

## Original Research Article

# Conformity assessment of drugs used by the elderly in terms of the beers criteria

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## ABSTRACT

**Background:** The risk of drug-drug interactions is more probable among the elderly population than that of the young patients, and this emerges as a potentially vital issue. Therefore, this survey aims to describe the conformity assessment of drugs used by the elderly in terms of The Beers Criteria.

**Methods:** This descriptive study was conducted at two different nursing-homes with 301 seniors. The-AGS-2012-Beers-Criteria-List and a questionnaire, assessing the socio-demographic characteristics and the health-condition/illness-history of the elderly, were used in collecting the data. The data were gathered July 2013-July 2014, and evaluated via SPSS 16.0. Descriptive-statistics and the chi-square-test were used to identify the data.

**Results:** The mean-age was  $79.01 \pm 8.13$ . The most-common co-morbidity was brain-and-nervous-system-disorders, with a rate of 31.1%. The average-number of chronic-diseases was  $3.5 \pm 1$ ; three and more co-morbidity rate of the individuals was 70.8%. The mean-quantity-of-medicine was  $5.4 \pm 3.24$ . The most-frequently-used-drugs were Antidementia/Alzheimer's-Disease and Non-Steroidal-Anti-Inflammatory-Drugs (NSAIDs) 37.5% and 33.2% respectively. It was stated that 21.1% of-all-the-medication consumed-by-the seniors were "risky-to-use" according to The Beers Criteria. It was also reported that 23.8% of-all-medication used by the 65-74 age-group, 19% of-all-drugs used by the 75-84 age-interval, and 21.2% of-all-the medicine consumed by the 85-and-older-group were found "inappropriate" in terms of The Beers Criteria.

**Conclusions:** In conclusion, the seniors have consumed a large-quantity-of-medicine; a significant-portion was concluded to be inappropriate-for-use in terms of the drug-drug and the drug-disease interactions according to The Beers Criteria. Nursing-home-health-care-professionals should re-assess the-medication-plans of the elderly by considering the-interaction-related-problems and should be aware of the potential-risks-of-the-drugs was suggested.

**Keywords:** Frail elderly, Medication errors, Drug polytherapy, Orthostatic hypotension, Prescription drug misuse

## INTRODUCTION

With aging societies, the number of the co-morbidity and medical treatment requirements have increased simultaneously; hence, this has resulted in polypharmacy.<sup>1</sup> Although the definition of polypharmacy is still controversial, it is defined as the use of one or more drugs unnecessarily or the use of five or more drugs in addition to the medications clinically indicated.<sup>1,2</sup>

Numerous studies have reported that the prevalence of polypharmacy in the elderly is at alarming dimensions in other countries, as well as our own. Polypharmacy reduces drug compliance and has negative consequences, such as drug side-effects, syndromes related to drug interactions and repeated hospitalization.<sup>3-9</sup> Furthermore, it has been asserted that there is a sharp increase in polypharmacy prevalence in the USA as well as the Baltic Countries with the Reimbursement System, which

ensures universal access to all prescribed medicines in order to ensure that health care services are equal for all individuals.<sup>6</sup> Although there are no general data about multiple drug usage prevalence that would indicate our country's polypharmacy profile, in a recent study, conducted with 187 65-and-older individuals, the polypharmacy rate was determined as 15%. In the same study, the polypharmacy proportion among 65-and-older individuals in Kars, in northeastern Turkey, was 23%; this proportion was 8% in Izmir (in western Turkey).<sup>10</sup>

The risk of drug-drug interactions is more probable among the elderly population than that of the young patients, and this emerges as a potentially vital issue.<sup>11</sup> The central nervous system (CNS) depressants have been shown to cause the greatest number of side effects in the elderly. Antibiotics, analgesics, anticoagulants, antihypertensive drugs, bronchodilators, diuretics and oral hypoglycemic agents are listed as medicine groups with many side effects.<sup>4</sup> It is reported that anxiety, depression, confusion, falls, unconsciousness, constipation, incontinence and extra-pyramidal system symptoms in the elderly can be associated with drug side-effects.<sup>4, 12</sup> In a Turkish study drug side-effects were observed in 26.2% of nursing homes' residents; 75% of the adverse effects were described as stomach complaints and 12.5% of them were defined as nausea by the seniors.<sup>12</sup> These kinds of drug side-effects and negative drug-drug interactions reveal that rational drug use in the elderly is crucial.

