)	12 (26.1%)		42 (91.3%)	4 (8.7%)		38 (82.6%)	8 (17.4%)	
>65 years old	49 (83.1%)	10 (16.9%)	0.22	54 (91.5%)	5 (8.5%)	0.52	53 (89.8%)	6 (10.2%)	0.54
and >5 medications	29 (72.5%)	11 (27.5%)		35 (87.5%)	5 (12.5%)		34 (85%)	6 (15%)	

ACU, ambulatory care unit; ED, emergency department; EPAC, Elective Procedures Admission Clinic.

Table 4 Association between BPMH sources and error rates

Sources		Total errors		p Value
		0 (N=76)	≥1 (N=20)	
General practitioner	No	67 (77%)	20 (23%)	0.11
	Yes	9 (100%)	0 (0%)	
Pharmacist	No	64 (81%)	15 (19%)	0.39
	Yes	12 (70.6%)	5 (29.4%)	
Patient's medication list	No	66 (80.5%)	16 (19.5%)	0.48
	Yes	10 (71.4%)	4 (28.6%)	
Previous admission	No	48 (82.8%)	10 (17.2%)	0.31
	Yes	28 (73.7%)	10 (26.3%)	
Own medications	No	36 (85.7%)	6 (14.3%)	0.21
	Yes	40 (74.1%)	14 (25.9%)	
Other	No	69 (81.2%)	16 (18.8%)	0.23
	Yes	7 (63.6%)	4 (36.4%)	
Residential aged care facility	No	75 (78.9%)	20 (21.1%)	NA
	Yes	1 (100%)	0 (0%)	
Patient or carer	No	2 (100%)	0 (0%)	NA
	Yes	74 (78.7%)	20 (21.3%)	

Three patients' BPMH did not have sources documented therefore were not included in analysis.
BPMH, best possible medication history; NA, not applicable.

Table 5 Associations between total errors (omissions and discrepancies) and patient variables

		Total errors		p Value
		0	≥1	
Age (years)	Mean (SD)	58.8 (18.8)	66 (16.2)	0.114
Total number of medications	Median (IQR)	6 (8)	11 (10)	0.001
Regular medications	Median (IQR)	4.5 (6)	7 (7)	0.001
PRN medications	Median (IQR)	1.5 (1)	3 (2)	0.009
Complementary medications	Median (IQR)	0 (1)	1 (2)	0.194

Table 6 Cornish definition erroneous documentation risk stratification

	n	%
Class I: Unlikely to cause patient discomfort or clinical deterioration	115	85.19
Class II: Those with the potential to cause moderate discomfort or clinical deterioration	18	13.33
Class III: Those with the potential to result in severe discomfort or clinical deterioration	2	1.48

Table 7 Examples of erroneous documentation and associated risk

Descriptor	Class
Fish oil strength not specified	I
Incorrect simvastatin dose	I
Hexamine hippurate omitted	I
Route or dosage form for enoxaparin incomplete	I
Aspirin administration time documented as morning when used at night	I
Incorrect frusemide dose documented (documented 40 mg morning, 20 mg midday; actual dose 80 mg morning and midday and 20 mg night)	II
Metoclopramide 10 mg three times per day omitted	II
Paracetamol sustained release formulation dose frequency documented as 1330 mg two times per day when using as 1330 mg three times per day)	II
Thyroxine 50 µg morning omitted	II

responsible for performance appraisal or competency assessment of junior and senior team member pharmacists, but they do not necessarily always receive feedback routinely themselves and hence this peer review process is underused in this population of pharmacists.

When comparing risk associated with erroneous medication history documentation, pharmacist errors and omissions are deemed less likely to cause harm than medical officers. Cornish *et al*²⁴ reported that 5.7% of unintended discrepancies in medication history completed by medical officers had the potential to result in severe discomfort or clinical deterioration. This compares with 1.48% of erroneous documentation by a pharmacist in this study. Vargas *et al*²⁶ reported that 6.5% of medication reconciliation errors resulted in or contributed to temporary or permanent harm to patients and Magalhaes *et al*²⁸ reported that 25% of unintentional discrepancies on admission to hospital could have resulted in or had the capacity to harm the patient. Our study found that more than 85% of erroneous documentation by pharmacists was unlikely to cause patient discomfort or clinical deterioration. When this is compared with 61.4% documented by Cornish *et al*,²⁴ the notion that erroneous BPMH documentation by pharmacists are less likely to cause harm than discrepancies by medical officers is supported.

The definition of Cornish *et al*²⁴ of an error was used to compare risk associated with erroneous documentation. This

methodology was used to ensure that results obtained were an accurate reflection of a comparator risk between pharmacist and medical officer medication history documentation. Using a narrower definition such as Stowasser²³ would overestimate pharmacist risk as erroneous documentation of non-prescription medications is not included in this definition.

