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Outcomes of clinical pharmacist's interventions in solving drug-related problems in geriatric patients of rural teaching hospital

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Abstract

This study was performed to assess outcomes of clinical pharmacist's interventions in solving drug-related problems in geriatric patients in the Medicine ward of Rajah Muthiah Medical College and Hospital, Annamalai University, during one year from January 2013 to January 2014. Demographic analyses of this prospective study revealed that out of 520 patients, 342 (65.76%) were males and 178 (34.23%) were females. The maximum patients were in the age group of 60-64 (38.84%) range lead to a significant increase in the number of medications. The most common diseases associated systems were cardiovascular system 147 (28.26%) patients. 93% of geriatric patients belong to rural area and only 6.34% geriatric patients belong to urban area (town). Most of the geriatric patients (95%) were illiterate. 93.84% of geriatric patients were married and 5.19% were widower. Only 0.38% of geriatric patients were never married. The study reveals that 56.53% of geriatric patients were prescribed 6-8 drugs for their treatment of diseases followed by 9-12 drugs (23.84%), ≤ 5 drugs (11.73%) and >12 drugs (7.88%). PCNE v 6.2 DRP system classification tool was used in this study to find out the Causes of DRP, pharmacist intervention in solving DRP and Outcomes of intervention. The drug selection is the most frequently identified cause for DRPs. Poly pharmacy and the hospital stay are significantly associated with various DRPs. More interventions were provided to the patient level, compare with prescriber level. Patient medication counseling is the most intervention in the study. Interventions proposed by a clinical pharmacist to tackle or avert medication related issues are to a huge degree acknowledged and endorsed by the prescribers. Most of the interventions are of high clinical importance. Outcomes of interventions indicate that almost 87.45% of problems are totally solved, by pharmacist's interventions in this study; it is expanding proof that support and intercession of clinical pharmacists in geriatric health care have a positive influence on clinical outcomes.

Keywords: Causes of DRP, Drug related Problem, Geriatric patients, Outcomes of intervention

1. Introduction

Drug-related problem (DRP) can be defined as: 'an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes'. In this point of view, a potential problem means a circumstance that may consequence in drug-related morbidity or fatality if no exploit is carried out; an actual problem is marked with signs and symptoms^[1]. It should be differentiated now that the use of the appearance problem in the phrase ,drug-related problem is used to specify a drug related incident bendable to recognition, healing, or more aptly, avoidance, and should not be understood in the regular usage wherever it softly gives the thought that ,something (mystery, inconsistency, confusion) is incorrect here^[2]. The very important element of this explanation is the consequence of the problem on the health-end effect of the pharmacotherapy. There is no drug-related problem if there is no possible persuade^[3]. A DRP arises when patient occurrences or is likely to experience whichever a disease or symptom having an exact or unspecified association through drug therapy^[4].

Charles and Linda (1990) categorized DRPs into following eight categories; untreated indications, improper drug selection, sub-therapeutic dosage, failure to receive drugs, over dosage, adverse drug reactions, drug interactions, drug use without indication.

Many ways of classifications are available to code drug related problems, but all those classifications have not been tested for validity and reproducibility. Among classifications which are continuously tested is PCNE classification. Its basic classification has 4 primary domains for problems, 8 primary domains for causes, 5 primary domains for Interventions and 4 primary domains for the outcome of the intervention. Classification of DRPs can serve as a cynosure for establishing a systematic process for pharmacists to put in appreciably to positive patient outcomes^[5].

The US Health and Human Services define Clinical Pharmacy as: ‘Functions performed by pharmacists on behalf of the patient to identify, resolve and prevent drug-related problems’ [6]. A Clinical pharmacist can play a very important role by addressing the whole range of drug therapy in hospitals and, in general, the clinical pharmacy services have been reported to improve patient care by reducing inappropriate prescribing [7, 8], improve disease management [9, 10] diminish adverse drug events, reduce length of stay, ADRs and mortality and give economic benefit [11]. The pharmacist’s responsibility to the optimizations of drug remedy may be evaluated by ascertaining the number of drug-related problems addressed or prevented, or by evaluating the clinical outcomes for the patients [12].

PCNE V 6.2 DRP system classification system has been significantly assessed mostly suitable classification that reveals results, and the effects are reproducible [13]. The aim of the study was to identify and describe the magnitude and types of DRPs in patients, to estimate the extent to which pharmacist plays his role in reducing the incidences of DRPs and solving drug-related issues.

