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Original Research

Identification of Drug-Related Problems (DRPS) of drugs with special dosage forms in geriatric patients (study at the outpatient pharmacy unit, Airlangga University Hospital, Surabaya)

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Abstract

Background: Geriatric syndrome is a condition of decreased organ function that causes DRPs, especially drugs with special dosage forms, such as an inhaler, insulin pens, and modified release drugs. Objective: To identify DRPs of drugs with special dosage forms in geriatric patients at the Outpatient Pharmacy Unit of RSUA Surabaya. **Methods:** It was an observational and prospective study with the interview method. Each problem identified was given a score to be analyzed descriptively and statistically. Data collection was carried out from April to June 2022. **Results:** The sample is 82 special dosage forms, there are drug delivery devices including inhaler (26%) and insulin pen (29%), and drug delivery systems including OROS (33%), retard (6%), and sustained-release (6%). DRPs were found in 40% of them. In inhaler form, the DRPs of DPI are failure to load the dose, shaking after the dose was loaded, and not checking the remaining dose after using the device. While in MDI, no DRPs were found. The DRPs of insulin pens are errors in device storage (25%), injection position (8%), and repeated use of blunt/broken needles (38%). While in modified release drugs is an error in drug storage (5%). The percentages of nonadherence are Turbuhaler 33%, Breezhaler 60%, Diskus 25%, MDI 0%, insulin pen 29%, and modified release drugs 24%. The solution is given by using verbal education such as leaflets. Statistical analysis showed a significant difference in the insulin pen and the modified release drug, while there was no significant difference in the inhaler. **Conclusion:** Each type of drug with a special dosage form has its problems and problem-solving in the form of interventions has not given maximum results.

Keywords: drugs with special dosage forms; geriatrics; drug-related problems; prospective studies; statistical analysis

INTRODUCTION

Geriatric patients are patients over 60 years old with multiple diseases due to decreased organ function. Under normal conditions, geriatric patients experience changes in cognitive, affective and psychomotor aspects.[1] In this situation, geriatric patients experience a condition called a geriatric syndrome. That was a multifactorial condition involving many risk factors with increasing age leading to decreased function and organ damage.[2] Geriatric syndrome and multimorbidity causes Drug Related Problem, especially drugs with special dosage forms.

Drugs with special dosage forms are drugs that with devices that have a special way of use (drug delivery device) and modified release drugs (drug delivery system).[3-5] In clinical practice, drug delivery devices consist of inhaler forms, namely dry powder inhaler (DPI) such as diskus, turbuhaler, breezhaler and metered dose inhaler (MDI), pen form such as insulin pen, and others. Meanwhile, drug delivery systems are modified releases drugs such as OROS, retarded and sustained release.[6,7]

Inhalers have different critical points. For example, the MDI requires slow and deep inhalation and hand-breath coordination, while the DPI requires strong and fast breaths.[8] The use of complex and specific tools makes it difficult for geriatric patients to apply it.[8,9] This is evidenced in a systematic literature review and meta-analysis study in 2017 that there are 50-100% of patients who make at least one error in using the tool.[10]

Another drug delivery device is a pen-shaped device such as an insulin pen. The critical point of administering insulin therapy in geriatric patients is dosing errors.[11] Patient safety, especially the incidence of hypoglycemia, is a concern for patients taking insulin.[11] In 2014, it was reported that 58% of diabetic patients had hypoglycemia.[12] In addition, DM patients often do not rotate injections. Injection rotation is done to avoid the risk of lipodystrophy.[13]

Besides to drug delivery devices, drugs with other special dosage forms are drugs with modified drug delivery systems (drug delivery systems), inconventional tablets. The rationale for administration of inconventional tablets is the peak plasma concentration profile that forms inconsistent fluctuations that can lead to under or excessive drug concentrations. The fluctuations that occur cause Adverse Drug Reactions (ADR), especially drugs with a narrow therapeutic index.[14] The critical

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point of this preparation is should not be crushed, broken or broken the drugs into small parts. Crushed drugs may risk of overdose by releasing high doses of the drug (dumping dose) and causing intoxication.

The use of drugs with special dosage forms has been proven to cause problems in geriatric patients.[15] In addition, physiological functions, comorbidities and complications as well as polypharmacy also have the potential to cause drug use errors that have an impact on patient safety. Therefore, this study will give information in identifying and evaluating drug therapy with special dosage forms in geriatric patients and providing solutions to improve the quality of services and counseling education for geriatric patients so as to increase the cure rate and success of therapy.