Avoiding high-risk and inappropriate drug use in seniors is a considerable, simple and also effective strategy to prevent drug side-effects and various drug-related problems.<sup>11</sup> Some criteria have been developed as a guide by health professionals for rational drug use in the elderly. Beers and his colleagues developed "The Beers Criteria" in 1991, to be used as a guide for rational drug use and also for reducing health costs for nursing home residents. The aim of The Beers Criteria is reducing exposure to potentially inappropriate medication (PIMs) to improve the quality of life of the elderly.<sup>11</sup> The Beers List depicts the drugs that should be avoided among the 65 years-and-older group.<sup>13</sup> It is a remarkable resource that determines both the specific risk and the degree of the risk of the PIMs for the elderly.<sup>11</sup>

In our country there are no specific criteria to meet the care needs and medication utilization control of the 65-and-older individuals.<sup>14</sup> It is suggested in literature that considering The Beers Criteria is a significant means of closely measuring drug-related complications, as well as risks that can occur with inappropriate medication usage in the elderly.<sup>13</sup>

Administering medication treatment to patients is one of the essential functions of nurses. Nurses are health professionals as well as educators and mentors of their patients.<sup>15</sup> Therefore, nurses should evaluate seniors' medicine usage and have knowledge, not only regarding clinical areas, but also in nursing homes and for stay-at-

home patients. They must be able to identify potential problems and dangers on this issue and be able to plan for any contingency.<sup>15</sup> It is also vital to determine the expectations, behaviors and improper acts regarding medication usage of the seniors.<sup>14</sup> In this sense, The Beers Criteria is a significant multipurpose resource that can be used in every step of the planning of rational drug use among the elderly.<sup>14</sup>

However, there was no definitive conclusion on a study that referenced The Beers Criteria to define the risk of medications and medication groups used by the elderly in our country. It is imperative to be aware of the severity of the risks caused by drugs used by the elderly. What's more, geriatric nurses, especially those who work in nursing homes, are accountable for administering the prescribed drugs and monitoring drug side-effects in light of drug administration rights.<sup>16</sup> Therefore, it has been predicted that this study will provide remarkable data, particularly for nurses who care for the elderly and physicians who arrange for medication treatment.

## METHODS

**Study design:** This research was conducted as a descriptive study with the aim of conformity assessment of drugs used by the elderly in terms of The Beers Criteria.

**Setting and sample:** This study was conducted in two different nursing homes with 370 elderly people (N=370). A sample has not been selected; thus, the total universe has been included in the sample. In two nursing homes, a total of 69 individuals who were younger than 65 years-old and did not agree to participate in the research were excluded from the study. Therefore, the study was completed with 301 elderly people (n=301).

**Data collection tools:** A questionnaire which evaluates the socio-demographic characteristics as well as the health-illness histories of the elderly and "The American Geriatrics Society (AGS) 2012 Beers Criteria" have been used to collect the data.<sup>22</sup> Application of the tools took about 17 minutes for each senior.

**The questionnaire:** It is consisted of 25 questions based on related literature.<sup>11,15,17</sup> The first seven questions identify socio-demographic features; questions 8-10 define the presence of chronic-disease, drug usage behaviors and the person who applies the drugs of the elderly. The fall history and drug-side-effects of the elderly are examined in questions 11-18. The last six questions specify current drug-related problems among the seniors, whether or not they take their drugs properly or have access to information given to them regarding the currently consumed medications. It also seeks to determine whether nurses are in control of seniors' drug-usage behavior or seniors do this on their own.

**The AGS 2012 Beers Criteria:** The Beers Criteria, including medications defined as having side effects due to physiological changes, which occur by aging and also pharmacological agents, was originally developed by Geriatrician Dr. Mark Beers in 1991 to evaluate the drugs used by the elderly living in nursing homes. The criteria was initially updated by Dr. Beers and his colleagues in 1997 and again in 2002; a third time by Fick and her colleagues in 2003 and finally in 2012 by AGS. The aim was to use The Beers Criteria as a guide in ensuring rational drug usage of 65-year-and-older seniors. The AGS 2012 Beers Criteria includes a list of 53 drugs and drug groups which should be avoided, and 14 drugs to be used carefully among the elderly.<sup>11</sup> The list was translated into Turkish by the researchers, then back translated into English, assessed and revised by four experts prior to application.