Materials and Methods

This Prospective Observational and Interventional study was carried out in the Medicine ward of Rajah Muthiah Medical College and Hospital, Annamalai University during one year from January 2013 to January 2014. The research protocol was

approved by Institutional Human Ethical Committee. The study included 520 hospitalized patients of geriatric age group (≥ 60years) of both sex. Demographic data, medical and medication history were collected from the patient’s case sheet after getting consent from the patients. Then collected information was analyzed according to their age, gender and therapeutic category.

A PCNE v 6.2 DRP system classification is helpful to document DRPs amid the older as it can assist pharmacist build up the strategy to diminish DRPs. The classification tool has been authenticated and was used in a lot of previous published studies to measure DRP occurrence [14-16]. This same tool was used in this study to find out the Causes of DRP, pharmacist intervention in solving DRP and Outcomes of intervention. All collected data were scrutinized with the SPSS v 20 for data management and analyzes in the study. The socio-demographic data were calculated and expressed as percentages. The summarized results were arranged and put into a table form with the use of Microsoft word 2010.

Results and Discussion

A total of 520 geriatric cases were collected from the Rajah Muthiah Medical College and Hospital. In our total study population 342(65.76%) cases were males and 178(34.23%) were females. Tabulated data of study population is given in Table-1.

Table 1: Characteristics of hospitalized geriatric patients

	Number of Patients	Percentage (%)
Gender		
Male	342	65.76
Female	178	34.23
Age Groups		
60 - 64	202	38.84
65 – 69	152	29.23
70 – 74	103	19.80
≥ 75	63	12.11
Demographic Status		
Urban	33	6.34
Rural	487	93.65
Literacy Status		
Illiterate	494	95
literate	26	5
Marital Status		
Never married	2	0.38
Separated	3	0.57
Widow	27	5.19
Married	488	93.84
Therapeutic Category		
Cardiovascular System	147	28.26
Respiratory System	103	19.80
Hepatic System	97	18.65
Endocrine system	73	14.03
Nervous System	41	7.85
Gastrointestinal System	36	6.92
Others	23	4.42
Number of drugs Prescribed		
≤ 5	61	11.73
6 - 8	294	56.53
9 – 12	124	23.84
> 12	41	7.88

Out of 520 geriatric patients, the majority of the elderly patients (38.84%) belongs to age group 60-64 years among that 123 were males and 79 were females followed by age

group 65-69 years (29.23%) among them 99 were males and 53 were female and above75 years (12.11%) patients among them 45 were males 18 were females. 93% of geriatric patients

belong to rural area and only 6.34% geriatric patients belong to urban area (Town). Most of the geriatric patients (95%) were illiterate, remaining 5% of geriatric patients were literate. A study done by Md Rafiq Islam [17] in rural area of Bangladesh (n=300) showed that 61% were illiterate. 93.84% of geriatric patients were married and 5.19% were widower. Only 0.38% of geriatric patients were never married. Geriatric patient's personal habits were observed that reveals 65.57% (n=341) of the patients used Tobacco products. 59.03 % (n=307) of patients used alcohol and habit of smoking. 4.2% of patients had habit of smoking only. 1.53% patients used only alcohol. This study indicates that most prevalent diseases were cardiovascular diseases (28.26%) followed by Respiratory diseases (19.80%), Hepatic diseases (18.65%), Endocrine diseases (14.03%), Nervous diseases (7.85%), Gastrointestinal diseases (6.92%) and other diseases (4.42%).

The majority of patients in our study had co morbid conditions. The prevalent co morbidities in our study are very similar to the ones reported in another Indian study [18]. Loss of functional reserve with aging makes geriatric patients vulnerable to the development of multiple diseases affecting different body systems. The presence of co morbidities means that multiple and complex drug therapy is required and thus the chances of ADRs and drug interactions are greater. The study reveals that 56.53% of geriatric patients were prescribed 6-8 drugs for their treatment of diseases followed by 9-12 drugs (23.84%), ≤ 5 drugs (11.73%) and >12 drugs (7.88%). Poly pharmacy unfortunately is very common in India [19] and some other countries [20-22]. It results in increased cost of treatment, which may lead to non-adherence by patients as they have more medicines than they can cope with. It also increases the risk of significant adverse drug interaction.

