Original Article

Knowledge, attitude, and practice of medical interns and postgraduate residents on American Geriatric Society updated Beers criteria

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Abstract:

BACKGROUND: Potentially inappropriate medication (PIM) prevalence in older adults is increasing day by day due to lack of knowledge among medical students and professionals.

OBJECTIVE: To determine the knowledge of medical students toward American Geriatric Society (AGS) Beers criteria for PIM prescribing.

MATERIALS AND METHODS: This cross-sectional study employed a self-administered questionnaire which was validated and designed to assess the knowledge, attitude, and practice of medical interns and postgraduate residents on Beers criteria for PIMs in older adults. The study was conducted in Faridkot region of Punjab in 2019. This study will utilize a purposive sampling strategy and a convenience sampling of up to 183 participants. Mann–Whitney U or Kruskal–Wallis tests were used to compare different issues as appropriate. P values of <0.05 were considered significant.

RESULTS: Out of 183 questionnaires distributed, only 155 participants (response rate 84.6%) had filled the survey and were included in the study. 61.3% ($n = 95$) of the respondents were males. The mean knowledge score of 155 participants was (5.16 ± 1.56), where the highest score was 9 and the lowest score was 2 out of 10. 15.5% ($n = 24$) of the participant strongly agreed that Beers criteria use is necessary in clinical setting and would be very helpful. While 22.5% ($n = 35$) of the participants strongly agreed that PIMs cause adverse drug event (ADE) and drug-related problems (DRPs) in older adults. Age of the participant had a significant effect on the knowledge score (p = 0.009), and participant aged between 31 and 40 years had significantly higher knowledge scores compared with participants falls under 20–30 years.

CONCLUSION: Medical students and postgraduate residents had average knowledge of PIMs and are unaware of the standard guidelines in older adults such as the Beers criteria. Lack of formal education or training about Beers guidelines was the main reason responsible for average knowledge among participants.

Keywords:

Attitude, Beers criteria, knowledge, older adults, practice

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Introduction

Globally, the population aged 65 years and over is growing faster than all the other age groups.[1,2] Defining elderly population is very difficult because different countries had set different age limits according to their population but the United Nations agreed cutoff is 60 years older which is considered in older population.[3,4] Age-related pharmacokinetic, pharmacodynamics alteration as well as cognitive impairment have been found to be directly associated with altered pharmacological action of the drug.[5] Moreover, due to age-related pharmacokinetic, pharmacodynamic, and body structural and functional changes

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in older adults, they are generally considered under special population and most of the times older adults are excluded form randomized controlled clinical trials (RCCT), that is why most of the prescribing decisions made in the elderly lack scientific evidence.[6] PIMs are those medications whose adverse risks exceed its health benefits especially when equally effective safer alternative is available.[7] Prescribing of PIMs by physicians is an important preventable cause of morbidity and mortality in the older adults.[8] Most of the older adults are on high-level polypharmacy (>10 medications per day) due to complex comorbidities and a new issue of concern is arising in older adults that is continuously increased prevalence of PIMs in older patients. However, PIMs have been found to be associated with increased incidence of adverse drug events, drug-related problems, increase economic burden, decrease quality of life, increase hospital admission, and organ failure. Till now, several criteria's have been developed and validated by different geriatric societies for an inappropriate prescribing in older adults, but still Beers criteria are one of the most widely accepted and cited guidelines.[7,9-13]

In 2012, the AGS gave the official patronage to Beers criteria and after that they are regularly updating criteria at a three-year interval. Beers criteria were introduced almost 29 years back but still now most of the healthcare professionals in India are totally unaware about the PIMs in older adults.[14] Lack of knowledge among doctors led to increase prevalence of PIMs in India. Various studies show that prevalence of PIMs in older adults and prescribing of at least one PIMs have been found to be ranged from 12 to 58% in older adults as per Beers criteria.[15-20] Moreover, in the USA, annual healthcare expenditure due to PIM prescribing in the elderly population was estimated to be around $7.2 billion.[21]

In Beers criteria, they have given the list of certain drugs that have been found to cause certain clinical problems in older adults such as falls, confusion, toxicity or even life-threatening events.[9] They had also provided additional information such as quality of evidence, rationale, and strength of recommendation which is proved to be very helpful for patients as well as for healthcare professionals. However, very little information is available on the extent of a medical interns and postgraduate residents' knowledge about PIM prescribing in older adults.