SUBJECT AND METHOD

Study design

This was observational-prospective study. The DRPs were identified through interviews. Medication counseling was given by pharmacist before patient do the interview. Participant interviewed two times (pretest and posttest). The pretest, the patient was asked questions and identified how they use the drugs. Problems found given a solution by verbal and nonverbal education (leaflets). After a month, the patient will be interviewed again with the same question. Then each problem will be given a score for analysis.

Study participant

The population was all outpatient geriatric patients who were given prescription services at the Outpatient Pharmacy Unit, Airlangga University Hospital, Surabaya. The sample was all outpatient geriatric patients from April to June 2022 who were given prescription services at the Outpatient Pharmacy Unit, Universitas Airlangga Surabaya, which met the inclusion criteria. Inclusion criteria were geriatric patients who were given prescription services at the Outpatient Pharmacy Unit of Airlangga University Hospital Surabaya who received drug therapy in special dosage forms and had used it at least once in the period from April to June 2022 and patients were willing to conduct interviews. Dropout criteria were geriatric patients who died before the posttest interview and patients who did not return a maximum of 1 week after the control time.

Study area and period

The study was conducted at the Outpatient Pharmacy Unit of the Airlangga University Hospital, Surabaya with sampling time from April to June 2022.

Data collection and identification of DRPs

The sampling technique used is time limited sampling. The samples taken were those that met the inclusion criteria during the study period. The research instruments were informed consent forms, e-prescriptions and data collection sheets. The number of questions that need to be answered by the patient is 38 items for drugs in the form of drug delivery devices and 26 items for drugs in the form of drug delivery systems. Then the problems found are classified based on the problem category (11 categories). Then each problem will be given a score for analysis.

Data analysis

Data analysis was carried out descriptively and statistically. Descriptive analysis is presented in the form of tables, diagrams or graphs covering patient characteristics, drug therapy with special dosage forms, and drug problems with special dosage forms in geriatric patients. Statistical analysis was used to determine the difference between the problem before and after the solution was given.

Ethical considerations

This research was analyzed and selected by the ethics committee of the Airlangga University Hospital Surabaya before the research was conducted. If this research meets the code of ethics, a Certificate of Ethical Eligibility will be issued.

RESULT

Subject characteristics

Based on the data obtained, the number of male geriatric patients who received prescription drugs with special dosage forms was more than female patients. This result occurs due to genetic factors, hormonal factors (such as insulin sensitivity) and also lifestyle habits such as smoking.[16,17] Drugs with special dosage forms are most widely used at the age of 60-69 years (young seniors). This study obtained 4 major groups of diseases diagnosed in geriatric patients including circulatory, endocrine, respiratory, and genitourinary system disorders (Table 1). Based on this diagnosis prescribed drugs with special dosage forms as in Table 2.

Table 1. Characteristics of geriatric patients

Characteristics		**Patient (n = 58)**	**%**
Gender			
Man		39	67
Woman		19	33
Age*			
60-69 (young seniors)		35	60
70-79 (middle elderly)		18	31
80 (elderly)		5	9
Codification based on patient diagnosis**			
I	Circulatory system disorders	32	55
	Hypertension Atherosclerosis Heart rhythm disturbances Cerebral infarction		
E	Endocrine system disorders	15	26
	Type 1 diabetes mellitus Type 2 diabetes mellitus		

J	Respiratory system disorders	15	26
	Asthma COPD		
N	Disorders of the genitourinary system	10	17
	Chronic kidney disease (CKD) Prostate enlargement		
G	Nervous system disorders	3	5
	Parkinson Insomnia		
Z	Preview of coronary angioplasty implant and graft	3	5
B	Infectious disease	1	2
	Tuberculosis		

Notes: *Age of geriatric patients is classified based on the Central Bureau of Statistics (2020); **Classification of patient diagnosis based on ICD-X, 1 patient can have more than 1 diagnosis

Table 2. Distribution of drug use in geriatric patients

Drugs with special dosage forms	**Drugs (n=82)**	**%**
Drug delivery device	45	55
Inhaler form	21	26
pen shape	24	29
Drug delivery system	37	45
OROS (Osmotic-controlled release oral delivery system)	27	33
retard	5	6
Sustained-release	5	6

Problems with the use of drugs with special dosage forms

Based on the data obtained, drugs with special dosage forms that have problems are 33 preparations (40%) (Figure 1).

