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Research Article

Prevalence and Risk Factors for Medication Discrepancies on Admission of Elderly Diabetics at Kenyatta National Hospital, Kenya

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Background: Medications discrepancies are defined as the variations in drug regimens during transition from one health care worker or hospital to another. The elderly diabetic patients are at risk of medication discrepancies due to their multiple comorbidities resulting in different medications from the many healthcare providers they are likely to see and physiological changes as a result of advanced age; hence the need for medication reconciliation.

Objectives: The main objective of the study was to measure the prevalence and identify risk factors for medication discrepancies at admission of inpatient elderly diabetics at Kenyatta National Hospital (KNH).

Methods: The study design was cross sectional descriptive study in which patients aged 60 years and above were recruited at the time of admission at the medical wards in 2016. Convenient sampling was conducted. A comparison of the medication used before and after admission was done to determine the number of discrepancies if any. Admitting clinicians were interviewed to determine if discrepancies were intentional or not. Linear regression was conducted to determine risk factors for the number of errors per patient.

Results: Among the 163 patients recruited, 1089 medication discrepancies were identified, 63.2% of the patients had at least one unintentional discrepancy. The number of unintentional discrepancies per patient was 1.5 per patient. The most common discrepancy was omissions 236 (98.3%). Independent risk factors for discrepancies were the number of medications prior to admission (adjusted β coefficient 1.377 (95% CI: 0.767, 1.987)), hypertension (β 0.992 (95% CI: 0.094, 1.890)) and those with discharge forms from other facilities (β 0.701 (95% CI: 0.010, 1.392)). Age had a negative association with medication discrepancies (β -0.755 (95% CI: -1.284, -0.226)).

Conclusion: The prevalence of medication discrepancies was high hence the need for medication reconciliation to reduce these discrepancies.

Key words: Medication Reconciliation, Unintentional discrepancies, Diabetes, Elderly diabetics

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1. Introduction

Medication discrepancies are defined as unexplained differences among prescriptions during transition from one health care worker or hospital to another (Climente-Martí et al, 2010). These medication discrepancies are either intentional or unintentional and can lead to reconciliation errors which can be detrimental to patients (Climente-Martí et al, 2010).

Intentional discrepancies are not errors but deliberate changes in a patient's medication regimen made by a provider. Unintentional discrepancies, however, are caused by accidental medication prescribing and are

medication errors. They can result in adverse drug events (ADEs) if actual harm is caused or (potential ADEs) that are near misses and have the potential to cause harm (Grossman, 2011). The unintentional discrepancies can result in poor management of acute and chronic diseases, hospital readmission, and death (Grossman, 2011).

The factors that contribute to medication errors include: older age, people with serious and multiple health conditions, those taking multiple medications and those using high risk medicines (Hilditch, 2012). The elderly are at increased risk of medication errors due to the following factors: normal ageing; not taking medication correctly, multiple chronic illnesses, poly-pharmacy, taking unnecessary medication through self-medication, wrong medication for the individual's medical condition, and inappropriate dose (Cameli et al, 2012).

Elderly diabetics are a heterogeneous group of patients. Some could be living alone, others with care givers while others could be in assisted care living. They require multiple drugs for their diabetes (DM) and their associated comorbidities (Dawn, 2014). Management of type 2 diabetes in the elderly population is difficult because of complex comorbidities and the difficulties they generally encounter in performing normal daily activities (Chau and Edelman, 2001).

Geriatric syndromes such as cognitive dysfunction, limited physical activity, vision and hearing impairment occur more often in the elderly with diabetes and may affect self-care abilities and health outcomes (Kirkman et al, 2012). This greatly increases the risk of medication-related problems and adverse events in these patients.

Medication reconciliation is a five step process of coming up with a list of a patient's current medications that is as complete and accurate as possible and then comparing the medications with those in the provider medication orders and should be conducted during transitions of care such as changes in clinical setting, practitioner or level of care in which new medications are ordered or existing orders are rewritten (Cameli et al, 2012). The process of reconciliation has been demonstrated to be a powerful strategy to reduce ADEs. Medication reconciliation at admission leads to a significant reduction in actual ADEs (Boockvar et al, 2011). There was a reduction in potential ADEs within three months of implementation when pharmacy technicians were used to initiate the process of reconciliation in surgical population (Michels and Meisel, 2003).