Table 2: Definition of DRP classification

Code	DRP	Definition
P1	Adverse reactions	Patient undergoes from an adverse drug event
P2	Drug choice problem	Patient gets or is going to get a mistaken (or no drug) drug for disease or condition
P3	Dosing problem	Patient gets more or less than the quantity of drug he or she needs
P4	Drug use problem	1) wrong drug is taken by patient
P5	Interactions	2) No drug was taken/administered for at least one dose of entire daily dose There is a manifest or potential drug-drug or drug-food or drug-disease interaction

Table 3: The drug-related problems on PCNE Classification

Drug Related Problems	Number of problems	Percentage (%)
Adverse drug reaction	97	12.40
Drug choice problem	264	33.75
Dosing problem	20	2.55
Drug use problem	69	8.82
Drug interaction	332	42.45
Total	782	100

Out of 520 patients, total numbers of 782 DRP were identified among 481 geriatric patients. The DRP were identified that according with their definition which is revealed in the table-2. There was an average of 1.62 problems per patients. The results demonstrated that in 93.27% (n=319) of males and 91.01% (n=162) of females DRPs were recognized. While the

occurrence of DRP in male patients was moderately high, this could be due to the fact that a high number of males stayed the hospital in that exacting time. This demo-graphic report is linked study [23] in their statement in which the occurrence of DRPs was elevated in males (58.06%) as compared to females (41.93%). Though age factor was not considered with DRP in this study.

782 DRPs were examined in this study and the common of the issues were associated to drug interaction of drugs (42.45%; n=332), followed by 33.75 % (n=264) drug choice problem, 12.40 %; (n=97) adverse drug reaction, 8.82%; n=69 drug use problem and 2.55%; n=20 dosing problem is shown Table-3. More number of drugs was prescribed for geriatric patients for their multiple diseases, this leads to drug interaction.

Table 4: Factors association with DRP (n=481)

Characters	Number of patients	DRP		Chi- square	P* -value
		Yes	No		
Gender					
Male	342	319(93.27)	23(6.72)	0.8647	0.3524
Female	178	162(91.01)	16(8.98)		
Polypharmacy					
Yes	459	451(98.25)	8(1.74)	186.9338	0
No	61	30(49.18)	31(50.81)		
Hospital stay					
≤1 week	178	174(97.75)	4(2.24)	10.7641	0.001035
>1 Week	342	307(89.76)	35(10.23)		

*P< 0.05 significant

In this study, statistical dissimilarity was identified between sex and the incidence of DRP. The male patients possess a high possibility (93.27%) of having DRPs match up to female patients (91.01%). They require of confirmation to propose that biological factors related with gender may influence the drug remedy. Gender is not significant at p<0.05 (p=0.3524) to DRP. The problem of Polypharmacy is usually description as a

risk factor that adds to the incidence of DRPs in different study subjects [24, 25]. 98.25% of Polypharmacy patients were exaggerated DRP. Polypharmacy is statistically significant (p= 0) with DRP. 89.76% DRP patients were stayed more than one week in the hospital. Hospital stay is significant at p< 0.05 with DRP (p=0.001).

Table 5: Causes of drug related problems

Primary Domain	Code V6.2	Causes of Drug Related Problems	Number of Causes	Total	Percentage (%)
1. Drug Selection	C1.1	Inappropriate drug (Beer’s criteria)	242	264	45.36
	C1.2	No indication for drug	5		
	C1.3	Inappropriate combination of drug	4		
	C1.4	Drug duplication	4		
	C1.5	Multiple drugs for indication	3		
	C1.6	More cost effective drugs	4		
	C1.7	Preventive drugs not given	2		
2. Drug Form	C2.1	Inappropriate drug form	3	3	0.51
3. Dose Selection	C3.1	Drug dose too low	4	20	3.43
	C3.2	Drug dose too high	6		
	C3.3	Dosage regimen not frequent enough	3		
	C3.4	Dosage regimen too frequent	4		
	C3.5	No therapeutic monitoring	2		
	C3.6	Pharmacokinetic problem requiring dose adjustment	1		
4. Drug Use Process	C5.1	Inappropriate dosing interval	37	69	11.85
	C5.2	Drug underused	5		
	C5.3	Drug overused	4		
	C5.4	Drug not taken/administrated at all	14		
	C5.5	Wrong drug taken/administrated	3		
	C5.6	Drug abused	2		
	C5.7	Patient unable to take prescribed dosage form	4		
5. Logistics	C6.1	Prescribed drug not available	3	11	1.89
	C6.2	Prescribing error(necessary information Missing)	6		
	C6.3	Dispensing error(wrong drug or dose dispensed)	2		
6. Patient	C7.1	Missed dose(patients forget to use/take drug)	213	215	36.94
	C7.2	Unnecessary use of drug	3		

Moreover various causes were recognized (table-5) that be the origin of DRPs. A total of 582 causes were recognized during the study which is relatively more than those found [26] in their study. The widely held of the causes were created by drug selection (45.36%), followed by patients (36.94%), Drug use process (11.85%), Dose selection (3.43), Logistics (1.89%) and Drug form (0.51%). The outcomes from this study exposed that amongst all the causes, “drug selection” was the majority often recognized the cause for DRPs such as drug

choice problems, drug interactions. The DRPs, of causes is directly associated to the dosage selection.