The objective of the study is (1) to determine the knowledge of medical students toward AGS Beers criteria for PIM (2) To know about the attitude and perception of students about PIMs safety, efficacy, reporting.

Subjects and Methods

Study design and participants

A cross-sectional paper-based survey was conducted between June 2018 and July 2019 using a self-administered questionnaire with an intention to obtain the responses regarding AGS updated Beers criteria for PIM prescribing. The study targeted currently studying students in the state of Punjab. The estimation of sample size was done with the help of Rao soft online calculator; there were approximately 500 medical interns and 250 postgraduate residents studying in different hospitals of Punjab. The researcher considered a 15% non-response rate, and to achieve a confidence level of 95% and a 5% margin of error, the study sample size comes out to be 155. The participants were randomly selected to participate in the study. Out of 183 questionnaires distributed, only 155 participants had filled the survey and returned and were included in the study.

Eligibility criteria

Participants were included if they (1): are pursuing Bachelor of Medicine and Bachelor of Surgery under Medical Council of India. (2) Pursuing Postgraduate resident degree from different departments under Medical Council of India.

Participants were excluded if they (1) did not fill the complete form.

Survey instrument development and implementation

A questionnaire was developed after going extensive literature review pertaining to knowledge, attitude, and practice of medical students toward AGS updated Beers criteria for PIMs. The questionnaire consists of three sections. Firstly, the developed questionnaire was validated using face and content validation methods by senior consultants working in geriatrics, medicine, research to ensure its readability. Secondly, it was assessed for reliability, clarity, and completion time through a pilot study that was pretested among 10 purposively selected respondents who were eventually excluded from the data analysis. Lastly, the survey questionnaire was distributed among the public after revising it based on the obtained comments/feedback from the participants. The 33-item questionnaires consist of four domains: First section assess the socio-demographic details of the participants.

(2): This section consists of 10 questions to evaluate the knowledge of participants toward Beers criteria. Each question in this section comprised of multiple-choice question. The participant had to choose one option for each answer. On evaluation, the respondent was given one score for correct answer and 0 score for incorrect

answer or unanswered question. The maximum possible score was 10. The score was not categorized as we do not have any standard guidelines. (3): Third section consists of 13 questions to assess the participant perception and attitude toward AGS updated Beers criteria for PIMs. Likert scales were used, and the participants had to answer from strongly agree to strongly disagree. No scoring was given to answers and all analysis was based on giving frequency for each response. (4): This section consists of six questions to assess the practice of participants. The respondents were required to choose "Yes" or "No" or "Sometimes" for each question asked. No scoring was given to answers and all analysis was based on giving frequency for each response.

Data analysis

Statistical analysis was carried out by using free Statistical Package for the Social Science (SPSS) version 25.0.[22] Each section assessing the knowledge, attitude, and practice of the respondent and socio-demographic details of the respondent were expressed in Frequency and percent. The knowledge scores were calculated as the mean (±SD) and the median (±IQR). The respondents factors influencing the knowledge score were tested using the Mann–Whitney U and Kruskal–Wallis tests as appropriate. *P* values of <0.05 were considered statistically significant.

Results

Socio-demographic details of the participant

Out of 183 questionnaires distributed, 155 (84.6% response rate) respondents fill the survey and returned and their response was included in the study for evaluation of their knowledge. Most of the physician feel reluctant to fill this questionnaire. Details regarding socio-demographic details of the respondent are shown in Table 1. 82.6% (*n* = 128) of the respondents falls under the age group of 20–30 years and 61.3% (*n* = 95) of the respondents were males. 64.5% (*n* = 100) of the respondents had bachelor's degree and 35.5% (*n* = 55) of the respondents had either completed or pursuing master's degree. Only 15.5% (*n* = 24) of the respondents had more than five-year experience but more than one-third of the respondents (84.5%, *n* = 131) had five or less years' experience.

Assessment of knowledge of participants

The knowledge of medical interns and postgraduate residents toward AGS updated Beers criteria for PIM are expressed in Table 2. The questionnaire consisted of 10 knowledge items and was tested. Out of 10 questions, only 8.3% (*n* = 13) of the respondents answered eight or more than eight questions correctly followed by 11.6% (*n* = 18) answered seven questions out of 10 questions correctly. Half of the respondents (*n* = 74,

Table 1: Socio-demographic details of the respondent

Characteristics	Frequency	Percentage
Age		
20-30 years	128	82.6
31-40 years	27	17.4
Gender		
Male	95	61.3
Female	60	38.7
Academic degree		
Bachelor degree (MBBS)	100	64.5
Master degree (MD/MS)	55	35.5
Years of experience		
5 or less	131	84.5
>5	24	15.5

47.7%) answered five or six questions correctly out of 10.

