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Pharmacy students' and pharmacists' perceptions about geriatric pharmacotherapy education

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Abstract

Background: An adequate background knowledge base in geriatric pharmacotherapy (GPT) must be attained by pharmacists in order for them to provide optimal care to the elderly.

Objectives: To investigate the perceptions of pharmacy students about the need for competency in GPT, pharmacists' level of self-perceived confidence in providing GPT, and their opinions about GPT training and education.

Methods: In this cross-sectional study, a questionnaire was distributed to pharmacy students from a public university and pharmacists from four public hospitals in Selangor, Malaysia between May and August 2013.

Results: The response rates were 85.8% (151/176) and 58.9% (128/217) for the pharmacy students and pharmacists respectively. Pharmacy students agreed with the need for GPT competency (mean agreement: 4.64 ± 0.61), but pharmacists' self-perceived confidence in GPT was moderate (mean agreement: 3.26 ± 0.71). The respondents' agreement about the adequacy of GPT education received during their undergraduate studies was also modest (pharmacy students, 3.22 ± 0.86; pharmacists, 2.84 ± 0.82; $p<0.01$). In addition, the respondents welcomed more education in GPT; considered knowledge in common GPT-related topics as important; preferred software to obtain GPT information; and perceived clinical attachment with geriatricians as useful to enhance their GPT knowledge.

Conclusion: Our findings provide a basis to make more GPT education available to both pharmacy students and pharmacists.

Keywords: *Education, Geriatric pharmacotherapy, Malaysia, Pharmacy students, Pharmacists*

Introduction

The number of people worldwide aged 65 years and older is estimated to increase dramatically in the coming decades (United Nations, 2012). Older patients generally suffer from multiple co-morbidities and are common users of medications (Hilmer *et al*., 2007; Reeve *et al*., 2013). The pharmacokinetics and pharmacodynamics of drugs can be affected by age-related physiological changes, predisposing elderly patients to adverse drug reactions (ADRs) (Hilmer *et al*., 2007). In addition, other drug-related problems (DRPs) that are common among the elderly, such as polypharmacy, drug-drug interactions, drug-disease interactions, the use of the potentially inappropriate medicines (PIMs), medication underuse, and lack of adherence may increase the complexity of geriatric pharmacotherapy (GPT) (Elliott, 2006; Hilmer *et al*., 2007; Page *et al*., 2010; Wahab *et al*., 2012; Elliott & Booth, 2014).

Pharmacists can participate in geriatric care by working with other healthcare providers to ensure that elderly patients are receiving the most appropriate, safest and most effective drug therapy (Hilmer *et al*., 2007). Moreover, pharmacists can ensure optimal pharmaco-

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therapy for elderly patients by designing, monitoring and assessing pharmaceutical care plans to achieve patients' therapeutic goals (Spinewine *et al*., 2012). Due to the demographic and epidemiological transitions, and the increased in demand for healthcare services by the elderly patients, the roles of pharmacists in geriatric care are substantial.

Given the complexity of GPT, and the multitude of risk factors for DRPs among the elderly, pharmacists should possess an adequate competency and knowledge of GPT in order to provide optimal pharmaceutical care to this group of patients. Pharmacists need to understand the influences of ageing on the pharmacokinetics and pharmacodynamics of drugs and should be familiar with common medical illnesses and syndromes among the elderly (Odegard *et al*., 2007). In addition, pharmacists should be competent in identifying, resolving and preventing geriatric-related DRPs.

Nevertheless, previous studies have shown that pharmacists may not be adequately provided with GPT education during their undergraduate studies or at their workplaces (Bardach & Rowles, 2012; Keijsers *et al*., 2012; Spinewine *et al*., 2012; Zou & Tannenbaum, 2014). It appears that courses with geriatric foci in pharmacy curricula are not always offered by pharmacy schools (Haddad *et al*., 2011). In a systematic review by Keijsers *et al*. (2012), it was shown that, in the last decade, undergraduate pharmacy courses only provide a median of ten (range = 1–160) hours of teaching of geriatric pharmacology or pharmacotherapy. GPT education at the postgraduate level is even more uncommon (Haddad *et al*., 2011; Keijsers *et al*., 2012).

