Are physicians and clinical pharmacists aware and knowledgeable enough about inappropriate prescribing for elderly patients? Findings from Malaysia

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ABSTRACT

Objectives To assess the knowledge of physicians and clinical pharmacists about inappropriate prescribing for elderly patients, their confidence in prescribing for elderly patients, and their perceptions of barriers to appropriate prescribing in this population.

Methods A cross-sectional study using a validated 20-item questionnaire was conducted among physicians (n=78) and clinical pharmacists (n=45) working in the medical wards of two tertiary hospitals in Malaysia. Knowledge was assessed by six clinical vignettes which were developed based on Beers criteria and the STOPP/START criteria. Other domains of the study were investigated using a four-point or five-point Likert scale.

Results Of the 82 participants who completed the questionnaire, 65% were physicians, 90.2% had never received training in geriatric medicine, and 70.8% estimated that 25% or more of their patients were elderly. Only six participants (7.3%) had ever used STOPP/START or Beers criteria when prescribing for elderly patients, and 60% of the respondents had never heard of either one of those criteria. The mean score (SD) for the knowledge part was 3.65 (1.46) points, and only 27 participants (22.9%) scored more than four out of a possible six points. Overall, 34% of the participants rated themselves as confident in prescribing for elderly patients, and this was significantly associated with their knowledge score (P=0.02). The mean number (SD) of barriers cited per participant was 6.88 (2.84), with polypharmacy being the most cited barrier.

Conclusions The majority of the participants had inadequate knowledge and low confidence regarding recommending medications for elderly patients. Continuing education on geriatric pharmacotherapy may be of value for the hospital physicians and pharmacists.

INTRODUCTION

Medications are considered to be appropriately prescribed when they are based on solid scientific evidence regarding a specific indication, are generally well tolerated and cost effective.[1] Potentially inappropriate prescribing (PIP) happens when the risks associated with giving a medication outweigh the expected benefits, or when a specific medication is indicated but not yet prescribed.[1] It is a well known fact that PIP is associated with increasing adverse drug reactions (ADRs) and medication-related hospitalisations.[2 3] Elderly people are more vulnerable to drug-related problems due to their altered pharmacokinetic and pharmacodynamic responses, comorbidities and polypharmacy.[1] In addition, older adults are usually excluded from clinical trials, thereby resulting in a lack of precise scientific evidence regarding prescribing among this population. All these factors make prescribing medications for elderly patients more challenging for healthcare professionals (HCPs). Several explicit criteria have been developed to help HCPs reduce inappropriate prescribing. Beers criteria[4] and the screening tool of older persons' prescriptions/the screening tool to alert doctors to right treatment (STOPP/START) criteria[5] are the most commonly cited tools for detecting PIP in elderly patients. Beers criteria and STOPP criteria address potentially inappropriate medications (PIMs), while START criteria address potential prescribing omissions (PPOs).

The prevalence of PIP among elderly patients varies significantly, depending on the study design, tools used and the targeted population.[6] Among elderly patients admitted to hospitals in six European countries, the prevalence of PIM was 22.7–77.3% and that of PPO was between 51.3% and 72.7%.[7]

Hospital admissions seem to offer a chance for HCPs to comprehensively review the medications of patients, optimise prescribing, and therefore, reduce preadmission PIM and PPO. However, several studies have reported insignificant changes or even an increase in the prevalence of PIP at discharge.[8–10]

The awareness and knowledge of HCPs about PIP are the key elements in preventing the negative outcomes associated with PIP. A limited number of studies have evaluated the knowledge of HCPs about PIP.[11] The results from these studies revealed that HCPs have inadequate knowledge about PIP, regardless of the large number of elderly patients treated by them daily.[11 12]

In Malaysia, clinical pharmacists have a substantial role in drug prescribing. Although they are not authorised to issue a prescription, they actively participate in therapeutic decisions hand in hand with the physicians. The objectives of this study were (1) to assess the knowledge and confidence of hospital physicians and clinical pharmacists about prescribing for elderly patients; and (2) to identify the perceived barriers to appropriate prescribing for elderly patients in daily practice.