**Data collection:** The sociodemographic data were gathered via face-to-face interviews between July 2013 and July 2014. The information of all the medication used by the sample group has been taken from the records of the existing nursing homes and also from the in-charge health care staff. The data collection process was started with the questionnaire. The blood pressure of the patients was first measured in the supine position, and secondly measured in the fowler's position, with a three-minute gap between readings, for the orthostatic hypotension assessment. So, a difference of 20 mmHg decrease in the systolic blood-pressure rates and a difference of 10 mmHg decrease in the diastolic blood-pressure rates were accepted as the lower limit of the orthostatic hypotension presence.<sup>18</sup> Lastly, features related to medication treatment of the seniors were evaluated and enrolled in the data collection form according to the Beers list.

**Data analysis:** The data obtained from the study was evaluated via the SPSS 16.0. Descriptive statistics have been used to analyze the data and they are illustrated as numbers and percentages.

## RESULTS

The socio-demographic characteristics of the elderly are depicted in Table 1. The mean age of the seniors was  $79.01 \pm 8.13$ . The number of the co-morbidities ( $n=1158$ ) and the overall number of the medications ( $n=1664$ ) were depicted as groups (Table 2. and Table 3). The number of drugs involving into the related medication groups was stated in brackets (Table 4).

Table 2 indicates the most common co-morbidities seen among the seniors. The average number of chronic diseases of the seniors was  $3.5 \pm 1.58$ , while the rate of the elderly who do not have any co-morbidity was 1%. The number of the mean consumed drugs among them was determined to be  $5.4 \pm 3.24$ .

**Table 1: Socio-demographic characteristics of the elders (n=301).**

Socio-demographic characteristics	n	%
<b>Age (year)</b>		
65-74	94	31.2
75-84	128	42.5
≥85	79	26.2
<b>Gender</b>		
Men	167	55.5
Women	134	44.5
<b>Education</b>		
Illiterate	91	30.2
Literate	43	14.3
Primary/Secondary	117	38.9
High school and higher education	50	16.6
<b>Regular monthly income</b>		
Yes	251	83.4
No	50	16.6
<b>The residence time in the nursing homes</b>		
<1 year	30	10
1-4 years	126	41.9
5-10 years	104	34.6
11-14 years	19	6.3
≥15 years	22	7.3

**Table 2: The most common co-morbidities and the number of consumed drugs.**

Co-morbidity groups (n=1158)*	n	%
Brain and Nervous System Disorders	360	31.1
Cardiovascular System Disorders	337	29.1
Endocrine System Disorders	96	8.2
Gastrointestinal System Disorders	87	7.5
Musculoskeletal System Disorders	71	6.1
<b>Number of the co-morbidity (n=301)</b>		
No disease	3	1
1	30	10
2	55	18.3
3	67	22.3
4	60	19.9
5	41	13.6
6 and more	45	15
<b>Drug use conditions (n=301)</b>		
Yes	298	99
No	3	1
<b>The number of the used drugs (n=298)</b>		
0	2	0.7
1	16	5.3
2	30	10
3	40	13.3
4	56	18.6
5	39	13
6 and more	118	39.2

\*Multiple answers were given.

**Table 3: Medications most frequently used, the risk status of the drugs and the distribution of the existing complaints of the elderly.**

Medication groups (n=298)*	n	%
Antidementia/Alzheimer's drugs	113	37.5
NSAIDs	100	33.2
Proton Pump Inhibitors (PPIs)	90	29.9
Oral antidiabetics	80	26.6
Angiotensin-Converting-Enzyme(ACE) inhibitors	76	25.2
Calcium channel blockers (CCBs)	72	23.9
Angiotensin-II antagonists	64	21.2
Antianemics	61	20.2
Antipsychotics	59	19.6
Antithrombotic drugs	57	18.9
<b>The risk status of the drugs in terms of the Beers Criteria (n=1664)</b>		
Appropriate to use	1209	74
To be used carefully	80	4.9
Inappropriate to use	345	21.1
<b>The existing complaints of the elderly (n=178)*</b>		
Insomnia	71	32.2
Constipation	58	26.3
Urinary Incontinence	56	25.4
Dizziness	32	14.5
Tinnitus	30	13.6
Drowsiness	29	13.2

\*Multiple answers were given.