In a study by Vira, 60% of participants had at least one unintended discrepancy and 18% had at least one clinically significant discrepancy. A medication reconciliation process intercepted about 75% of the 20 clinically significant discrepancies before patients were harmed (Vira, Colquhoun, and Etchells, 2006). Omission or addition of a medication to the patient's medical record are the most frequent types of medication discrepancies and are common to all three points of care, admission, transfers within hospital units and discharge (Azzi et al, 2014).

Issues with regard to management of medication in the treatment of diabetes have been well documented, however less is known about the prevalence and predictors of medication discrepancies associated with diabetic patients 60 years of age and older at admission in hospitals in Kenya. The aim of this study was to determine the prevalence and risk factors for medication discrepancies at admission of inpatient elderly diabetics at Kenyatta National Hospital (KNH).

2. Methods

2.1 Study Design and Site

The design was a cross sectional study involving elderly diabetic patients hospitalized at Kenyatta National Hospital from January to May 2016. KNH is the largest National Teaching and Referral hospital in Kenya. There were a total of 422 elderly diabetic participants admitted to the wards in the year 2014 and 238 elderly diabetics in the first half of 2015. The number of diabetic participants attending clinic at KNH diabetes clinic in the year 2014 was 2763 and in 2015 up to June was 1867.

2.2 Study Population and Eligibility Criteria

The study population was elderly diabetic participants who were admitted to the medical wards at KNH in 2016. Elderly diabetic patients were defined as patients that were 60 years of age and older who were on insulin or oral hypoglycaemic drugs. Voluntary informed consent was obtained from the participants. Proxy consent was required if participant was too ill, had no knowledge of their medications and there was a language barrier. Participants who declined to give consent or were comatose were excluded from the study.

2.3 Sample Size Determination

The sample size was based on the estimates of the prevalence of medication discrepancies for participants on admission to hospital according to Cornish et al 2005 who found a 60% discrepancy rate. Sample size was calculated using the Hulley formula (Hulley et al, 2007). The calculated minimal size was approximately 148 patients. The calculated sample size was inflated by 10% inflation to cater for poor response during data collection giving a final sample size of 163 participants.

2.4 Sampling Method and Participant Recruitment

Convenient sampling was conducted where every participant who met the inclusion criteria was recruited a day after admission in order to allow for standard care to take place. A list of patients who had a history of diabetes and were admitted within 48 hours was obtained from the admission register on the date of recruitment. Files of these patients were perused to identify patients who met the inclusion criteria. Patients

were recruited in the afternoons when there was reduced work in the wards or after ward rounds. For patients who were too ill or only spoke their mother tongue, the next of kin were interviewed during visiting hours.

2.5 Data Collection and Reconciliation

The list of the participants who accepted to take part in the study and who met the inclusion criteria was obtained. The files were retrieved and the following information obtained: the sociodemographic traits, admission day, and admission time, diagnosis at admission, medication history, comorbidities and medication list on admission.

Best Possible Medication Histories (BPMH) was obtained using the aid of questionnaires. Additional methods were used because it was anticipated that participants would have poor knowledge of their medications. A list of medications used at home prior to admission was obtained. The patient was then requested to ask his caregivers to bring his home medications in the next visit if he did not have them with him at the time of the interview. For participants with poor knowledge of drugs or those who could not speak English or Kiswahili, the research pharmacist then interviewed the caregivers during visiting hours. Questions were asked on use of prescription, over the counter and herbal medication. The total number, name /brand and doses of drugs the patient was taking prior to admission were noted.

A comparison was made between the list of drugs used prior to admission and that of the admission list in the participant's file. Each participant's pre admission and admission medications were studied for discrepancies and categorized by the investigator with the help of clinicians who agreed to take part in the study. An attempt made to correct any errors as soon as possible.