With the emergence of pharmacist prescribing models across the world, it is important that pharmacists maintain their highly specialised BPMH taking skills so that patient safety can be enhanced through accurate prescribing or deprescribing during an inpatient hospital stay or ambulatory care appointment.

Although pharmacist documentation of a BPMH is seemingly at least three times more accurate than documentation by a medical officer, and discrepancies are less likely to cause patient harm, efforts to influence medication history accuracy and quality should be implemented to reduce harm risk as much as possible. Based on this study, it would be prudent to ensure that care is taken when conducting a BPMH interview for patients on more than seven regular medications (table 5) or who require more than three sources to confirm (table 3). There should be further research undertaken to ascertain ways in which BPMH quality can be improved, such as the optimisation of professional and peer support framework for team leader pharmacists.

A similar approach to this study could be undertaken to compare pharmacy service model quality across sites or countries. However, the definitions used to define an 'error' or 'erroneous documentation' in this study are neither exhaustive nor broad. The omission of or a discrepancy in a prescription medication is not necessarily the only clinically relevant erroneous documentation that could occur which may result in patient harm. Hence, we would propose a broader definition of erroneous BPMH documentation. An error should be defined as any regular, when required (PRN) or complementary medicine that has incorrect or incomplete name, dose, frequency, administration route (non-oral medication) or omission of any regular, when required (PRN) or complementary medicine that the patient has taken in the preceding week.

LIMITATIONS

The comparator used within this study was a structured interview process, with a standardised checklist which also incorporated specific questioning on when required (PRN) medication use. The patients included in this study already had a BPMH documented; therefore, some recall bias may have been introduced through an additional medication history documentation opportunity. This has been observed in the literature previously where second drug interviews revealed additional information about BPMH in 69% of patients.²⁹ A further limitation is that the CMH was documented further into the patients' admission than the BPMH (although only 24–48 hours) so improvement in the patients' clinical condition could also lead to enhanced recall of medication-related information. A potential future study technique could be to randomise documentation of a CMH to either before or after BPMH.

The number of participants included within this study was small. This small sample size may have led to underpowered statistical analysis which may hide true influences of accurate medication history documentation. Also, this study was only conducted at a single metropolitan, tertiary referral site where a clinical pharmacy service has been long established and is a core strategy to optimise patient care. Hence, comparisons to other sites where clinical pharmacy service delivery is not as well

established or population demographics may not be transferable. However, one could also argue patients included in this study may be of a more complex nature than a non-tertiary referral, non-metropolitan site.

CONCLUSION

Six out of seven BPMH documented by pharmacists as part of usual clinical practice are accurate. Major influences on accuracy include the number of medications a patient takes and the number of sources used to obtain a BPMH. The vast majority of erroneous documentation by pharmacists is unlikely to cause patient discomfort or clinical deterioration. Studies addressing interventions to enhance BPMH accuracy and the resultant patient outcomes are warranted.

What this paper adds

What is already known on this subject

- Documentation of a best possible medication history is important to enhance patient safety.
- Pharmacists have been shown to document more accurate medication histories.

What this study adds

- This study assesses the accuracy of best possible medication history documentation by pharmacists in a real-world clinical setting.
- This study assesses the risks associated with erroneous documentation by pharmacists.

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REFERENCES

- 1 National Prescribing Centre. Medicines Reconciliation: a Guide to implementation. <https://www.nicpld.org/courses/hospVoc/assets/MM/NPCMedicinesRecGuidelImplementation.pdf> (accessed 28 Apr 2016).
- 2 Mekonnen AB, McLachlan AJ, Brien JA. Effectiveness of pharmacist-led medication reconciliation programmes on clinical outcomes at hospital transitions: a systematic review and meta-analysis. *BMJ Open* 2016;6:e010003.
- 3 Kwan JL, Lo L, Sampson M, et al. Medication reconciliation during transitions of care as a patient safety strategy: a systematic review. *Ann Intern Med* 2013;158:397–403.
- 4 Boockvar KS, Blum S, Kugler A, et al. Effect of admission medication reconciliation on adverse drug events from admission medication changes. *Arch Intern Med* 2011;171:860–1.
- 5 Mergenhagen KA, Blum SS, Kugler A, et al. Pharmacist- versus physician-initiated admission medication reconciliation: impact on adverse drug events. *Am J Geriatr Pharmacother* 2012;10:242–50.
- 6 Cadman B, Wright D, Bale A, et al. Pharmacist provided medicines reconciliation within 24 hours of admission and on discharge: a randomised controlled pilot study. *BMJ Open* 2017;7:e013647.
- 7 Roughead EE, Semple SJ, Rosenfeld E. The extent of medication errors and adverse drug reactions throughout the patient journey in acute care in Australia. *Int J Evid Based Healthc* 2016;14:113–22.
- 8 Australian Commission on Safety & Quality in Health Care. *National Safety and Quality Health Service Standards* (September 2012). Sydney, Australia: ACSQHC, 2012.