**Table 4: The risk status of some medication groups in terms of the AGS 2012 Beers Criteria.**

Medication groups	The risk status					
	Appropriate-to-use		To-be-used-carefully		Inappropriate-to-use	
	n	%	n	%	n	%
NSAIDs (n=113)					113	100
PPIs (n=90)	90	100				
Insulin (n=28)					28	100
CCBs (n=72)	58	80.6			14	19.4
Angiotensin-II antagonists (n=64)	64	100				
ACE inhibitors (n=76)	76	100				
Selective beta 2 adrenoreceptor agonists (n=36)	36	100				
Antiepileptics (n=34)	27	79.4	7	20.6		
Other nervous system drugs (n=23)	23	100				
Antidementia/ Alzheimer's drugs (n=113)	113	100				
Antihypertensives (n=15)					15	100
Benign Prostate Hyperplasia (BPH) Drugs (n=47)	45	95.7			2	4.3
Antipsychotics (n=59)					59	100
Thyroid medications (n=24)					24	100
Corticosteroids (n=4)					4	100
Urinary antispasmodics (n=15)	2	13.3			13	86.7
Antihistaminics (n=10)	5	50.0			5	50.0
Analgesics (n=15)	13	86.7			2	13.3
Musculoskeletal system relaxants (n=6)	2	33.3			4	66.7
Oral antidiabetics (n=80)	80	100				
Antidepressants (n=34)	29	85.3	2	5.9	3	8.8
Selective serotonin reuptake inhibitors (SSRIs) (n=52)			48	92.3	4	7.7
Anticholinergics (n=33)	11	33.3			22	66.7

**Table 5: The risk situation of the medications with regard to both the genders and the age groups (n=1634).**

Risk situation of the existed medications								
	Appropriate-to-use		To-be-used-carefully		Inappropriate-to-use		Total	
Genders	n	%*	n	%*	n	%*	n	%*
Men	659	75.1	37	4.2	182	20.7	878	52.8
Women	550	72.8	43	5.7	163	21.6	756	47.2
Age groups								
65-74 years	311	72	18	4.2	103	23.8	432	264
75-84 years	545	75.2	39	5.4	141	19.4	725	44.4
85+ years	353	74.0	23	4.8	101	21.2	477	29.2
<b>Total</b>	<b>1209</b>	<b>74.0</b>	<b>80</b>	<b>4.9</b>	<b>345</b>	<b>21.1</b>	<b>1634</b>	<b>100</b>

\*Percentages have been analyzed on the drug number as “line percentages”.

The most frequently used top ten medication groups, the risk status of the drugs and the distribution of the existing complaints of the seniors were indicated in Table 3. Approximately one out of every five drugs were found as “inappropriate-to-use” in terms of the Beers Criteria. The frequency of orthostatic hypotension also has been assessed among the seniors and the proportion of the presence of orthostatic hypotension has been identified as 9%; besides, 9.6% of the elders could not be evaluated in terms of orthostatic hypotension due to various factors, such as the status of dependency, fractures, or refusing the measurement of the blood pressure.

The distribution of the risk status of some medication groups used by the seniors in terms of the Beers Criteria is shown in Table 4. The drugs such as all the lipid metabolism drugs, beta blockers, antacids, adrenergics, antianemics, psycho stimulants, dopaminergics, vitamins, minerals, vasoprotectives, laxatives and glaucoma medications used by the residents were identified as appropriate-to-use drugs.

Finally, the risk situation of the medications with regard to both the genders and the age groups has been indicated in Table 5. It was stated that 20.7% of all the medications consumed by men, and 21.6% of all medicine consumed by women, were “appropriate-to-use” according to The Beers Criteria.

## DISCUSSION

The sociodemographic features of the sample group are indicated in Table 1. It should not be ignored that with the presence of a physician in the nursing homes and also having health insurance can pave the way for easy-access to medication for older adults. Furthermore, those with only a primary/secondary education and the illiterate may be at a disadvantage in terms of proper medication usage or being aware of the potential side effects.