The prescribers' names and contacts were obtained from patient files and the ward in charge of the various wards. An interview was then set up with each of the clinicians so as to determine if the discrepancies were intentional or not. Consent was obtained from prescribers prior to an interview. Five clinicians agreed to take part in the study and were made aware of the discrepancies identified by the investigator. The discrepancies were classified as intentional, undocumented intentional and unintentional. Medication discrepancies for which no clinical rationale could be identified (unintentional changes) were concluded to be medication errors.

2.6 Study Variables

The main outcome variable was the number of discrepancies between preadmission and admission medications. Medication discrepancies were any differences that were intentional or unintentional, between the diabetes-related medication list in the patient's file, and the diabetes-related medications reported by the patient during the medication use interview. Any additions, omissions and dose changes of drugs in the hospital admission medication list were considered medication discrepancies.

The dependent variables of interest were: age, sex, ward, marital status, job status, poly-pharmacy, comorbidities, cadre of admitting clinician, education level, time of admission, discharge forms from previous facility, and management of own medication.

2.7 Statistical Analysis

Continuous data was summarized in form of means, standard deviations, medians and interquartile ranges (IQR). Categorical data was summarized as counts and percentages. The total number of discrepancies was regressed against its covariates. Those variables whose p value was less than 0.05 and also those with high clinical impact were considered for multivariable linear regression analysis with robust estimation. This was used to adjust for confounding as well. Linear regression analysis with robust estimation was carried out using SPSS version 21 software. Backward stepwise model building was done to come up with a parsimonious model. The level of significance was set at 0.05.

Table 1: Baseline characteristics of study participants

Characteristic		**n=163(%)**
Age	60-64	60 (36.8)
	65-69	41 (25.2)
	70-74	28 (17.2)
	75-79	20 (12.3)
	80-84	5 (3.1)
	>84	9 (5.5)
Sex	Male	82 (50.3)
	Female	81 (49.7)
Wards	7A	31(19.0)
	7B	20 (12.3
	7D	26(16.0)
	8A	31(19.0)
	8B	28(17.2)
	8D	25(15.3)
Marital status	Single	16 (9.9)
	Married	122 (75.3)
	Divorced	6 (3.7)
	Widowed	18 (11.1)
Education level	Primary	119 (73.0)
	Secondary	38 (23.3)
	Certificate	1(0.6)
	Diploma	3 (1.8)
	Degree	2 (1.2)
Job status	Employed	12 (7.5)
	Self-employed	80 (49.1)
	Retired	22 (13.5)
	Other	5 (3.1)
	Unemployed	44 (27.0)

**Wards 7C and 8C had only one participant each.*

2.9 Ethical Considerations

Approval to carry out the study was obtained from the Kenyatta National Hospital/ University of Nairobi Research and Ethics Committee in November 2015 approval number **KNH-ERC/A/470**, prior to commencement of the study.

Informed consent was obtained from participants and proxy consent obtained from caregivers of patients who were too ill, had no knowledge of their medications and could not communicate in English or Kiswahili. Consent from the admitting clinicians was also obtained.

To ensure confidentiality, unique patient numbers rather than patient names or outpatient numbers were used.

3. Results

During the three and a half month study, 183 T2DM elderly patients were screened for eligibility, of these, 163 met the inclusion criteria. Twenty patients were excluded for the following reasons: 3 were discharged home before an interview could be carried out; 5 declined consent; 8 died before a medication use interview; and 4 were not on any antidiabetic medication**.** The characteristics of the 163 participants are summarized in **Table 1.** Most of the participants were aged between 60 and 64 years (36.8%, n=60). As age increased, the number of participants declined. The median age was 67 years [62-73]. Nearly half, 50.3% of the participants were male. About three quarters (75.3%) of the participants were married. Most (73%) had attained primary level education and 49.1% were self-employed in farming.