METHODS

Questionnaire development
The questionnaire was partially adapted, with permission, from a questionnaire used by Ramaswamy et al.[11] In addition to the demographic information, the original questionnaire covered four aspects, namely, confidence, practice, barriers, and knowledge about prescribing for elderly patients. The knowledge part was modified and updated resulting in six clinical vignettes based on the latest version of Beers criteria (2015) and the STOPP/START criteria version 2.

Questionnaire validation
The items of the questionnaire were validated by a panel of seven experts composed of lecturers and researchers holding a PhD degree in pharmacy practice. The experts were asked to rate the items in terms of relevance and clarity by means of a four-point scale rating, where 1=not relevant, 2=somewhat relevant, 3=relevant, 4=very relevant; and 1=not clear, 2=somewhat clear, 3=clear, 4=very clear. Then, the content validity index for items (I-CVI) and the average content validity index for scale (S-CVI/Ave) were calculated. The I-CVI was computed as the number of experts giving a rating of 'relevant' or 'very relevant' divided by the total number of experts, and the (S-CVI/Ave) was defined as the average of the I-CVIs.[13]

The final questionnaire
The final questionnaire (online supplementary appendix) consisted of five parts: (1) Demographic and practical information regarding the participants, including the estimated percentage of patients above 65 years old seen daily, and whether or not they were providing care for elderly patients in long-term care settings. The answers for the last question were converted into dichotomous variables, namely, 'yes', if they were currently providing such a service, and 'no', if they never provided or were no longer providing the service. (2) The confidence of the physicians/pharmacists in recommending medications for elderly patients. The participants were asked to what extent they agreed/disagreed with the statement, 'I have confidence in my ability to recommend appropriate medications for the elderly', by using a five-point Likert scale. The results were further dichotomised into 'more confident', if the participant answered 'strongly agree' or 'agree', and 'less confident', if the participant answered 'neutral', 'disagree' or 'strongly disagree'. (3) The academic resources used in prescribing for elderly patients. The participants were questioned as to how frequently they used resources when prescribing for elderly patients by means of a four-point Likert scale (online supplementary appendix). The participants were also asked about their use and knowledge of Beers criteria and STOPP/START criteria by means of a five-point scale (online supplementary appendix). A physician/pharmacist was considered to be using a specific resource if he/she stated that it was 'often used' or 'sometimes used'. (4) Knowledge: the knowledge about prescribing for elderly patients was assessed by six clinical vignettes based on Beers and STOPP/START criteria. The participants were given one point for each correct answer to the vignettes, with the highest possible score being 6. (5) The perceived barriers: the participants were asked to state their level of agreement with regard to 12 potential barriers to appropriate prescribing in elderly patients using a five-point Likert scale (online supplementary appendix). The results were further dichotomised into 'agree that is a real barrier', if the participant's answer was 'strongly agree' or 'agree', and 'disagree that is

a real barrier', if the participant's answer was 'neutral', 'disagree' or 'strongly disagree'.

The final instrument and the study protocol were approved by the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia (NMRR-15-718-25235), and by the clinical research centres of the two hospitals involved.

Study design and setting
This cross-sectional study was conducted at the medical inpatient departments of two Malaysian hospitals in December 2016. These hospitals are the largest two tertiary hospitals in the state of Pahang, the largest state in peninsular Malaysia.

Study population
A paper survey of the final validated instrument was distributed to all physicians (n=78) and clinical pharmacists (n=45) who were serving in the medical inpatient departments of the two hospitals.

Statistical analysis
The data were analysed using the Statistical Package for the Social Sciences version 24.0 (IBM SPSS Statistics 24). A Shapiro–Wilk normality test was performed to test the normality of the continuous variables. The mean, SD and median were calculated for the continuous variables. The Kruskal–Wallis and Mann–Whitney U tests were used to determine the differences in continuous variables among the subgroups. χ^2 test was used to compare categorical variables. The significance level was set at 5%.