The existing co-morbidities of the elderly have been explained in Table 2. In a research conducted in France with 150 75-year-and-over seniors, cardiovascular system

diseases and neurologic system disorders were determined to be the most commonly seen diseases among the elders.<sup>19</sup> The number of the co-morbidities and the drug usage actions associated with the chronic-diseases of the elderly has been listed in Table 2. Although the proportion of seniors who have three or more numbers of co-morbidity was found to be higher in our study than in the related literature, it can be said that these differences may be related to the diversities of the age characteristics of the other studies' sample groups.<sup>7, 17</sup>

The polypharmacy is stated as a significant issue in many studies.<sup>1,2,5,7,10,19-22</sup> The rate of drug consumption is affected by different variables, such as the quality of health care services, the health care budget, the level of education of the physicians, the culture of the community and so on.<sup>1, 3, 5, 10</sup> These could be why the mean number of medications used by the elderly were found to be higher in the research of Lee et al (2013) and Fouquet et al (2012), (respectively  $7\pm3.6$  and  $7.6\pm3.5$ ) than our study's finding ( $5.4\pm3.24$ ).<sup>8,19</sup> What's more, the average amount of medicine consumed by the elderly in our study was found to be much higher than several studies conducted in Turkey Southern Brazil and Spain.<sup>3, 9, 20</sup> It is thought that this distinction could be due to the fact that the elderly in the specified studies had greater access to health care services in the nursing homes.

When it comes to the risk status of the medications used by the seniors, approximately one-out-of-five drugs used by the sample group were found to be “inappropriate-to-use” in terms of the Beers Criteria (Table 3.). Likewise, in a study conducted in Spain with 407 65+ seniors, 40% of the medicine consumed by their sample group were found to be “inappropriate-to-use”.<sup>9</sup> Lee et al stated 49% of the 1440 prescribed drugs used by 191 75-year-and-older seniors with depressive symptoms, as “inappropriate”.<sup>8</sup> Similarly, Skaar and O'Connor found 34.4% of the 13.809.975 prescribed drugs, consumed by the 12.000 65-year-and-older patients with dental problems in addition to their chronic-diseases, as “inappropriate-to-use” in terms of the AGS 2012 Beers Criteria.<sup>22</sup> Nevertheless, in a study, 3.5% of the 1140 prescribed medications were stated as “inappropriate-



drugs-to-use” according to the Beers Criteria, which was adapted to the French seniors.<sup>19</sup> The reason why this finding is significantly lower than our study’s result and that of the other given example papers, could be related to the French research<sup>19</sup>, conducted at a university hospital instead of in a community, that may lack some medication for the elderly; also it could be relevant to the physicians’ prescription behaviors and society’s requests about the medication prescription issue. Moreover, the increased risk proportion of the Skaar and O’Conner’s study (2012) could have been the consequence of the usage of the medications prescribed by various physicians to the seniors living in the community.

It is not known whether some complaints from individuals in the advanced age group are stem from their medication treatment or existing co-morbidities, or due to the limitations of aging. Therefore, in this study, instead of asking the existing drug-side-effects of seniors, we preferred to ask about their current complaints (Table 3). In the literature, stomach problems associated with medication treatment was stated to be the most widespread complaint among the older people. After gastro difficulties, dizziness and tinnitus are also the most frequently expressed drug-side-effects by the seniors.<sup>7,12,17</sup>