Table 2: Comorbidities and Medical History of study participants

Comorbidities		**n**	**%**
Hypertension		131	80.4
Cardiovascular		26	16.0
End Stage Renal Disease		22	13.5
Chronic Renal Disease		20	12.3
Cancer		12	7.4
Retroviral Disease		5	3.1
Epilepsy		3	1.8
Asthma		3	1.8
Liver Disease		2	1.2
Parkinsonism		2	1.2
Arthritis		1	0.6
Medical history			
Years since diagnosed	1-5 years	44	27.2
	5-10 years	36	22.2
	10-15 years	42	25.9
	>15 years	40	24.7
Attendance of clinic	Monthly	99	60.7
	Every 3 months	39	23.9
	Never	19	11.7
	Other	6	3.7
Attendance of clinic for comorbidities	Yes	122	74.8
	No	22	13.5
	No comorbidities	19	11.7
Diagnosis at Admission			
Diabetic foot		21	12.9
Heart disorders		17	10.4
End organ damage		11	6.7
Respiratory infections		11	6.7
Sepsis		10	6.1

Participant Medical Information

A large number of the participants were admitted at night from 8 p.m to midnight (30.1%, n=49); followed by the wee hours of the morning which was midnight to 6 a.m (23.9%, n=39). Senior health officers/ registrars were the most common admitting clinicians (80.6%, n=108). About half, 50.9%, of the patients were admitted from home and the most common diagnosis at admission was diabetic foot (12.9%, n=21). **Table 2** summarizes the medical information of the study participants.

Nearly 80%, (131) had hypertension. Only one participant had arthritis. Other comorbidities are as shown in **Table 2**. From the past medical history taken, 27.2% of the patients were diagnosed 1-5 years ago and a large proportion were attending clinic for diabetes (60.7%) and other comorbidities (74.8%). Majority of the participants (82.7%) managed their own medication. The rest had a family member manage their medication intake and storage (**Table 2).**

Patterns of Medicine use among the Participants

A total of 112 (68.7%) participants were on metformin prior to admission; 68 (41.7%) were on insulin 70/30; and 54 (33.1%) were on glibenclamide. The use of glibenclamide is a medication error as it is discouraged in elderly persons. About 35% of the participants were put on soluble insulin on admission. Only six were put on Insulin 70/30 upon admission.

For participants with hypertension as comorbidity, enalapril (27%, n=44) was the most commonly used drug prior to admission followed by nifedipine (20.2%, n=33) and lastly amlodipine (18.4%, n=30) (**Table 3**). On admission, enalapril was also the most commonly prescribed drug; 15 patients were put on this drug. Twelve participants were prescribed nifedipine. Participants with other comorbidities had an additional 215 medications in total prior to admission. On admission, an additional 422 medications were given to participants for various medical reasons.

Table 3: Patterns of Medicine use among the Elderly Participants

Drug Classes	Medication used at home	Number of participants n (%)	Medications added on admission	Number of participants n (%)
Hypoglycemic Agents	Insulin 70/30	68(41.7)	Soluble insulin	57 (35.0)
	Metformin	112 (68.7)	Insulin 70/30	6 (3.7)
	Glibenclamide	54 (33.1)	Metformin	1 (0.6)
	Glimepride	2 (1.2)		
	Gliclazide	5 (3.1)		
	Saxagliptin	2 (1.2)		
	Chlorpropramide	1(0.6)		
Antihypertensive Drugs				
ACE inhibitors	Enalapril	44 (27.0)	Enalapril	15 (9.2)
Calcium Channel blockers	Nifedipine	33 (20.2)	Amlodipine	7 (4.3)
	Amlodipine	30 (18.4)	Nifedipine	12 (7.4)
			Nimodipine	1 (0.6)
Beta blockers	Atenolol	13 (8.0)	Atenolol	2 (1.2)
	Propranolol	2 (1.2)		
	Metoprolol	2 (1.2)		
	Nebivolol	3 (1.8)		
Alpha and Beta blocker	Carvedilol	20 (12.3)	Carvedilol	6 (3.7)
Alpha 2 adrenergic receptor antagonists	Methyldopa	4 (2.5)	Methyldopa	1 (0.6)
Angiotensin II receptor antagonists	Losartan	16 (9.8)	Losartan	7 (4.3)
	Losartan/ Hydrochlorothiazide	21 (12.9)	Losartan/ Hydrochlorothiazide	4 (2.5)
	Telmisartan/ Hydroclorothiazide	2 (1.2)	Telmisartan	1 (0.6)
Vasodilators	Hydralazine	2 (1.2)	Hydralazine	5 (3.1)