RESULTS

Content validity
Two items of the perceived barriers were rated as 'somewhat clear' by two experts. These items were rephrased and given back to the experts. After editing, the experts rated these items as clear/very clear. All other items of the whole questionnaire were rated as clear/very clear. All items of confidence, resources of information, perceived barriers were rated as relevant/very relevant. For the knowledge part items, four vignettes had the experts' consensus of being congruent to the construct; that is, the I-CVI was 1.00, and the other two items were rated as relevant by six out of the seven experts (I-CVI=0.86). The S-CVI/Ave was 0.95.

Sample characteristics
Eighty-two participants out of 123 (67%) answered the survey, with 57% being female, and the mean age (SD) was 29 years (4). The majority in the sample (65%) were physicians and none of them were geriatricians. Only 8.5% of the respondents had been in practice for more than 10 years, and eight respondents (9.8%) had received training in geriatric medicine. More than 70% of the participants stated that at least a quarter of their patients were elderly, and only 13.4% of the respondents were providing care for elderly patients in long-term healthcare settings (table 1).

Confidence and usage of medical resources
A third of the participants (34%) were more confident in their ability to recommend appropriate medications for elderly patients. There was no significant difference in the number of physicians and clinical pharmacists who considered themselves as more confident about this issue (P=0.157). The most common sources of information to help in prescribing for elderly patients

Table 1 Characteristics of the participants (n=82)

Characteristic		n (%)*
Gender		
Female		47 (57)
Male		35 (43)
Age		
Mean years (SD)		29 (4)
Median (range, IQR) years		28 (24 – 50 , 26 – 30)
Profession		
Physicians		53 (65)
Clinical pharmacists		29 (35)
Years in practice		
1 – 5 years		51 (62.2)
6 – 10 years		24 (29.3)
> 10 years		7 (8.5)
Received training in geriatric medicine		
Yes		8 (9.8)
No		74 (90.2)
Percentage of elderly patients seen by the participants		
< 10 %		9 (11)
10 – 24 %		15 (18.2)
25 – 49 %		29 (35.4)
> 50%		29 (35.4)
Providing care in long-term settings		
Never	No	68 (82.9)
Used to but stopped		3 (3.7)
Less than once weekly	Yes	6 (7.3)
Once weekly or more		5 (6.1)

*Except where otherwise indicated.

Table 2 Confidence and practices of the physicians and pharmacists in relation to geriatric patients (n=82)

Variable		n (%)
Confidence in prescribing appropriate medications for geriatrics		
More confident		28 (34)
Less confident		54 (66)
Resources of information used regarding recommending medications for the geriatrics		
Computer (eg, websites, Google)		74 (90.24)
Consultant (pharmacist/physician)		74 (90.24)
Software on handheld device		72 (87.80)
Clinical practice guidelines		71 (86.59)
Handbook		48 (58.54)
Journal articles		43 (52.44)
Textbook		32 (39.02)
Use of Beers criteria		
Never heard of	No	55 (67.1)
Known but never used		14 (17.1)
Rarely used		9 (11)
Sometimes used	Yes	2 (2.4)
Often used		2 (2.4)
Use of STOPP/START criteria		
Never heard of	No	56 (68.3)
Known but never used		12 (14.6)
Rarely used		9 (11)
Sometimes used	Yes	3 (3.7)
Often used		2 (2.4)

Table 3 Percentages of respondents who answered vignettes correctly (n=82)

Body system	Vignette	Addressed criteria	n (%)
Cardiovascular	1 (HTN on DM)	STOPP/Beers	56 (68)
	3 (HTN)	STOPP/Beers	60 (73)
	6 (IHD on DM and HTN)	START	46 (56)
Endocrine	2 (DM)	STOPP/Beers	55 (67)
Psychiatry	4 (depression)	START	54 (66)
Musculoskeletal	5 (arthritis on HTN and IHD)	STOPP/Beers	28 (34)

DM, diabetes mellitus; HTN, hypertension; IHD, ischaemic heart disease.

were website searches and consultations with other professionals (90%) (table 2). Only six participants (7.3%) had ever used STOPP/START or Beers criteria when prescribing medications for elderly patients, while 60% of the respondents had never heard of either one of those criteria (table 2).