It was observed that 62.6% (*n* = 97) of the participants know that Beers criteria have been given by AGS and 37.4% (*n* = 59) did not answered this question correctly. Over 88.3% (*n* = 137) answered two knowledge items incorrectly (i.e., How many times Beer criteria have been updated till now). Only 41.9% (*n* = 65) of the participants know about the AGS updated 2019 Beers criteria. Most of the respondent answered four knowledge items correctly (i.e., Beers criteria recommended guidelines are for geriatric Patients). 75.5% (*n* = 117) of the participants answered 6th item correctly and it means they know that elderly population are considered as special population and are excluded for randomized controlled clinical trials. 69% (*n* = 107) of the participants answered 7th item incorrectly (i.e., Delphi technique has been used in Beers criteria for decision making). It was quite shocking that only 38.7% (*n* = 60) of the participant answered correctly about 8th knowledge item (i.e., PIM list of drugs has been given in the AGS updated Beer criteria). Only 54.8% (*n* = 85) of the participant know about the different new areas introduced by the AGS in the 2015 Beers criteria. Figure 1 represents distribution of respondents according to their knowledge score.

Influence of participants socio-demographic and professional characteristic on knowledge score

This study further analyzed the different socio-demographic and professional characteristics that may influence their knowledge score as described in Table 3. The data of the participants were assessed for normality distribution using Kolmogorov–Smirnov test and Shapiro–Wilk (SW) test with *P* value of 0.001 and 0.001, respectively. The results showed that data of the study participants were not normally distributed (i.e., knowledge score). Mann–Whitney U and Kruskal–Wallis nonparametric tests were used. Out of the four characteristics tested, only age of the participant had a significant effect on the knowledge score (p = 0.009),
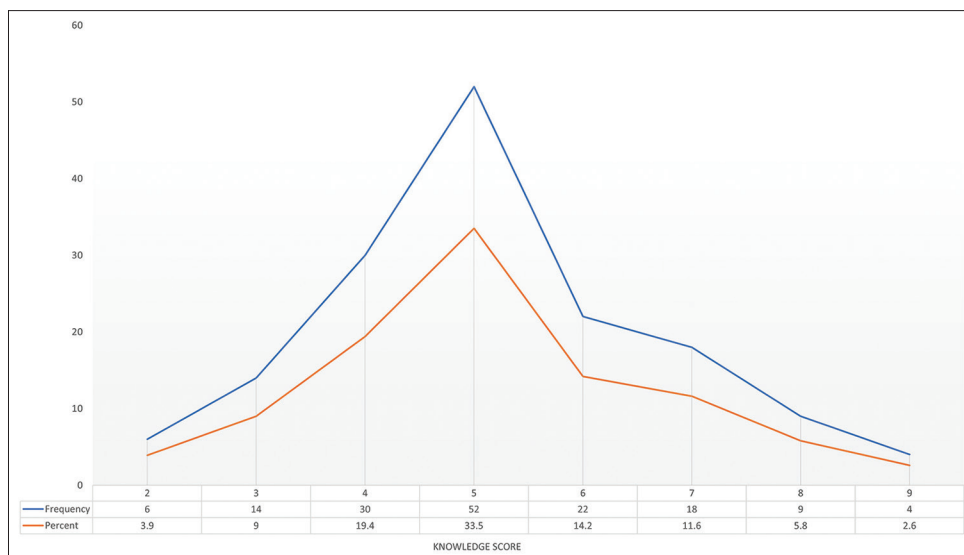
Figure 1: Distribution of respondents according to their knowledge score

Table 2: Knowledge of respondents toward AGS updated Beers criteria for PIM

Knowledge item	Frequency (%)	
	Correct response	Incorrect response
1. Which society has given Beers criteria?	(62.6)	58 (37.4)
2. How many times Beer criteria have been updated till now?	18 (11.6)	137 (88.3)
3. In which year AGS updated latest Beers criteria version?	65 (41.9)	90 (58.1)
4. Beers criteria recommended guidelines are for which Patients?	147 (94.8)	8 (5.2)
5. According to Beers criteria, which age group of patients are considered as geriatric?	92 (59.4)	63 (40.6)
6. Why elderly Patient are excluded from Randomized Controlled Clinical trials?	117 (75.5)	(24.5)
7. Which technique has been used in Beers criteria for decision making?	48 (31)	107 (69)
8. Which list of drugs has been given in the AGS updated Beer criteria?	60 (38.7)	95 (61.3)
9. What are the different new areas introduced in the AGS updated 2015 Beer criteria?	85 (54.8)	70 (45.2)
10. Beer criteria: a guide for?	77 (49.7)	78 (50.3)