The Medication Reconciliation process and Prevalence of Medication Discrepancies

The Best Possible Medication History (BPMH) was obtained from various sources, and from this, a pre-admission medication list was generated. The most common source was patient/caregiver interview (100%, n=163).

This was followed by the medication history in the participants' files written by the provider (97.5%, n=159). Only 15.3% had their medication with them for reconciliation. Most patients' medications were reconciled 24 hours after admission (47.9%, n=78). Then 69(42.3%) patients had their medications reconciled 2 to 3 days after admission. Only 16(9.8%) patients had their medications reconciled 4 to 12 days after admission.

On reconciliation of the 163 patients' medication, 1089 medication discrepancies were identified. The mean number of discrepancies per participant was 6.68 ± 2.4. Only one patient had no medication discrepancy.

Approximately 16% (n=27) of the participants had a total of 6 medication discrepancies each. The most common class of drugs with discrepancies was antidiabetic drugs (37.9%, n=91). Others include antihypertensive drugs, diuretics, lipid lowering drugs like atorvastatin, cardiac glycosides like digoxin and anti-platelets among others.

Classification of medication discrepancies is presented in **Figure 1.** Classification was done as described by Pippins et al (2008), as summarized below:

Omissions: absence of a patient's prescribed medication from a prescription.

Dose Changes: changes to the doses of a patient's prescribed medication.

Additions: extra medication prescribed in a patient's prescription.

Duplications: repetition of a medication(s) in a patient's prescription.