There is a *prima facie* case, therefore, that more attention should be given to enhancing GPT competency and knowledge among pharmacy students and pharmacists (Delafuente, 2009). To date, research on GPT education in Malaysia is lacking and there is limited information in the literature regarding the needs for GPT competency and the adequacy of GPT knowledge, from the point of view of both pharmacy students and pharmacists themselves. Such information is required to understand the current status of GPT education in the pharmacy curricula, and to identify specific measures to improve competency and knowledge in GPT among pharmacy students and pharmacists.

The main aim of the present study was to determine the perceptions of Malaysian pharmacy students about the extent to which pharmacists need competency in GPT, the self-perceived confidence of pharmacists in respect to GPT, and their opinions on the adequacy of GPT education during their undergraduate studies. The secondary objectives of the study were to obtain the respondents' opinions of the importance of knowledge of common GPT-related topics and to determine their preferred sources of information for GPT, and preferred methods to enhance their competency and knowledge in the area.

Methods

Questionnaire development

The present study is a cross-sectional study using a self-administered survey instrument which was distributed to pharmacy students from a public university and pharmacists from four public hospitals in Selangor, Malaysia between May and August 2013. For the purpose of the study, a self-administered survey instrument was developed following a detailed review of relevant literature (Elliott, 2006; Odegard *et al*., 2007; Maio *et al*., 2011; Ramaswamy *et al*., 2011). In this present study, the questionnaire was constructed in English, translated into Malay and back-translated into English for accuracy and validity. The final version of the questionnaire contains survey items in both languages. The questionnaire was reviewed by professors in pharmacy, senior pharmacy lecturers, and senior practicing pharmacists for face validity. It was then pre-tested on a small sample of pharmacy students (n = 10) and pharmacists (n = 10) to evaluate its readability and comprehensibility. Results from the pre-testing were not included in the final analysis of data.

There were five sections in the survey instrument. The purpose of the first section was to obtain the generic demographic information of the respondents. The second section consisted of three survey items. The first survey item asked the students their perceptions about the need for pharmacists to be competent in GPT. A modification was made to this survey item for the practising pharmacists in that they were asked to rate their confidence in providing GPT to elderly patients. The next two items in the second section asked both respondent groups whether they had received sufficient GPT education throughout their undergraduate studies, and whether there was a perceived requirement for more GPT education in pharmacy curricula.

The third section of the instrument asked the pharmacy students and pharmacists to rate the importance of having knowledge of four GPT-related topics. The topics presented in this section of the survey represent the basic and clinical sciences in GPT (Odegard *et al*., 2007). The fourth section listed various sources of information, and the respondents were asked to rate their preference for each of the sources when looking for GPT information. Finally, in the fifth section, the respondents were asked to indicate their level of agreement with measures that could enhance their competency and knowledge of GPT. Apart from the demographic section, responses of the participants were based on a five-point Likert-type scale; 1 = absolutely disagree, to 5 = absolutely agree (for section two, four and five); and 1 = not at all important, to 5 = very important (for section three).

Selection of pharmacy students

Pharmacy students were recruited from the final year cohort of an undergraduate pharmacy programme at Universiti Teknologi MARA (UiTM), Malaysia. At this public university, students are accepted at an average age

of 19–20 years into a four-year Bachelor of Pharmacy programme upon completion of A-level, a matriculation programme, foundation studies, or a pharmacy diploma. The recommended total sample size was 121 (calculated with a pre-determined margin of error of 5%, a response distribution of 50%, and a confidence level of 95%). We included all final year pharmacy students in this study who, at the time of completing the survey, were three months from finishing their Bachelor's degree. At the time of data collection, 176 final year pharmacy students were sampled.

Selection of pharmacists

Pharmacists were recruited from four public hospitals located around the Klang Valley, Malaysia. The hospitals selected in the present study were chosen for convenience due to logistics reasons. In addition to preparation and dispensing of medications, pharmacists from the selected hospitals were also involved in patient care by providing clinical pharmacy services and pharmaceutical care. Since one of the objectives of the present study was to evaluate the adequacy of the content of GPT education in the local pharmacy curricula, only pharmacists who received their undergraduate education in Malaysia were invited to participate in the study. Based on the sample size calculation with a pre-determined margin of error of 5%, a response distribution of 50%, and a confidence level of 95% , the minimum recommended sample size is 139. At the time of data collection, 217 pharmacists who met the inclusion criteria were sampled.