Comparison between factors and classification of DRPs

In this study, some factors like Polypharmacy, hospital stay was compared with various classifications of DRP that was an adverse drug reaction, Drug choice problem, dosing problem, Drug use problem and Drug interaction.

Table 6: Comparison between factors and ADR

Factors	Adverse drug reaction (n=97) (12.40%)			Chi- square	p-value
	Yes	No			
Polypharmacy				17.688	2.5E-0.5
Yes	82(84.53)	369(81.8)			
No	15(15.46)	15(50)			
Hospital stay				8.3839	0.00378
≤1 week	21(33.2)	157(88.20)			
>1 Week	76(63.8)	266(77.77)			

The Polypharmacy is statistically significant at p<0.05(p=2.5E-0.5) with ADR. Hospital stay is statistically significant at p<0.05(0.00378) with ADR (table-6). More number of drugs prescribed for multiple diseases, it leads to

adverse drug reaction in the geriatric patients. All the potential ADR should be engaged into concern, particularly in the older that may experience significant harmful results.

Table 7: Comparison between factors and Drug choice problem

Factors	Drug choice problem (n=264) (33.75%)			Chi- square	p-value
	Yes	No			
Polypharmacy				15.9326	6.6E-05
Yes	237(89.7)	214(47.453)			
No	27(10.22)	3(10%)			
Hospital stay				48.3956	0
≤1 week	128(48.4)	50(28.08)			
>1 Week	136(51.5)	206 (60.23)			

Polypharmacy is statistically significant at p<0.05 (p=6.6E-05) with Drug choice problem.

The hospital stay is statistically significant at p<0.05(p=0) with Drug choice problem (table-7) The second most problem

was drug choice problem same with DRP in this study and this outcome was related to olden studies [27, 28].

Table 8: Comparison between factors and dosing problem

Factors	Dosing problem (n=20) (2.55%)			
	Yes	No	Chi-square	p-value
Polypharmacy				
Yes	17(85)	434(96.23)	2.7401	0.0978
No	3(15)	27(90)		
Hospital stay				
≤1 week	15(75)	163(91.57)	15.3564	8.9E-05
>1 Week	5(25)	337(98.53)		

Polypharmacy is statistically not significant at p<0.05 (p=0.0978) with the dosing problem.

The hospital stay is statistically significant at p<0.05 (p=8.9E-05) with dosing problem (table-8). There is no association of Polypharmacy with dosing problem, but hospital stay is associated with dosing of medicine in geriatric patients.

Table 9: Comparison between factors and Drug use problem

Factors	Drug use problem (n=69) (8.82%)			
	Yes	No	Chi-square	p-value
Polypharmacy				
Yes	52(75.36)	399(88.47)	46.6398	0
No	17(24.63)	13(43.33)		
Hospital stay				
≤1 week	49(71.10)	129(72.47)	47.8132	0
>1 Week	20(28.98)	322(97.07)		

Polypharmacy is statistically significant at p< 0.05 (p=0) with Drug use problem.

The hospital stay is statistically significant at p<0.05 (p=0) with Drug use problem (table-9). The forgetfulness may exist one of the reasons for non-adherence in this study. A systematic review verified the poor compliance in elderly patients who were prescribed more medicines; Non-adherence has confirmed to be related with harmful results such as high levels in the clinical parameter.

Table 10: Comparison between factors and Drug interaction

Factors	Drug interaction (n=332) (42.45%)			
	Yes	No	Chi-square	p-value
Polypharmacy				
Yes	321(96.68)	130(28.82)	15.6665	7.6E-05
No	11(3.31)	19(63.33)		
Hospital stay				
≤1 week	31(9.33)	147(82.58)	252.7629	0
>1 Week	301(90.66)	41(11.98)		

Polypharmacy is statistically significant at p < 0.05 (p=0.) with Drug interaction. The hospital stay is statistically significant at p<0.05 (p=0) with Drug interaction (table-10).

It is an identified the reality that Polypharmacy is powerfully related with DRPs and this has been exposed by several studies [29-32]. The outcomes of our study revealed a significant statistical link between Polypharmacy and drug interactions [33].