Table 3: Influence of participants socio-demographic and professional characteristic on knowledge score

Characteristic	n	Median knowledge score (IQR)	Mean knowledge score±SD	P
Age				
20-30 years	128	5 (2)	4.97±1.35	0.009
31-40 years	27	7 (4)	6.07±2.11	
Gender				
Male	95	5 (2)	5.22±1.59	0.012
Female	60	5 (2)	5.07±1.51	
Academic degree				
Bachelor degree	100	5 (2)	5.06±1.16	0.588
Master degree	55	5 (3)	5.35±2.10	
Years of experience				
5 or less	131	5 (2)	5.08±1.42	0.477
>5	24	5 (3)	5.58±2.14	

P were calculated using Kruskal-Wallis and Mann-Whitney *U* tests as appropriate

and participant aged between 31 and 40 years had significantly higher knowledge scores compared with participants falls under 20–30 years (mean ± SD: 6.07 ± 2.11 vs. 4.97 ± 1.35, respectively). Though we

are expecting that respondents who are pursuing or pursued master's degree with five or more years practice experience would have higher knowledge score than the respondents with bachelor's degree and less than five-year experience, but this did not reach statistical significance in this case ($P > 0.05$).

Attitude of participants on AGS Beers criteria for PIMs

Attitude of medical interns and postgraduate residents on Beers criteria expressed in Table 4. Thirteen items were assessed on a five-point Likert scale to assess attitude and perception of the participants. Participants must answer from strongly agree to strongly disagree. Regarding the attitudinal statement "*In, India there is an urgent need to understand the health & disease profile of elderly and their health care by healthcare professionals*" almost 96% ($n = 149$) of the respondent agreed (Strongly Agree + Agree) with the statement. Most of the respondents (89.6%, $n = 139$) totally agreed with the following statement: "*Age-related changes in elderly leads to increase risk of ADR & Drug-related problem.*" For the statement: "*in

Table 4: Attitude of medical interns and postgraduate residents toward Beers criteria for PIMs

Attitude items	*n* (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1.In India, there is a urgent need to understand the health & disease profile of elderly and their health care by healthcare professionals	88 (56.7)	61 (39.3)	2 (1.3)	4 (2.6)	0 (0)
2. Age-related changes in elderly lead to increase risk of ADR & Drug-related problem	53 (34.1)	86 (55.5)	12 (7.7)	4 (2.7)	0 (0)
3. Many elderly patients are mentally ill	28 (18.1)	64 (41.3)	48 (31)	9 (5.8)	6 (3.8)
4. In the elderly, prescribing decision has made in the absence of scientific evidence	22 (14.2)	50 (32.3)	59 (38.1)	15 (9.6)	9 (5.8)
5. Many elderly patients are on polypharmacy due to multiple comorbidities	60 (38.7)	73 (47.1)	8 (5.2)	12 (7.7)	2 (1.3)
6. Is Beers criteria use is helpful & necessary for detecting PIM	24 (15.5)	89 (57.4)	38 (24.5)	4 (2.6)	0 (0)
7. Does PIMs cause ADR & Drug-related problem in elderly patient	35 (22.5)	68 (43.9)	46 (29.7)	4 (2.6)	2 (1.3)
8. Does educational intervention on Beer criteria is necessary	48 (31)	85 (54.8)	18 (11.6)	2 (1.3)	2 (1.3)
9. Does Geriatric Society of India are required to give same criteria for elderly patient	64 (41.3)	69 (44.5)	22 (14.2)	0 (0)	0 (0)
10.Do you think some appropriate medication considered as potentially inappropriate in Beers criteria	30 (19.4)	40 (25.8)	77 (49.6)	8 (5.2)	0 (0)
11.Do you think ADR & Drug-related problem can be reduced through the use of Beers criteria	28 (18)	93 (60)	32 (20.7)	2 (1.3)	0 (0)
12.Do you think PIMs should be avoided in geriatric patient having age ≥60	44 (28.4)	81 (52.3)	30 (19.3)	0 (0)	0 (0)
13. Do you think PIMs are associated with poor health outcomes and increased economic burden and hospital admission	42 (27.1)	57 (36.8)	48 (31)	5 (3.2)	3 (1.9)

ADR - Adverse drug reaction, PIM - Potentially inappropriate medication

the elderly, prescribing decision has made in the absence of scientific evidence" the respondents had mixed perception or opinion: 46.5% (*n* = 72) of the respondents agreed with the statement (Strongly Agree + Agree), whereas 38.1% (*n* = 59) of the respondent were neutral with the statement while 15.4% (*n* = 24) were disagree (Strongly Disagree + Disagree).