Problems with the use of drugs in the form of inhalers

Inhaler form that is most used by geriatric patients is Turbuhaler. Drug profiles by inhaler form are shown in (Table 3). The patient obtained a maximum score of 38 in MDI, which means that there were no drug use problems. In the DPI preparation, Turbuhaler, technical errors were found in the form of dosage preparation errors and shaking the inhaler after dosage preparation. In Breezhaler and diskus, it was found that the use of drugs was irregular, the patient had difficulty opening the preparation, preparing the dose and shaking the device after preparation which should not be allowed (Table 4).

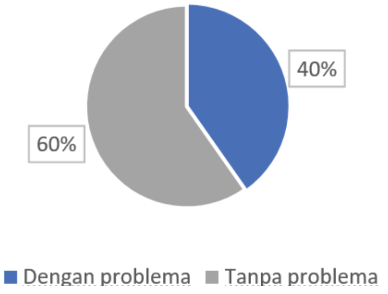

Figure 1. Drug problems in geriatric patients

Table 3. Inhaler profile in geriatric patient

Inhaler profile	**Drugs (n=21)**	**%**
Type of inhaler		
Turbuhaler	9	43
Breezhaler	5	24
Diskus	4	19
Metered dose inhaler	3	14
Inhaler drug class		
LABA + ICS	13	62
LABA	5	24
SABA	3	14
Frequency of use of inhaler*		
2 times/day	14	67
1 time/day	7	33
PRN / when it's tight	3	14
Length of use**		
5 years	21	100
6-10 years	0	0
>10 years	0	0

Table 4. Distribution of the causes of Dry Powder Inhaler (DPI) problems based on Beers et al., 2014 with modifications

Inhalation technique	**problem**	**Solution**	**Turbuhaler n=9(%)**		**Breezhalers n=5(%)**		**Diskus n=4(%)**	
			1st Interview	**2nd Interview**	**1st Interview**	**2nd Interview**	**1st Interview**	**2nd Interview**
Understanding drug uses instruction	Difficulty reading and understanding the instructions	Provision of drug information and leaflets	1 (11)	1 (11)	0 (0)	0 (0)	0 (0)	0 (0)
Adherence to medication	Non-adherence to medication	Alarm, family reminder	3 (33)	3 (33)	3 (60)	2 (40)	1 (11)	0 (0)
Opening the packaging	Failed to open	Educate on how to use the right medicine with leaflets	0 (0)	0 (0)	0 (0)	0 (0)	1 (25)	1 (25)
Medication preparation Check the dosage before use Open the mouthpiece and insert the capsule	Do not check the remaining dose before use	Explains how to check remaining drug doses with leaflets	2 (22) -	2 (22) -	- 0 (0)	- 0 (0)	1 (25) -	1 (25) -

Dosage preparation Piercing the capsule Twist error	Incorrect dose preparation	Educate on how to use the right medicine with leaflets	- - 2 (22)	- - 1 (11)	0 (0) - -	0 (0) - -	- 1 (25) -	- 0 (0) -
Shaking the inhaler after dosage preparation is not allowed	Shaking the inhaler after dosage preparation	Educate on how to use the right medicine with leaflets	1 (11)	0 (0)	0 (0)	0 (0)	1 (25)	1 (25)
Check remaining dose	Not checking the remaining dose	Explains how to check remaining drug doses with leaflets	0 (0)	0 (0)	0 (0)	0 (0)	1 (25)	1 (25)

Problems with the use of pen-shaped drugs

The insulin pen profile including insulin type, frequency and duration of insulin pen use is listed in Table 5. Errors in insulin pen use are shown in Table 6. The same results were found in a previous study that there were 75% of patients who kept their insulin pens at room temperature which should be at 2-8°C, >60% of patients used needles ≥5 times which should change needles every time, and only 60% of geriatric patients who used needles. inject insulin at the right angle.[18,19]

Table 5. Insulin pen profile

Insulin pen profile	Number of drugs (n=24)	%
Type of insulin		
Rapid-acting insulin	11	46
Insulin aspart	10	42
Insulin glulisine	1	4
Long-acting insulin	11	46
Insulin detemir	6	25
Insulin glargine	5	21
2-in1 Insulin Co-Formulation	2	8
Insulin degludec+insulin aspart	2	8
Frequency of insulin use		
3 times/day	11	46
2 times/day	2	8
1 time/day	11	46
Length of use*		
5 years	19	79
6-10 years	4	17
>10 years	1	4

Problems with drug use with modified release

The profile of modified release drugs shown in Table 7. Based on the data obtained, the DRPs of modified release drug are non-adherence to medication and drug storage error (Table 8).