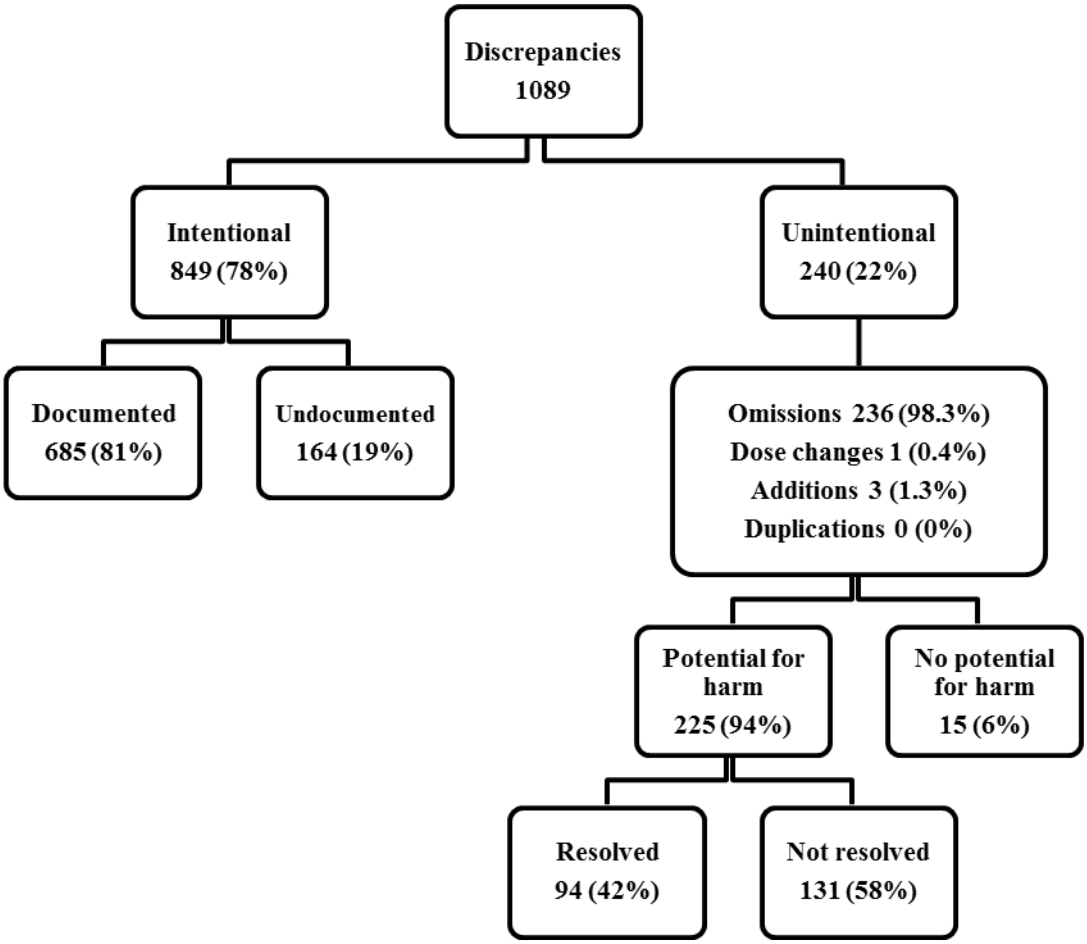

Figure 1: Classification of medication discrepancies detected

Of the medication discrepancies, 849 were intentional and of these 19% of them were undocumented; a mean number of one undocumented discrepancy per participant. The remaining discrepancies (22%, n=240) were unintentional discrepancies. Omissions were the most common unintentional discrepancies (98.3%, n=236), while 0.4% were dose changes (n=1) and 1.3% were additions (n=3). The unintentional discrepancy per participant was 1.5. There were no therapeutic duplications. One hundred and three patients (63.2%; 95% CI, 55.6%-70.3%) had at least one unintentional discrepancy. Of the 103, 35.9% had only one unintentional discrepancy (n=37). Majority (55.3%, n=57) had 2-4 discrepancies; nine (8.7%) had more than 4 discrepancies.

Among the unintentional discrepancies, 94% were judged to have potential for harm (n=225). Only 42% were resolved. An example of a discrepancy with a potential for harm was the omission of metformin, insulin 70/30 among others from the admission orders with no clinical rationale. The most common drug classes of medications for which there were unintentional discrepancies were antidiabetic (37.9%, n=91), antihypertensive (24.2%, n=58) and diuretic drugs (8.3%, n=20). All these are Class A drugs that are essential; their omission can be potentially harmful.

Risk factors for Medication Discrepancies

Descriptive analysis carried out showed that wards 7A with a mean number of discrepancies of 8 (SD 3), 7D and 8B with a mean number of discrepancies of 7 (SD 2) had the highest number of discrepancies; most likely this was due to the high number of participants from each of these wards. Participants with 3 comorbidities had the most medication discrepancies with a mean of 8(SD 2).

Another observation of interest was that most discrepancies occurred in the morning (approximately 8 discrepancies per participant). Those who had more than 10 medications prior to admission also had the highest number of medication discrepancies a mean of 9(SD 3).

Participants with hypertension and cancer had a mean number of discrepancies of 7(SD 2), those with retroviral disease had a mean number 9(SD 2) and end stage renal disease a mean number of 8(SD 3) Participants with these comorbidities had the most discrepancies. Bi-variable linear regression analysis was carried out with the number of medication discrepancies as the dependent variable **Table 4**.

Table 4: Regression analysis for determination of possible predictors to medication discrepancies