- 9 Badowski SA, Rosenbloom D, Dawson PH. Clinical importance of pharmacist-obtained medication histories using a validated questionnaire. *Am J Hosp Pharm* 1984;41:731–2.
- 10 Coombes I, Arent M, Cardiff L, et al. Improvement in Pharmacist's Performance Facilitated by an Adapted Competency-Based General Level Framework. *J Pharm Pract Res* 2010;40:111–8.
- 11 Kramer JS, Stewart MR, Fogg SM, et al. A quantitative evaluation of medication histories and reconciliation by discipline. *Hosp Pharm* 2014;49:826–38.
- 12 Aag T, Garcia BH, Viktil KK. Should nurses or clinical pharmacists perform medication reconciliation? A randomized controlled trial. *Eur J Clin Pharmacol* 2014;70:1325–32.
- 13 Mergenhausen KA, Blum SS, Kugler A, et al. Pharmacist- versus physician-initiated admission medication reconciliation: impact on adverse drug events. *Am J Geriatr Pharmacother* 2012;10:242–50.
- 14 Steurbaut S, Leemans L, Leysen T, et al. Medication history reconciliation by clinical pharmacists in elderly inpatients admitted from home or a nursing home. *Ann Pharmacother* 2010;44:1596–603.
- 15 De Winter S, Spriet I, Indevuyst C, et al. Pharmacist- versus physician-acquired medication history: a prospective study at the emergency department. *Qual Saf Health Care* 2010;19:371–5.
- 16 Reeder TA, Mutnick A. Pharmacist- versus physician-obtained medication histories. *Am J Health Syst Pharm* 2008;65:857–60.
- 17 Hayes BD, Donovan JL, Smith BS, et al. Pharmacist-conducted medication reconciliation in an emergency department. *Am J Health Syst Pharm* 2007;64:1720–3.
- 18 Crook M, Ajdukovic M, Angley C, et al. Eliciting comprehensive medication histories in the emergency department: the role of the pharmacist. *Pharm Pract* 2007;5:78–84.
- 19 Quélenec B, Beretz L, Paya D, et al. Potential clinical impact of medication discrepancies at hospital admission. *Eur J Intern Med* 2013;24:530–5.
- 20 Gleason KM, McDaniel MR, Feinglass J, et al. Results of the medications at Transitions and clinical handoffs (MATCH) study: an analysis of medication reconciliation errors and risk factors at hospital admission. *J Gen Intern Med* 2010;25:441–7.
- 21 Australian Commission on Safety and Quality in Health Care. *Safety and Quality Improvement Guide Standard 4: medication Safety (October 2012)*. Sydney, Australia: ACSQHC, 2012.
- 22 Gordon W, Perrott J, Dahri K. Accuracy of medication histories: the first step of medication reconciliation. *Ann Pharmacother* 2008;42:144.
- 23 Stowasser DA, McGuire TM, Petrie GM, et al. Information Quality A Major Consideration in the Development of Medication Liaison Services. *The Australian Journal of Hospital Pharmacy* 1997;27:362–6.
- 24 Cornish PL, Knowles SR, Marchesano R, et al. Unintended medication discrepancies at the time of hospital admission. *Arch Intern Med* 2005;165:424–9.
- 25 Hellström LM, Bondesson Å, Höglund P, et al. Errors in medication history at hospital admission: prevalence and predicting factors. *BMC Clin Pharmacol* 2012;12:1–9.
- 26 Rodríguez Vargas B, Delgado Silveira E, Iglesias Peinado I, et al. Prevalence and risk factors for medication reconciliation errors during hospital admission in elderly patients. *Int J Clin Pharm* 2016;38:1164–71.
- 27 Flynn EA, Barker KN, Gibson JT, et al. Impact of interruptions and distractions on dispensing errors in an ambulatory care pharmacy. *Am J Health Syst Pharm* 1999;56:1319–25.
- 28 Magalhães GF, Santos GN, Santos GB, et al. Medication reconciliation in patients hospitalized in a cardiology unit. *PLoS One* 2014;9:e115491.
- 29 Andersen SE, Pedersen AB, Bach KF. Medication history on internal medicine wards: assessment of extra information collected from second drug interviews and GP lists. *Pharmacoepidemiol Drug Saf* 2003;12:491–8.