Category of DRPs with special dosage forms

The problem category is based on,[20,21] and Lim et al., 2018. Table 9 can be seen that the number and percentage of medication at the 2nd interview decreased compared to the 1st interview. This means that the DPRs is resolved after given a solution.

Table 6. Distribution of the causes of insulin pen problems based on Beers et al., 2014 with modification

Injection technique	problem	Solution	insulin pen n=24(%)	
			1st Interview	2nd Interview
Adherence to medication	Non-adherence to medication	Alarm, family reminder	7 (29)	3 (12)
Medication storage	Incorrest storage of new insulin pens at room temperature	Education for new insulin pen storage in the refrigerator	6 (25)	0 (0)
Upright injection position	The injection position is too tilted	Educate the technique of injecting vertically with leaflets	2 (8)	0 (0)
Using the needle once or replace when it's dull	Using pen needle for a week – a month or until dull	Education on needle uses is 3 times then replace it, education on how to know a blunt needle by scraping on the hand, if you feel jagged, then it's time to replace the needle, and education the right way to inject insulin	8 (38)	4 (17)

Table 7. Modified release drugs profile

Drug profile with modified release	Number of drugs (n=37)	Drugs with Modified Release n=37(%)
Frequency of drug use		
2 times/day	35	86
1 time/day	2	14
Length of use*		
5 years	35	95
6-10 years	2	5
>10 years	0	0

Table 8. Distribution of the causes of modified release drugs problem based on Beers et al., 2014 with modified

Drug Use Techniques	problem	Solution	Drugs with Modified Release n=37(%)	
			1st Interview	2nd Interview
Adherence to medication	Non-adherence to medication	Alarm, family reminder	9 (24)	0 (0)
Medicine storage	Incorrect storage of drugs in the refrigerator which should be at room temperature	Education for drugs storage at the room temperature	2 (5)	1 (3)

Table 9. Category of drug problem with special dosage form based on Beers et al., 2014; PCNE, 2017; Lim et al., 2018 with modifications

Problem category	Drug delivery device										Drug delivery system	
	Turbuhaler n=9(%)		Breezhaler n=5(%)		Diskus n=4(%)		MDI n=3(%)		insulin pen n=24(%)		Drugs with Modified Release n=37(%)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Adherence to medication	3 (33)	3 (33)	3 (60)	2 (40)	1 (25)	0 (0)	0 (0)	0 (0)	7 (29)	4 (17)	9 (24)	1 (3)
Incorrect storage	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (25)	0 (0)	2 (5)	1 (3)
Error using the device	2 (22)	2 (22)	0 (0)	0 (0)	1 (25)	1 (25)	0 (0)	0 (0)	8 (33)	4 (17)	0 (0)	0 (0)
Do not follow the medication instructions	1 (11)	1 (11)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uncontrolled disease	3 (33)	2 (22)	0 (0)	1 (20)	0 (0)	0 (0)	1 (33)	1 (33)	13 (54)	13 (54)	9 (24)	10 (27)

Statistical analysis the DPRs between before and after the solution

Cause of DRPs: The results of the significance value of the normality test were found to be 0.00 (<0.05) so that the data were not normally distributed (Table 10). Then test the difference between the problems before and after the solution was given with the Wilcoxon non-parametric test (Table 11). Wilcoxon non-parametric test results showed a significant difference between the 1st and 2nd interview scores on insulin pens and modified-release drugs. However, no significant differences were found in the turbuhaler, breezhaler and diskus.

Problem categories: The results of the significance value of the normality test for the problem category score obtained 0.00 (<0.05) so that the data is not normally distributed, as shown in Table 12. Then test the difference between the problems before and after the solution was given with the Wilcoxon non-parametric test. Wilcoxon non-parametric test results showed that there was a significant difference between the 1st and 2nd interview scores on insulin pens and modified-release drugs. However, there was no significant difference in turbuhaler, breezhaler, and diskus. (Table 13)

DISCUSSION

Drugs with special dosage forms in this study were inhaled drugs. In MDI, the researcher did not find any usage problems. The score obtained by the patient during the 1st and 2nd interviews was the maximum score, which was 38.00 ± 0.00. This means that each question point is done correctly by the patient. The results obtained are different from previous research which states that MDI users tend to make more mistakes than DPI users.[10] In geriatric patients there is a decrease in lung function,