Table 11: Pharmacist’s interventions for drug-related problems

Primary domain	Code V6.2	intervention	Number of intervention	Total	Percentage (%)
No intervention	I0.0	No intervention	0	0	0
1. At prescriber level	I1.1	Prescriber informed only	41	149	25.60
	I1.2	Prescriber asked for information	4		
	I1.3	Intervention proposed, approved by prescriber	89		
	I1.4	Intervention proposed not approved by prescriber	13		
	I1.5	Intervention proposed, outcome known	2		
2. At patient/Carer level	I2.1	Patient (medication) counseling	301	386	66.32
	I2.2	Written information provided only	6		
	I2.3	Referred to prescriber	3		
	I2.4	Spoken to family member/Carer	76		
3. At drug level	I3.1	Drug change to	11	41	7.04
	I3.2	Dosage change to	6		
	I3.3	Formulation change to	4		
	I3.4	Instruction of use changed to	7		
	I3.5	Drug stopped	12		
	I3.6	New drug started	1		
4. Others	I4.1	Other intervention	2	6	1.03
	I4.2	Side effects reported to authorities	4		

All the causes of DRP were intervened in various levels, which are shown in table-11. All the intervention were classified according to PCNE, they are prescriber level in the PCNE classification the items I1.1 to I1.5, patients level in the PCNE classification the items I2.1 to I2.4, drug level in the PCNE classification the items I3.1 to I3.6 and other interventions in the PCNE classification the items I4.1 to I4.2. 66.32% (n=386) of intervention were provided in patients level. The medication counseling was the major intervention which needed for Patient to taking their medication properly. 25.60% (n=149) of intervention for Prescriber level. More Interventions were

proposed, and approved by prescriber regarding medication. 7.04% (n=41) of interventions were provided for drug level. Some drugs were stopped and changed, because of their adverse reaction in geriatric patients. The interventions made by the pharmacist were mostly at patient’s level, followed by prescriber level and drug level. These results were not related with the Indian study [34]. Where the recommendations were often given at drug level. Contrastingly no interventions were provided by the clinical pharmacist at patient level. The need of patient-pharmacist communication very important for effective utilisation of medicine.

Table 12: Outcomes of interventions

Primary Domain	Code V6.2	Outcomes	No of problems solved	Total	Percentage (%)
0. Not known	O0.0	Outcome intervention not known	16	16	2.79
1. Solved	O1.0	Problem totally solved	509	509	87.45
2. Partially solved	O2.0	Problem Partially solved	3	3	0.51
3. Not solved	O3.1	Not Solved lack of cooperation of Patient	32	54	9.27
	O3.2	Lack of Cooperation of Prescriber	9		
	O3.3	Intervention not effective	11		
	O3.4	No need or possibility to solve problem	2		

Outcomes of interventions were measured and classified according their category is shown table-12. It reveals that 87.45% (n=509) of problems totally solved, 9.27% (n=54) problems not solved in the PCNE classification the items O3.1 to O3.4, 2.79% (n=16) Outcome of intervention not known and 0.51% (3) partially solved. A similar study has been conducted in Pakistan, that result showing, 86.33% of drug related problems were solved by pharmacist's intervention [35]. This study indicates that pharmacist's intervention is important for solving DRP in the geriatric patients. The overall observation through from this study was that pharmacists have bigger responsibility in elderly healthcare team in minimizing and preventing DRPs and by this means can potentially reduce the unnecessary hospital stay, readmission, laboratory monitoring and drug expenditure.

Conclusion

The most prevalent diseases are cardiovascular diseases, followed by respiratory and hepatic diseases. It is important to realize that the number of medications and treatment with Drugs acting on the gastrointestinal system were the most frequently prescribed drugs, followed by cardiovascular drugs and Antimicrobial drugs, Which are significantly associated with DRPs. Potential drug interactions, Drug choice problem, adverse drug reaction, drug use problem, reduced medication adherence and the lack of health awareness were the most common DRP found in geriatric patients in this study.

The geriatric patients from the hospital using five or more drugs for the treatment of chronic disease are associated with DRP. The results of the present study, the number of DRP increases with the number of drugs prescribed. Particularly in the geriatric patient group, the occurrence of DRP may result in increased risk of hospital readmission, morbidity, mortality, and health care costs. The clinical pharmacists should identify, resolves, and prevents the occurrence of DRP that is the important task for in this group of patients.

The drug selection is the most frequently identified cause for DRPs. Poly pharmacy and the hospital stay are significantly associated with various DRPs. More interventions were provided to the patient level, compare with prescriber level. Patient medication counseling is the most intervention in the study. Interventions proposed by a clinical pharmacist to tackle or avert medication related issues are to a huge degree acknowledged and endorsed by the prescribers. Most of the interventions are of high clinical importance. Outcomes of interventions indicate that almost 87.45% of problems are totally solved, by pharmacist's interventions in this study; it is expanding proof that support and intercession of clinical pharmacists in geriatric health care have a positive influence on clinical outcomes.

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