Almost one-third of the respondent (85.8%, *n* = 133) totally agreed with the statement: "*Many elderly patients are on Polypharmacy due to multiple comorbidities.*" Majority of the respondents (72.9%, *n* = 113) were agreed with the statement: "*Beers criteria use is helpful & necessary for detecting PIM.*" Regarding the statement: "*PIMs cause ADR & Drug-related problem in elderly patient*" 66.4% (*n* = 103) of the respondent were agreed with statement (Strongly Agree + Agree).

A very high proportion of the respondent (*n* = 133, 85.8%) agreed (Strongly Agree + Agree) with the statement: "*Educational intervention on Beer criteria is necessary*" and same proportion of the population agreed (Strongly Agree + Agree) on the other statement also: "*Geriatric Society of India are required to give same Criteria for elderly patient.*"

Almost half of the participants (*n* = 77, 49.6%) answered neutral on the statement: "*some appropriate medication considered as potentially inappropriate in beers criteria.*"

Seventy-eight percent (*n* = 121) of the participant agreed (Strongly Agree + Agree) with the statement:

"*ADR & Drug-related problem can be reduced through the use of Beers criteria,*" whereas a major chunk of participant (*n* = 125, 80.5%) agreed (Strongly Agree + Agree) with the statement: "*PIMs should be avoided in geriatric patient having age ≥60*" and 63.9% (*n* = 99) participants agreed (Strongly Agree + Agree) with the statement: "*PIMs are associated with poor health outcomes and increased economic burden and hospital admission.*"

Practice of participants on PIMs in older adults

Table 5 illustrates participants practice toward PIMs given by AGS updated Beers criteria. Practice questionnaire contains items related to their clinical practice. Most of the participants (*n* = 72, 46.5%) do not monitor patient for better health outcomes after prescribing PIMs in elderly patient and near about same participant (*n* = 70, 45.1%) do not mention PIMs on the patient record if PIMs have been prescribed. Only 43.2% (*n* = 67) of the participant referred any kind of other criteria or guidelines while prescribing, whereas only 33.5% (*n* = 52) of the participant considered Beers criteria guidelines for prescribing in geriatric patient.

Discussion

The older adult population is growing older at an unprecedented rate. In 2017, the share of older adults exceeded 25% in all 10 of the most aged countries and in 2050, older adults will comprise more than 39% (2 billion) of the world population.[23] Medication selection, safety, efficacy, quality, adherence, and health-related

Table 5: Practice of participants toward PIM given in Beers criteria

Practice item	*n* (%)		
	Yes	Sometimes	No
1.Do you avoid PIMs in elderly patient for better health outcome	91 (58.7)	44 (28.4)	20 (12.9)
2. Do you report ADR & Drug-related problem cause by PIMs	48 (31)	79 (51)	28 (18)
3. Do you consider Beer criteria guidelines while prescribing in geriatric patient	52 (33.5)	44 (28.4)	59 (38.1)
4. Do you follow any other criteria while prescribing in elderly patient	67 (43.2)	48 (31)	40 (25.8)
5. Do you mention PIMs on the patient record if PIMs has been prescribed	55 (35.5)	30 (19.4)	70 (45.1)
6. Do you monitor patient for better health outcomes after prescribing PIMs in elderly patient	63 (40.6)	20 (12.9)	72 (46.5)