Knowledge
The mean (SD) and median scores for knowledge were 3.65 (1.46) and 4.00 points, respectively. Fifty-five respondents (67.1%) scored four points or lower. Seven respondents answered all six vignettes correctly, and two respondents did not answer any vignette correctly. The most frequent vignette that was correctly answered was number 3, which pertained to the management of hypertension, and the least one was number 5, which was related to the management of arthritis in elderly patients with cardiovascular diseases. Seventy-three percent of the respondents correctly chose to stop doxazosin in a patient with controlled hypertension and a history of falls. However, only 34% of the respondents correctly chose to avoid nonsteroidal anti-inflammatory drugs (NSAIDs) because of severe hypertension, and selective cyclooxygenase 2 (COX-2) inhibitors because of ischaemic heart disease. Table 3 shows the details of the vignettes that were answered correctly.

The respondents were divided into subgroups based on their characteristics (eg, gender, profession, training received) to test the differences in the knowledge scores. No significant differences in the knowledge scores were found between the subgroups except for confidence, where the participants who rated themselves as more confident in prescribing for elderly patients had significantly higher scores than those with less confidence (table 4).

Barriers to appropriate prescribing for elderly patients
Participants were asked about their perception of barriers which restrain appropriate prescribing for elderly patients. Four participants cited all the 12 proposed statements as real barriers to appropriate prescribing in elderly patients, and three others did not consider any of the proposed statements as real barriers. The mean (SD) number of barriers cited per participant was 6.88 (2.84) barriers with no difference between physicians and clinical pharmacists (P=0.274). The most cited barrier was 'the patient is taking a large number of medications', whereas the least cited one was 'the patient requests to begin a specific medication' (table 5).

DISCUSSION
This study assessed the knowledge, confidence and perception of hospital physicians and clinical pharmacists about appropriate

Table 4 Comparison of knowledge scores based on participants' characteristics

Variable	Knowledge score		Significance (P value)
	Mean (SD)	Median	
Gender			
Female	3.62 (1.49)	4.00	0.777
Male	3.69 (1.47)	4.00	
Profession			
Physicians	3.58 (1.56)	3.00	0.762
Clinical pharmacists	3.76 (1.27)	4.00	
Received training			
Yes	4.38 (0.74)	4.5	0.115
No	3.57 (1.5)	3.5	
Years in practice			
1 – 5 years	3.37 (1.55)	3.00	0.097
6 – 10 years	4.17 (1.23)	4.00	
> 10 years	3.86 (1.46)	4.00	
Use of STOPP/START criteria			
Yes	4.4 (1.14)	4.00	0.270
No	3.6 (1.47)	4.00	
Use of Beers criteria			
Yes	4.00 (0.82)	4.00	0.670
No	3.63 (1.49)	4.00	
Providing care in long-term settings			
Yes	3.45 (1.44)	3.00	0.616
No	3.68 (1.47)	4.00	
Confidence in prescribing for elderly			
Less confident	3.37 (1.60)	3.00	0.020
More confident	4.18 (0.94)	4.00	
Percentage of elderly patients seen by the participants			
< 10 %	3.89 (1.05)	4.00	0.434
10 – 24 %	3.33 (1.29)	3.00	
25 – 49 %	3.90 (1.52)	4.00	
> 50%	3.65 (1.46)	4.00	

Table 5 Barriers to appropriate prescribing, with the number (percentage) of participants who cited the barrier in descending order

Proposed barriers to appropriate prescribing in elderly patients	n (%)
The patient is taking a large number of medications	71 (86.6)
Lack of formal education on prescribing for the elderly	64 (78)
Potential drug–drug interactions	59 (72)
Cost of medication	55 (67)
Limited options in the drug formularies	51 (62.2)
Lack of information about current patient's medications	50 (61)
Lack of acceptable therapeutic alternatives	46 (56.1)
Difficulty in communicating with other healthcare providers involved in a patient's care	46 (56.1)
Lack of time	36 (43.9)
The patient is unwilling to discontinue a medication prescribed by another physician	36 (43.9)
Lack of access to a pharmacist/physician	32 (39)
The patient requests to begin a specific medication	18 (22)

prescribing in elderly patients. Since there is no standard, validated tool to assess the knowledge regarding appropriate prescribing in elderly patients, the latest versions of Beers criteria and STOPP/START criteria were used to develop a scale to assess the relevant knowledge.