Table 10. The normality score test result for the cause of problem

	Kolmogorov-Smirnov. test (p)
1st interview score related to cause	0.00
2nd interview score related to cause	0.00

Table 11. Wilcoxon non-parametric test results for the cause of the problem

Drugs with special dosage forms	Score		p
	1st Interview	2nd Interview	
Turbuhaler	36.78 ± 2.04	37.00 ± 1.65	0.157
Breezhaler	37.40 ± 0.54	37.60 ± 0.54	0.317
Diskus	36.50 ± 2.38	37.00 ± 2.00	0.157
Insulin pen	37.04 ± 0.86	37.71 ± 0.55	0.002
Drugs with modified release	25.70 ± 0.52	25.95 ± 0.23	0.007

Table 12. The normality test result for the problem category

	Kolmogorov-Smirnov. test (p)
1st interview scores related to the problem category	0.00
2nd interview score related to problem category	0.00

Table 13. Wilcoxon Non-parametric test results for the category problem

Drugs with special dosage forms	Score		p
	1st Interview	2nd Interview	
Turbuhaler	1.00 ± 1.11	0.89± 1.16	0.317
Breezhaler	0.60 ± 0.54	0.60± 0.54	1,000
Diskus	0.50 ± 0.58	0.25± 0.50	0.317
Insulin pen	1.42 ± 0.83	0.83± 0.56	0.002
Modified release drugs	0.54 ± 0.69	0.30 ± 0.46	0.029

such as decreased respiratory muscle strength, diaphragm, recoil elasticity, decreased sensory, motor, and muscle mass.[1] This can cause difficulty hand-breathing coordination when using the MDI. However, this error was not found by the researcher.

The next inhaler preparation is DPI, namely turbuhaler. In this preparation, there were 1 (11%) preparation where the patient had difficulty reading and understanding the instructions for use. Cognitive function is an important factor to perform the inhalation technique well. Comorbidities, such as Alzheimer's, Parkinson's, and stroke are usually found in patients with cognitive impairment. However, it can also occur due to hypoxemia or depression.[22] In addition, patients should check the dosage of the preparation before use. This study found that 22% of preparations were not dose checked by geriatric patients. Checking the dosage of the preparation before use is done to ensure that the dosage in the preparation is still there. In the turbuhaler, dosage preparation is done by rotating the preparation 2 times until it clicks. Failure of dose preparation causes the drug to not come out of the preparation so that the patient breathes empty air during inhalation. This study also found 11% of the preparations were shaken by patients after dosage preparation was carried out. Shaking the DPI after dosage preparation should not be done because it causes loss of drug dose.[23]

In the breezhaler, the researcher found no misuse (Table V.4). However, the investigators found 60% of the preparations were not used regularly by the patients. Based on GINA 2022, recommendations for long-term inhaled corticosteroid therapy are used in patients with persistent asthma. Judging from the function and active ingredients used, DPI contains ICS-LABA which includes budesonide-formoterol on turbuhaler and salmeterol-fluticasone on diskus or LABA alone such as indacaterol on breezhaler. This active ingredient is used on a regular basis to control asthma and prevent exacerbations.

The next DPI preparation is diskus. Based on the results in Table V.4, the mean score of interviewing geriatric patients who used diskus was the lowest compared to other inhaler forms. This shows that geriatric patients experience the most problems when using diskus. The way to open the diskus is by sliding the groove on the slide using your thumb. Then the dosage preparation is done by sliding the lever using the thumb as well.[24] Problems in opening the preparation and dosage preparation on the diskus were found in 25% of the preparations. After using the inhaler, the patient needs to check the remaining dose on the preparation. This is important to make sure the patient has inhaled the medicine.[22] Agility and strength play an important role in inhaler handling. DPI is a preparation that does not require hand-breath coordination as in MDI. However, DPI requires dexterity to dose preparation and puncture the capsule before the inhaler is used.