Variables	Bi-variable Regression Analysis		Parsimonious Multivariable Regression Analysis	
	Crude β coefficients		Adjusted β coefficients	
	β (95% CI)	P value	β (95% CI)	P value
Age group	-0.667 (-1.245, -0.0896)	**0.024**	**-0.755(-1.284, -0.226)**	**0.005**
Ward	-0.112 (-0.274, 0.049	0.173	-	-
Education Level	-0.220 (-0.759, 0.319)	0.422	-	-
Number of comorbidities	0.665 (0.197, 1.133)	**0.006**	-	-
Hypertension	1.469 (0.539, 2.400)	**0.002**	**0.992 (0.094, 1.890)**	**0.031**
End stage renal disease	1.735 (0.654, 2.816)	**0.002**	-	-
Retroviral disease	2.186 (0.005, 4.368	0.05	-	-
Cancer	-1.455 (-2.894, -0.015)	0.048	-	-
Asthma	1.683 (-1.137, 4.504)	0.24	-	-
Discharge forms from previous facility	0.615 (-0.147, 1.377)	0.113	**0.701 (0.010, 1.392)**	**0.047**
Number of previous medication	1.488 (0 .880, 2.096)	**<0.0001**	**1.377 (0.767, 1.987)**	**<0.0001**
Management of own medication	-0.712(-1.713, 0.289)	0.162	-	-
Time of admission	0.029(-0.211, 0.268)	0.813	-	-

On multivariable linear regression analysis, the number of medications prior to admission, and having hypertension as comorbidity were significant predictors for medication discrepancies at admission. There was a negative association between increasing age and medication discrepancies; participants who were younger were in this case found to be more likely to have medication discrepancies (adjusted β coefficient -0.755 (95% CI: -1.284, -0.226)); this was statistically significant (p=0.005). Participants with hypertension were more likely to have medication discrepancies than those without hypertension (adjusted β coefficient 0.992 (95% CI: 0.094, 1.890)). For every unit increase in the number of medications given before admission, the number of medication errors per patient increased by 1.4 units. Those with many medications prior to

admission were more likely to have medication discrepancies than those with fewer medications on admission (adjusted β coefficient 1.377 (95% CI: 0.767, 1.987)). Those with information on their drug usage from discharge forms from previous facilities interestingly showed a positive relationship with the number of medication discrepancies (adjusted β coefficient 0.701 (95% CI: 0.010, 1.392)). Therefore the number of previous medication, hypertension and those with discharge forms from other facilities were significant predictors of the number of medication discrepancies.

4.0 Discussion

In the study population of elderly diabetics, all but one of the patients had medication discrepancies following medication reconciliation. On classification of the discrepancies, 63.2% of the patients (95% CI 55.6-70.3) experienced at least one unintentional discrepancy. The findings were far greater than other studies probably as a result of different conceptualization, definitions and methods. One study showed that at least about 60% had at least one unintentional discrepancy (Vira et al, 2006). Other studies found about half of participants had at least one unintentional discrepancy (Cornish et al, 2005 and Hellström et al, 2012).

The most common unintentional discrepancy/error was an omission of a medication the participant reported taking before admission (n=236, 98.3%). This was consistent with other studies that also showed that omissions were the most common unintended discrepancy (Cornish et al, 2005; Hellström et al, 2012; Quélennec et al, 2013).

About 94% of the unintentional discrepancies had the potential for harm. This prevalence of unintentional medication discrepancies with potential for harm was 1.4 per participant and this was similar to a study that also reported an average of 1.4 per patient (Pippins et al, 2008). It is important to note that some studies use medication discrepancies to mean the same as medication errors; however in this study the two concepts are different. Unintentional discrepancies in this study are the errors and specifically reconciliation errors.

The most common drug classes involved in unintentional discrepancies were antidiabetic (37.9%, n=91), antihypertensive (24.2%, n=58) and diuretic drugs (8.3%, n=20). This has a clinical impact on management of diabetic patients more so those with hypertension as comorbidity. This finding is in contrast to a study that identified nervous system (22.0%), gastrointestinal (20.0%) and cardiovascular (18.0%) medications as the most common drugs involved; however the study was not conducted only on elderly diabetic patients (Quélennec et al, 2013).

The results showed, wards with high density of medical cases had higher number of discrepancies. Those admitted in the morning between 6.00 am and 11.59a.m had the most discrepancies. The probable reason why most discrepancies occurred at this time could be because this is a busy time when ward rounds are being conducted and the quality of care may decline. The higher the number of comorbidities a patient had, the higher the number of discrepancies.