According to the literature, the use of clinical vignettes to assess the quality of a physician's practice is comparable to the standardised patients method and is better than medical record abstraction.[14 15] Six clinical vignettes were developed to cover the common geriatric diseases. The experts' rating of the developed scale showed good content validity. According to Lynn *et al*, an item is considered as representing the domain of interest being measured when six out of seven experts rate it as relevant to that domain (I-CVI ≥0.86).[16] The S-CVI/Ave is an interchangeable term that pertains to the average congruency percentage (ACP), and according to Waltz *et al*, the ACP should be ≥0.9 for a scale to be considered as validated.[17]

It is believed that this is the first study to assess the knowledge of hospital physicians and clinical pharmacists about appropriate prescribing for elderly patients in Malaysia. The results of the knowledge score showed that only about a third of the participants (36.9%) achieved a 'high score'; that is greater than the median point. This revealed that the majority of the participants possessed inadequate knowledge despite the high percentage

of elderly patients seen by them every day. Similar results were found in studies conducted in other countries with regard to both primary care physicians[12] and hospital physicians.[11] It is important to mention here that the estimation of percentage of elderly patients seen daily was self-reported, which makes it subject to recall bias and hence it may not exactly represent the actual practice.

The results of the current study found that only about one-third of the participants (34.1%) had confidence in their ability to prescribe appropriately for elderly patients. This finding is consistent with the results reported from another study in Malaysia, where low self-perceived confidence about geriatric pharmacotherapy was reported among pharmacists and pharmacy students.[18] It is noteworthy that we found a significant association between the confidence of the physicians and pharmacists and their knowledge scores (P=0.02). This probably reflected the perception of the participants concerning their inadequate knowledge in geriatric pharmacotherapy since the majority of them did not feel confident to recommend medications for elderly patients.

In a previous study in Malaysia, pharmacists considered continuous professional development courses as one of the best measures to enhance their competency and knowledge about geriatric pharmacotherapy.[18] Although our study showed no difference in the knowledge scores between participants who had received training in geriatric medicine and those who had not, the sample size is low to reach significance. (Only eight physicians/pharmacists had received training).

Although many studies have demonstrated the advantages of using Beers criteria or STOPP/START criteria in prescribing for geriatrics,[6] the present results showed that these criteria were tremendously underused among the hospital physicians and pharmacists. These findings were consistent with the results of other studies conducted in the United States and Italy.[11 12] There was no significant difference in regard to the knowledge between the participants who used STOPP/START criteria or Beers criteria and those who did not. However, the proportion of participants who used these tools is low to reach significance.

The current study also showed that the years of practice were not associated with the achievement of a higher score in the clinical vignettes. It may be assumed that the longer duration of practice would mean more experience and knowledge and, therefore, a better quality of care would be provided. However, several studies have demonstrated that physicians who have been

in practice for a longer period have lower levels of knowledge and may be at risk for providing lower-quality care.[12 19] In addition, no significant difference was found between the scores of participants who had been providing care in long-term settings and those who had not. However, this result is limited by the low number of participants who provided care in long-term settings.

The most frequent incorrectly answered clinical vignettes were numbers 5 and 6. Vignette 5 assessed the knowledge about prescribing a long-term analgesic for an elderly patient with a history of ischaemic heart disease and severe hypertension. The majority of the participants chose to avoid propoxyphene, which is a short-acting opioid analgesic, and to start with a selective/non-selective NSAID. It is well established that selective COX-2 inhibitors are contraindicated in the case of ischaemic heart disease,[20] and that long-term use of non-selective NSAIDs exacerbate hypertension, and is associated with renal, cardiovascular and gastrointestinal side effects.[21] Vignette 5 was designed to assess the inappropriate omission of angiotensin-converting enzyme (ACE) inhibitors in patients with coronary artery disease (CAD). It has been proven that ACE inhibitors have a prophylactic effect against cardiovascular events in patients with CAD.[22] The Eighth Joint National Committee (JNC 8) guidelines consider the presence of CAD as a compelling indication for an ACE inhibitor.[23] About half of the participants in the current study failed to choose an ACE inhibitor for secondary prophylaxis of CAD. This finding reinforced the results found by other studies about the tendency to underprescribe ACE inhibitors in patients with documented CAD.[24 25]