The Second drug delivery device which is frequently prescribed for the geriatric patients is insulin pen. In this study, the problems found in the use of insulin pens were the errors in storage of preparations, injection position, and repeated use of blunt/broken needles (Table 6). New insulin pens should be stored at 2-8oC or in the refrigerator, but should not be frozen. Freezing insulin preparations can reduce its effectiveness.[25] However, after insulin is used, insulin opinion is stored for 4 weeks at room temperature. Injecting insulin at low temperatures can cause pain to the patient.[19] The needle size used by the patient in this study was 4mm long. This size is ideal for achieving the intramuscular position when injected vertically or at a 90^o angle.[26] In this study, it was found that patients who inject were too tilted, causing pain during injection. In addition, needles should be changed after each use. The reason for the repeated use of needles that patients usually convey is that the patient feels that the needles prescribed by the doctor are used for 1 month. The average number of needles doctors prescribe is 2-4 needles. In addition, saving money is also a reason for patients not to buy additional needles.[18] Repeated use of needles can eliminate the sterility of the needles. In addition, needle tip damage such as blunt and broken were also found. If the blunt needle is still used, the patient will feel pain when injecting insulin. The solution given by the researcher is to educate the use of needles a maximum of 3 times as well as education on how to find a blunt needle. This education provides a change in the form of a decrease in the use of repeated needles from 8 pens (38%) to 4 pens (17%). In this study, it was found that 29% of the preparations were not used regularly by patients. Irregular use of insulin leads to an increased risk of hyperglycemia.[27]

In drug delivery system, drugs with modified release were found to be OROS, retarded and sustained-release. The problems of drug use found were drug storage errors and irregular drug use. Drug storage errors occurred in nifedipine OROS, namely in the refrigerator (Table V.7). Storage of nifedipine OROS is at <30°C but should not be frozen. Judging from the problem of drugs with other special dosage forms, irregular drug use almost always appears as a problem. Research by Yap stated that there are several factors that cause geriatric patients not to comply with medication, including 1) patient factors, 2) drug factors, 3) health personnel factors, 4) health care system factors, and 5) socioeconomic factors. Compliance with treatment depends on each individual, the willingness and ability of each individual. Geriatric patients who have experienced geriatric syndrome conditions, namely a decrease in organ function becomes an obstacle in carrying out treatment.[28] Counseling and approach by pharmacists as well as family and environmental support are needed to improve geriatric patient compliance in undergoing treatment. In this study, many geriatric patients came to the Airlangga University Hospital without their families or caregivers. The users of this dosage form are patients with a chronic disease, which means that they use it for a long time. Patients and caregivers refuse to listen what the pharmacist re-explains because they already know how to use the medications. It is necessary to regularly monitor whether the technique is correct. In previous studies, the most common errors found in the use of modified-release drugs were breaking, grinding and chewing of modified-release drugs. If this is done, it will cause a dumping dose.[29] However, in this study, researchers did not find the same problem.

This study creates a modified problem category from Lim et al., 2018; PCNE, 2017; Beers et al., 2014. Of the 11 categories made, the causes of the problems found fall into 5 categories, including irregular drug use, storage errors, incorrect use of tools, drug use not according to instructions, and uncontrolled disease. Researchers categorize the disease is not controlled by looking at the data on blood pressure, blood glucose levels, and symptoms experienced by patients. In this study, 22% DPI, 33% MDI, 54% insulin pens and 27% modified-release preparations were used by patients with uncontrolled disease. Looking at the percentage of types of drugs, there is a decrease in the number of drugs that fall into the problem category (Table 9).

Statistical analysis was carried out to determine the difference in the problem after being given a solution. The results of the Wilcoxon test for problem-causing scores and problem categories showed significant differences in the 1st and 2nd interview scores on insulin pens and modified-release drugs. This states that the solution provided by the researcher can overcome the problem of drug use in geriatric patients. However, the turbuhaler, breezhaler, diskus and MDI showed no significant difference between the 1st and 2nd interview scores. The average score for the cause of problems in inhaler preparations tends to increase. This means that the use of inhaled drugs in geriatric patients is getting better. However, based on statistical tests did not show a significant difference. Likewise, the score for the problem category tends to decrease, which means that there are fewer problems with using inhalers in geriatric patients, but it does not provide a significant difference in statistical analysis. This is different from previous studies which stated that there were significant differences in the technique of using drugs with special dosage forms before and after being given education by health workers. There was no significant difference between the 1st and 2nd interviews, possibly related to the decline in organ function in geriatric patients, the effectiveness of education by the investigators or due to the correct patient use technique at the 1st and 2nd interviews, such as in the MDI. This is different from previous studies which stated that there were significant differences in the technique of using drugs with special dosage forms before and after being given education by health workers. There was no significant difference between the 1st and 2nd interviews, possibly related to the decline in organ function in geriatric patients, the effectiveness of education by the investigators or due to the correct patient use technique at the 1st and 2nd interviews, such as in the MDI. This is different from previous studies which stated that there were significant differences in the technique of using drugs with special dosage forms before and after being given education by health workers. There was no significant difference between the 1st and 2nd interviews, possibly related to the decline in organ function in geriatric patients, the effectiveness of education by the investigators or due to the correct patient use technique at the 1st and 2nd interviews, such as in the MDI.[19,30] Previous research has stated that the success rate of patients when using inhalers depends on the first verbal and nonverbal education and regular monitoring of use techniques.[15]