quality of life in elderly patients are the important issues that need special attention of physician.[2,24-28] So, there are very few trained geriatricians available to handle the situation. Resident doctors and medical students play an imperative role in clinical setting, and it is very important that students and doctors should understand, learn, and apply knowledge regarding PIM prescribing in older adults.[32] It was observed that medical interns and primary care doctors do not have a strong understanding and knowledge of PIM. Having good scientific knowledge, positive attitude, perception, and practice toward Beers criteria could influence the selection of drugs especially in elderly patient.[29] Beers criteria are one of the most important, most common, and most updated strategy to determine the PIMs in elderly patients. In the absence of a specific guidelines, Beers criteria guidelines can be used to assess the knowledge of physicians related to PIMs in India. Moreover, the AGS updated Beers criteria have been extensively used for survey. The healthcare professionals should have proper knowledge of AGS updated Beers criteria. So, that the healthcare professionals can easily identify and avoid PIMs and drug-related problems in the elderly patients. In the study, it was observed that 62.6% (*n* = 97) of the participants know about the AGS Beers criteria. According to our knowledge, this is the first study in India as well as in world that assess the knowledge, attitude, and practice of physician toward Beers criteria. So, we cannot compare our findings of the study with the previous study because we could not be able to find similar study. In the study, it was observed that most of the students/physician feel reluctant to fill this form; this may be due to following reasons: lack of knowledge, lack of time, and lack of understanding about the importance of study.

A clear understanding of PIMs is necessary, and one could expect participant should know about latest updated Beers criteria, but in the study, it was observed that most of the respondents (*n* = 90, 58.1%) do not know that AGS has updated latest Beers criteria version in 2019. Almost one-third of the participants answered incorrect to the question regarding the Beers criteria updates starting from 1991 to till now. Most of the respondents do not know about the list of drugs that have been given in the Beers criteria. It was observed that nearly half of the

respondents do not know about the different new areas introduced in the 2015 update. The changes from 2015 Beers criteria to 2019 Beers criteria are almost same and are not much extensive, but the changes in 2012 Beers criteria to 2015 Beers criteria were very extensive.[30]

In the study, it was observed that there was no statistically significant difference in the knowledge score ($P > 0.05$) between participants who had more years of experience and the others. No statistically significant difference was found between the participants with master's degree and the participants with bachelor's degree. Again, we cannot compare the findings of our study with the other findings because there is no such study published in India.

The mean knowledge score of the participant comes out to be (5.16 ± 1.56). Only 13 participants score 8 or more than 8 out 10. So, from the result we can find that most of the respondents had average knowledge of PIMs, AGS updated Beers criteria. Most of the respondents (*n* = 133, 85.8%) show positive attitude toward learning and agree with the statement: "*Educational intervention on Beer criteria is necessary.*[33-35]" Various researchers have identified doctor characteristics that have found to be associated with specific barriers such as lack of formal education on PIMs in elderly was seen as a barrier by students and residents.[14] So, education approaches such as continuing medical education programs on Beers criteria will prove to be beneficial for students and residents. The author believed and recommended that educational intervention on PIM should be provided to all healthcare professionals. Moreover, various researchers have identified that polypharmacy is highly prevalent among older adults and is one of the predictors of PIMs. Physician should avoid the unnecessary drugs. The main important strategy of treating older adults is not necessarily to find a defined set number of medication and try to stay below it, but to find the right medication at the right dosage and for the shortest possible duration on a case-by-case basis. This individualized approach to treating patients will provide a much safer and effective means of practicing and will improve patients' quality of life.[31] This study has many strengths about the major limitations where a scoring system was not established for the attitudes and practice domains during the study instrument development. However, Beers criteria

guidelines can be used to avoid ADR and drug-related problems in elderly patient and to increase quality of life, decrease economic burden, decrease hospital admission in older adults, but still more work is needed to develop evidence-based guidelines in India.

Limitation

The main limitation of this study is that it included participants from one region of India. So, the results obtained from this study cannot be generalize to other demographics. Secondly, the sample size for this study is not enough to extrapolate the results to whole population.

Conclusion

A major chunk of medical interns and postgraduate residents in India had average or poor knowledge regarding PIM, Beers criteria, different recommended criteria for elderly patient. A Geriatric Society of India or competent authorities should focus on these issues and must give specific guidelines for Indian elderly patient (i.e., similar like Beers criteria). An educational program should be included in the core syllabus of all healthcare professionals to decrease the prevalence of PIMs in India.

Ethics approval

This study includes medical interns and postgraduate residents from different departments of tertiary care teaching hospital of Punjab. The study has been approved by the University Centre of Excellence in Research, Baba Farid University of Health Sciences, Faridkot, Ethical Review Board. All participants were asked to fill informed consent prior to registration. The informed consent page presented two options (I agree/I disagree). Subjects who chose I agree option were allowed to fill the questionnaire, and subjects could take back their name at any time during the process. All methods were carried out in accordance with relevant guidelines and regulations.

Conflicts of interest
There are no conflicts of interest.

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