The study identified the most commonly used medical resources by the hospital physicians/pharmacists in their daily practice. The participants cited website searches and handheld software devices as the first and second most frequently used resources, respectively. These findings may give an idea about the appropriate method for designing an educational intervention for the hospital physicians/pharmacists. Educational sessions associated with the development of a specific smartphone application for prescribing in elderly patients may be one of the educational approaches to enhance the knowledge of the physicians and pharmacists regarding appropriate prescribing in elderly patients. Knowledge enhancement should affect the decision making during practice and, therefore, improve the quality of prescribing for a particular patient.[11]

The study also investigated the perception of the hospital physicians/pharmacists towards the barriers to appropriate prescribing for elderly patients. Comparable to similar studies,[11 12] the participants cited the presence of a large number of medications and the potential drug–drug interactions as the main real barriers in practice. It is well established that polypharmacy increases the risk for potentially inappropriate prescribing, adverse drug events and drug–drug interactions.[26] Although, polypharmacy is sometimes unavoidable in elderly patients, its negative clinical outcomes can be minimised. This can be done by an inter-professional review of the patient's case and medications, discontinuation of unnecessary medications, and the use of explicit criteria for prescribing in geriatrics.[26] Interestingly, a lack of formal education on prescribing for the elderly was the next frequently cited barrier. This finding supports the conclusion of this study about the perception of the participants regarding their inadequate knowledge about PIP, and the crucial need for continuing education in this field.

CONCLUSION

This study revealed that only a minority of participants had adequate knowledge about prescribing for elderly patients, and awareness of the presence of specific criteria for prescribing in this population. The majority admitted they were not confident to prescribe medications for elderly patients. Polypharmacy and the lack of formal education on geriatric pharmacotherapy were cited as the most important barriers to appropriate prescribing. Educational intervention and its potential impact on physicians' and clinical pharmacists' knowledge and practice should be considered for future research.

Limitations

This study was conducted among healthcare professionals serving in the general medical departments of two Malaysian hospitals with relatively low number of participants. This made it difficult to generalize the results for all healthcare professionals in Malaysia or for all Malaysian hospitals. In addition, a third of the approached physicians/pharmacists did not answer the survey, making the results susceptible to nonresponse bias. However, the response rate for this study was higher than that of others.[11 12]

What this paper adds

What is already known on this subject

► Potentially inappropriate prescribing is common in elderly patients and it is of great concern because of its related negative outcomes in this vulnerable population.

► The few available studies showed lack of confidence and inadequate knowledge of healthcare professionals about appropriate prescribing for elderly patients.

What this study adds

► This was the first study in Malaysia to assess the knowledge of hospital physicians and clinical pharmacists about appropriate prescribing in elderly patients and their perception towards barriers to optimise prescribing in this population.

► The study revealed a lack of awareness of physicians and pharmacists about the existence of special criteria for prescribing for elderly patients coupled with a lack of confidence and knowledge about appropriate prescribing for this population.

REFERENCES

1 O'Connor MN, Gallagher P, O'Mahony D, *et al*. Inappropriate prescribing: criteria, detection and prevention. *Drugs Aging* 2012;29:437–52.

2 Hamilton H, Gallagher P, Ryan C, *et al*. Potentially inappropriate medications defined by STOPP criteria and the risk of adverse drug events in older hospitalized patients. *Arch Intern Med* 2011;171:1013–9.

3 van der Stelt CA, Vermeulen Windsant-van den Tweel AM, Egberts AC, *et al*. The association between potentially inappropriate prescribing and medication-related hospital admissions in older patients: a nested case control study. *Drug Saf* 2016;39:79–87.

4 Samuel MJ. By the American Geriatrics Society 2015 Beers Criteria Update Expert Panel. American geriatrics society 2015 updated beers criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc* 2015;63:2227–46.

5 O'Mahony D, O'Sullivan D, Byrne S, *et al*. STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. *Age Ageing* 2015;44:213–8.