This research was conducted on all drugs with special dosage forms include drug delivery device and modified release drugs in Airlangga University Hospital. In this study, patients can find out their drug use problems and get appropriate solutions with verbal and nonverbal counseling (leaflets). However, this study was only conducted for two months so this is necessary to do a longer period of research to eliminate biased results.

CONCLUSION

Based on the results of the identification of problems with the use of drugs with special dosage forms as many as 82 preparations in geriatric patients, it can be concluded that:

Problems with the use of drugs with special dosage forms:

The forms of DPI are failure of dose preparation, the presence of shaking after preparation, not checking the remaining dose after using the device, and irregular drug use. While on MDI no problems were found.

Types of insulin pens: incorrect storage of preparations, position when injecting, repeated use of blunt/broken needles, and irregular drug use.

Drug preparations with modified release: drug storage errors, and irregular drug use.

Efforts to solve the problem of using drugs with special dosage forms in the form of interventions with verbal and nonverbal counseling (leaflets) have not given maximum results.

Drug Related Problems of drugs with special dosage forms including special drug delivery devices and modified release drugs are found in geriatric patients. These errors cannot be underestimated because it can lead to inadequate therapeutic outcomes, loss of therapeutic effectiveness and increased health care costs. Verbal and non-verbal counseling (leaflets) from healthcare professionals must consider the potential and risk of drug use errors, take a prevention, and correct it when find an error. There are several things that require further research such as how long and how much frequency of counseling is needed to resolve this problem in order to achieve the effectiveness of therapy and medication safety.

References

1. Halter JB. Hazzard's Geriatric Medicine and Gerontology. 7th ed. China: McGraw-Hill Education. 2017.
2. Carlson C, Merel SE, Yukawa M. Geriatric Syndromes and Geriatric Assessment for the Generalist. Medical Clinics of North America. 2015;99(2):263-279. https://doi.org/10.1016/j.mcna.2014.11.003
3. Allen LV, Ansel HC. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems. 10th ed. Philadelphia: Lippincott Williams & Wilkins. 2014.
4. Etse J. Novel Dosage Form Analysis. 2 ed., Separation Science and Technology. 2nd ed. New Jersey, USA: Elsevier Inc. 2011.