Risk factors for the occurrence of medication discrepancies included an increased number of preadmission drugs and hypertension as comorbidity. There was a linear relationship between the number of medications prior to admission and the number of discrepancies ($P < 0.0001$) and this was similar to studies by Stitt et al (2011) and Hellstom et al (2012). This relationship is not surprising and was expected. A study in 2008 contradicted this finding (Pippins et al, 2008).

Older age showed a negative correlation to medication discrepancies, in that, the younger age was associated with more medication discrepancies. Stitt et al (2011) showed no relationship between age and the number of medication discrepancies. This finding contrasted another that found that older age as a significant predictor to medication discrepancies. This again could be due to the different definitions and use of medication discrepancies and medication errors. The differences noted in general could be due to fewer ward pharmacists in Kenya compared to the west. It is also probable that clinicians paid greater attention to older patients, hence, fewer errors.

A positive association was found between hypertension and medication discrepancies. There was however no studies showing this association. This could be the first of them. The variables end stage renal disease (ESRD), retroviral disease (RD) and cancer may not have shown statistical significance but showed clinical significance in that, participants with these comorbidities had more medication discrepancies. It is of clinical importance to note that these participants are more likely to have medication discrepancies compared to those without these comorbidities. There are however no studies supporting this clinical significance. This could be the first.

The study showed that those with discharge forms from previous facilities were also more likely to have medication discrepancies. This not only showed statistical significance but clinical significance. This could be an indication of the lack of accurate discharge summaries and not just inaccurate medication histories. Several studies have been done that show a high discrepancy rate at discharge (Wong et al, 2008; Nelson et al, 2011; Geurts et al, 2013). There was however no studies to support this as risk factor to medication discrepancies at admission.

The findings from this study have significant implications for practice as they showed that those participants with hypertension, an increased number of medications prior to admission and discharge summaries from previous facilities could benefit most from medication reconciliation at admission. As a starting point medication reconciliation should focus on patients with high number of drugs prior to admission

and those diabetics with hypertension since results showed these as key predictors to medication discrepancies. Pharmacists, physicians, nurses, and patients play a key role in this process. Pharmacists especially are central to medication reconciliation and are responsible for identification and resolving errors with collaboration from the physicians, nurses and the patients themselves. However, an adequate system of rectification of errors is needed. A reconciliation tool should be developed specific for an institution and reconciliation done after admission by the hospital pharmacist.

Further study needs to be done on the clinical impact of unintentional discrepancies more so those with the potential for harm. Future studies can include nurses and not just prescribers. Medication reconciliation would need to be carried out on other vulnerable groups such as pregnant women, those on high risk medication among others. There are no other studies in Kenya and Africa on medication discrepancies. This is the first and will provide baseline data for future study in this area. The strength of this study is that it also highlighted the critical role a pharmacist can play in preventing patient medication errors through medication reconciliation.

There were limitations to this descriptive study. First, it was conducted only in the internal medicine wards of a single hospital limiting its generalizability. Secondly, there is currently no gold standard for the identification of medication use at home. Therefore an assumption was made that the drugs the patient or caregiver gave as drugs used prior to admission were the accurate drugs being used. This limitation was mitigated by using various sources to obtain medication history. Thirdly, the classification of the discrepancies into intentional, undocumented intentional and unintentional partly relies on subjective judgement and is therefore subject to bias. One could argue that undocumented intentional medication discrepancies represent "latent" medication errors that could lead to harm. Lastly there was a likelihood of Hawthorne bias that resulted from clinicians' awareness of the researcher's presence in the wards. This was managed by using the research assistant to collect data and collection of data randomly across the wards and at different times.

5.0 Conclusion

A total of 1089 medication discrepancies were identified and classified into intentional and unintentional discrepancies. Omissions were the most commonly occurring type of discrepancies. A high number of these discrepancies had the potential to cause harm and only 42% were resolved. Hypertension, increased number of medication prior to admission, and discharge summaries from previous facilities were significant predictors of medication discrepancies.

Conflict of Interest declaration

The authors declare no conflict of interest.

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