6 Hill-Taylor B, Sketris I, Hayden J, *et al*. Application of the STOPP/START criteria: a systematic review of the prevalence of potentially inappropriate prescribing in older adults, and evidence of clinical, humanistic and economic impact. *J Clin Pharm Ther* 2013;38:360–72.

7 Gallagher P, Lang PO, Cherubini A, *et al*. Prevalence of potentially inappropriate prescribing in an acutely ill population of older patients admitted to six European hospitals. *Eur J Clin Pharmacol* 2011;67:1175–88.

8 Gutiérrez-Valencia M, Izquierdo M, Malafarina V, *et al*. Impact of hospitalization in an acute geriatric unit on polypharmacy and potentially inappropriate prescriptions: A retrospective study. *Geriatr Gerontol Int* 2017;17:2354–60.

9 Wickop B, Härterich S, Sommer C, *et al*. Potentially inappropriate medication use in multimorbid elderly inpatients: differences between the FORTA, PRISCUS and STOPP ratings. *Drugs Real World Outcomes* 2016;3:317–25.

10 Bakken MS, Ranhoff AH, Engeland A, *et al*. Inappropriate prescribing for older people admitted to an intermediate-care nursing home unit and hospital wards. *Scand J Prim Health Care* 2012;30:169–75.

11 Ramaswamy R, Maio V, Diamond JJ, *et al*. Potentially inappropriate prescribing in elderly: assessing doctor knowledge, confidence and barriers. *J Eval Clin Pract* 2011;17:1153–9.

12 Maio V, Jutkowitz E, Herrera K, *et al*. Appropriate medication prescribing in elderly patients: how knowledgeable are primary care physicians? A survey study in Parma, Italy. *J Clin Pharm Ther* 2011;36:468–80.

13 Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? Critique and recommendations. *Res Nurs Health* 2006;29:489–97.

14 Veloski J, Tai S, Evans AS, *et al*. Clinical vignette-based surveys: a tool for assessing physician practice variation. *Am J Med Qual* 2005;20:151–7.

15 Peabody JW, Luck J, Glassman P, *et al*. Measuring the quality of physician practice by using clinical vignettes: a prospective validation study. *Ann Intern Med* 2004;141:771–3.

16 Lynn MR. Determination and quantification of content validity. *Nurs Res* 1986;35:382–5.

17 Waltz C, Strickland OL, Lenz E. *Measurement in nursing and health research*. 5th edn: Springer Publishing Company, 2016.

18 Wahab MSA, Othman N, Kowalski SR, *et al*. Pharmacy students' and pharmacists' perceptions about geriatric pharmacotherapy education. *Pharmacy education* 2017;17. http://pharmacyeducation.fip.org/pharmacyeducation/article/view/468

19 Choudhry NK, Fletcher RH, Soumerai SB. Systematic review: the relationship between clinical experience and quality of health care. *Ann Intern Med* 2005;142:260.

20 Joint Formulary Committee. *British national formulary*. 73rd edn. London: Joint Formulary Committee, 2017.

21 White WB. Defining the problem of treating the patient with hypertension and arthritis pain. *Am J Med* 2009;122:S3–S9.

22 McAlister FA. Angiotensin-converting enzyme inhibitors or angiotensin receptor blockers are beneficial in normotensive atherosclerotic patients: a collaborative meta-analysis of randomized trials. *Eur Heart J* 2012;33:505–14.

23 James PA, Oparil S, Carter BL, *et al*. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the eighth joint national committee (JNC 8). *JAMA* 2014;311:507–20.

24 Liu CL, Peng LN, Chen YT, *et al*. Potentially inappropriate prescribing (IP) for elderly medical inpatients in Taiwan: a hospital-based study. *Arch Gerontol Geriatr* 2012;55:148–51.

25 Barry PJ, Gallagher P, Ryan C, *et al*. START (screening tool to alert doctors to the right treatment)--an evidence-based screening tool to detect prescribing omissions in elderly patients. *Age Ageing* 2007;36:632–8.

26 Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. *Expert Opin Drug Saf* 2014;13:57–65.