https://doi.org/10.1016 /B978-0-12-375680-0.00006-1

5. Atkin S, Javed Z, Fulcher G. Insulin degludec and insulin aspart: Novel insulins for the management of diabetes mellitus. Therapeutic Advances in Chronic Disease. 2015;6(6):375-388. https://doi.org/10.1177/2040622315608646
6. Dolovich MB, Dhand R. Aerosol drug delivery: Developments in device design and clinical use. The Lancet. 2011;377(9770):1032-1045. https://doi.org/10.1016/S0140-6736(10)60926-9
7. Clark AR, Weers JG, Dhand R. The Confusing World of Dry Powder Inhalers: It Is All about Inspiratory Pressures, Not Inspiratory Flow Rates. Journal of Aerosol Medicine and Pulmonary Drug Delivery. 2020;33(1):1-11. https://doi.org/10.1089/jamp.2019.1556
8. Haughney J. Choosing inhaler devices for people with asthma: Current knowledge and outstanding research needs. Respiratory Medicine. 2010;104(9):1237-1245. https://doi.org/10.1016/ j.rmed.2010.04.012
9. Ibrahim M, Verma R, Garcia-Contreras L. Inhalation drug delivery devices: Technology update. Medical Devices: Evidence and Research. 2015;8(1):131-139. https://doi.org/10.2147/MDER.S48888
10. Chrystyn H. Device errors in asthma and COPD: Systematic literature review and meta-analysis. Primary Care Respiratory Medicine. 2017;27(1):1-9. https://doi.org/10.1038/s41533-017-0016-z
11. Wright BM, Bellone JM, McCoy EK. A review of insulin pen devices and use in the elderly diabetic population. Clinical Medicine Insights: Endocrinology and Diabetes. 2010;3:53-63. https://doi.org/10.4137/CMED. S5534
12. Mira JJ. Oversights, confusions and misinterpretations related to self-care and medication in diabetic and renal patients. Medical Principles and Practice. 2014;23(3):246-252. https://doi.org/10.1159/000358225
13. Hambridge K. The management of lipohypertrophy in diabetes care. British journal of nursing (Mark Allen Publishing). 2007;16(9):520-524. https://doi.org/10.12968/bjon.2007.16.9.23428
14. Murugesan S. Oral Modified Drug Release Solid Dosage Form with Special Reference to Design; An Overview. Current Drug Research Reviews. 2020;12(1):1-10. https://doi.org/10.2174/2589977511666191121094520
15. Mira JJ. A systematic review of patient medication errors on self-administering medication at home. Expert Opinion on Drug Safety. 2015;14(6):815-838. https://doi.org/10.1517/1474 0338.2015.1026326
16. Tramunt B. Sex differences in metabolic regulation and diabetes susceptibility. Diabetologia. 2019. https://doi.org/10.1007/s00125-019-05040-3
17. Reitsma MB. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and initiation among young people in 204 countries and territories, 1990–2019. The Lancet Public Health. 2021;6(7):e472-e481. https://doi.org/10.1016/S2468-2667(21)00102-X
18. Spollett G. Improvement of Insulin Injection Technique: Examination of Current Issues and Recommendations. Diabetes Educator. 2016. https://doi.org/10.1177/0145721716648017
19. Gorska. Improved insulin injection technique, treatment satisfaction and glycemic control: Results from a large cohort education study. Journal of Clinical and Translational Endocrinology. 2020. https://doi.org/10.1016/j.jcte.2020.100217
20. Beers E. Practical problems with medication use that older people experience: A qualitative study. Journal of the American Geriatrics Society. 2014;62(12):2339-2344. https://doi.org/10.1111/jgs.13126
21. PCNE. Classification for Drug Related Problems. Pharmaceutical Care Network Europe Association, 2017;8(2):1-10. Available at: https://www.pcne.org/upload /files/318_PCNE_classification_V8-03.pdf
22. Barrons R, Pegram A, Borries A. Inhaler device selection: Special considerations in elderly patients with chronic obstructive pulmonary disease. American Journal of Health-System Pharmacy. 2011;68(13):1221-1232. https://doi.org/10.2146/ajhp100452
23. Price DB. Inhaler Errors in the CRITICAL Study: Type, Frequency, and Association with Asthma Outcomes. Journal of Allergy and Clinical Immunology: In Practice. 2017;5(4):1071-1081.e9. https://doi.org/10.1016/j.jaip.2017.01.004
24. NPS MedicineWise. Inhaler technique: Device-specific checklists, NPS Medicine Wise. 2020. https://doi.org/10.7748/ns.26.29.55.s49
25. Kramer. Storage Of Insulin – IDF Europe Awareness Paper. 2020.
26. Gibney MA. Skin and subcutaneous adipose layer thickness in adults with diabetes at sites used for insulin injections: Implications for needle length recommendations. Current Medical Research and Opinion. 2010;26(6):1519-1530. https://doi.org/10.185/03007995.2010.481203
27. Sarbacker GB, Urteaga EM. Adherence to insulin therapy. Diabetes Spectrum. 2016. https://doi.org/10.2337/diaspect.29.3.166
28. Yap. Medication adherence in the elderly. Journal of Clinical Gerontology and Geriatrics. 2016. https://doi.org/10.1016/j.jcgg.2015.05.001
29. Aldila F, Walpola RL. Medicine self-administration errors in the older adult population: A systematic review. Research in Social and Administrative Pharmacy. 2021;17(11):1877-1886. https://doi.org/10.1016/j.sapharm.2021.03.008
30. Al-Showair RAM. Can all patients with COPD use the correct inhalation flow with all inhalers and does training help? Respiratory Medicine. 2017;101(11):2395-2401. https://doi.org/10.1016/j.rmed.2007.06.00
31. Cipolle RJ, Strand LM, Morley PC. Pharmaceutical Care Practice: The Patient Centered Approach to Medication Management Services. Pharmaceutical Care Practice: The Patient-Centered Approach to Medication Management Services. 2012;3e(Part D):1-30.