In our study, while all the NSAIDs, H<sub>2</sub>-receptor antagonists, digitals, antipsychotics, corticosteroids, Ergot-alkaloids, benzodiazepines and antihypertensive drugs were totally inappropriate; the high proportion of the urinary antispasmodic drugs, anticholinergics and musculoskeletal system relaxants were inappropriate; and the risk rate of the antihistaminic drugs was equal according to the Beers Criteria (Table 4.). In a different study, 40% of the inappropriate-to-use prescribed drugs consisted of CNS agents and 16% of those were musculoskeletal system relaxants.<sup>8</sup> Correspondingly, in another study, the long-acting (half-life  $\geq 20$  hours) benzodiazepines (i.e. diazepam) were the most inappropriate-to-use medicines (30%); the short-acting benzodiazepines (i.e. lorazepam, alprazolam) were on the second line (17.5%) and the antipsychotic drugs with anticholinergic-impact were on the third line (12.5%) among the inappropriate-to-use drug groups.<sup>19</sup> Similarly, Skaar and O’Connor (2012) found that estrogen-containing drugs were the most frequently prescribed medications (5.3%); second was Digoxin (Digitals) at 4.27%; Naproxen (NSAIDs) was third (3.49%); Alprazolam and Lorezepam (Benzodiazepines) were the fourth and fifth most commonly prescribed drugs respectively (3.29% and 3.28%) among the precarious medications for the seniors.<sup>22</sup> In another research, while H<sub>2</sub>-receptor antagonists were found to be first (20.5%); benzodiazepines were second (11.4%); anticholinergics and antihistamines were third (both 7.9%) among the inappropriate-to-use medications.<sup>23</sup> In a paper conducted in the southern US, antihistamines (promethazine) was found to be the most frequently prescribed (46.9%) inappropriate-to-use drugs among the nursing home residents.<sup>24</sup> As in the studies, conducted in different

countries to assess the conformity of the drugs used by seniors on the basis of the Beers Criteria, the proportion of the inappropriate-to-use drugs and/or drug groups treating senility is fairly high in our research, too. In contrast to the literature, the anti-Parkinson agents were determined as appropriate-to-use drugs in our study (Table 4). Meanwhile, it has been stated in a different study that these kind of inappropriate-to-use drugs were consumed among a very small percentage of their sample group (n=20).<sup>21</sup>

The sliding-scaled insulin is reported to be an unsafe product for the elderly on the grounds of increased-risk of hypoglycemia in the Beers Criteria.<sup>14</sup> Although, all the sliding-scaled insulin products were determined as inappropriate-to-use in the elderly, all oral anti-diabetic agents were found to be appropriate-to-use for senility, and this is the significant point in our study. Moreover, there have been identified several drug groups which do not cause any risk for the elderly, such as antacids and PPIs (Table 4). Although, in the literature, the proportion of the inappropriate-to-use vasodilators among seniors (7.5%) were less than that of what they were in this study; this diversity has been thought to be a result of both the size of the sample group and the selected vasodilators, probably prescribed mostly among the different kind of appropriate-to-use drugs in terms of the Beers Criteria, of the given example study.<sup>19</sup> The risk distribution of the drugs has been evaluated with respect to gender (Table 5). Similar to our findings, Skaar and O’Connor (2012) found that medications prescribed to women were less appropriate (38.1%) as those in men (29.5%) in terms of the Beers Criteria.<sup>22</sup> Nevertheless, the number of the medications used by the elderly men who participated in our study was determined to be more than that of the elderly women (Table 5). This finding is different from the other studies conducted in different regions of Turkey.<sup>10,20</sup> Increasing the number of consumed drugs is a considerable factor in the emergence of drug-related hazardous situations by augmenting the drug-drug interactions.<sup>3,22</sup> Therefore, the increased number of medication used by older men can be considered to be a determining factor in increasing the rate of inappropriate-to-use medications among the elderly population. When it comes to the distribution of risk conditions by age groups, the drugs, used by the 65-74 age group, have been found to be more risky than those by the other age groups in our research (Table 5). Similarly, in a study, conducted in Ireland with 600 seniors aged 65-and-older, the usage of risky drugs among the 65-74 aged seniors were identified as 30.4%.<sup>25</sup>

There were some limitations in this study. Firstly, The Beers Criteria is a medication list compiled with the aim of the assessment of drugs used by 65-and-older individuals in the context of “drug-drug” and “drug-syndrome” interactions. Therefore, the medicine used by the seniors could not be examined in terms of “drug-food” interactions in this research. Moreover, it has been assumed that the elderly use their medications regularly.

Finally, the results of the study can be generalized only regarding seniors in existing nursing homes.

## CONCLUSION

In conclusion the Beers Criteria could strongly contribute to the reduction of inappropriate drug prescription and improve the quality of life among the seniors if nurses closely monitor both the impacts of the drugs used and the complaints of the seniors, and share this information with other members of health care team (physicians, pharmacologists etc.). The results obtained via this research indicate the significance of using caution and being receptive to the cooperation of physicians, nurses and pharmacologists from the beginning of the prescription treatment process to the evaluation of the conformity, the dosage, taking times and the impacts of any medication.

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