Data collection

The survey instrument was distributed to the pharmacy students in May 2013 by two dedicated research assistants. The survey was distributed at the end of a mandatory lecture to maximise the response rate. The survey instrument was distributed by hand to the pharmacists of the four selected hospitals, in August 2013. All of the respondents were given two weeks to respond. Non-responders were re-invited to participate. The participation of the pharmacy students and pharmacists in the study was voluntary. The respondents were assured of confidentiality and anonymity.

Ethical approval

The study received ethical approval from the ethical committee of the Faculty of Pharmacy (600-RMI-5/1/6); and from the national Medical Research Ethics Committee (MREC) (NMRR-13-298-15181) to survey the pharmacy students and pharmacists, respectively.

Data analysis

Data from the questionnaires were entered into Statistical Package for the Social Sciences version 17 (SPSS, Inc., Chicago). Comparisons between pharmacy students and pharmacists were undertaken using *chi*-square or Fisher's exact tests for categorical variables and Mann-Whitney U tests for continuous variables. Correlations utilised Spearman's ρ. For section four (preferred sources of information for GPT), the Likert-type scale responses were dichotomised using the two highest level responses ("strongly agree" and "agree") compared to the other three lower responses. A significant difference was considered if the p-value was less than 0.05.

Results

Characteristics of respondents

Table I outlines the demographic characteristics of the study respondents. This study had a high participation and return rate from the pharmacy students (response rate: 85.8%, 151/176) but a lower response rate from the pharmacists (response rate: 58.9%, 128/217). The majority of the pharmacy students were Malay (97.4%, 147/151) and 77.5% (117/151) of them were female. The mean age of the pharmacy students was 23.91 ± 1.41 years old. At the time of the survey, the cumulative grade point average (CGPA) of the majority of the pharmacy students (66.2%, 100/151) was between 3.1–3.5. Similar to the pharmacy students, the majority of the pharmacists were female (82.8%, 106/128). Almost half (46.9%, 60/128) of the pharmacists were Malay, 46.1% (59/128) were Chinese and 7% (9/128) were Indian. The mean age for the pharmacists was 28.19 ± 4.9 years old, with majority having a bachelor's degree in pharmacy as their highest academic qualification (95.3%, 122/128). At the time of the survey, the majority of the pharmacists (65.6%, 84/128) cited their working experience to be less than five years. Only 6.2% (8/128) of the pharmacists had ten years and more of working experience. The respondent groups were similar only with regard to gender distribution (p=0.27).

Perceptions of pharmacy students and pharmacists

Table II shows the responses of the pharmacy students regarding their perceptions about the need for pharmacists to be competent in GPT. With an agreement score of 4.64 ± 0.61, the pharmacy students agreed that pharmacists should be competent in GPT. The pharmacists however only moderately agreed that they were in fact confident in providing GPT (mean agreement: 3.26 ± 0.71). There is a positive but weak correlation between the age of the pharmacists (ρ=0.327, p<0.01) and years of working experience (ρ=0.208, p=0.018) with self-perceived confidence in GPT. In addition the agreement of both pharmacy students and pharmacists about the adequacy of GPT education during their undergraduate studies, were fairly low (pharmacy students: 3.22 ± 0.86 vs. pharmacists: 2.84 ± 0.82; p<0.01). Moreover, both respondent groups agreed that more geriatric pharmacy education should be included in the pharmacy curricula (pharmacy students: 4.24 ± 0.73 vs. pharmacists: 4.15 ± 0.59; p=0.08).

Table I: Characteristics of the pharmacy student and pharmacist respondents participated in the survey

Characteristics	Pharmacy Students (n = 151)	Pharmacists (n = 128)	*p*
Response rate	85.8%	58.9%	<0.05[a]
Gender			
Male	34 (22.5)	22 (17.2)	0.27[a]
Female	117 (77.5)	106 (82.8)	
Race			
Malay	147 (97.4)	60 (46.9)	<0.01[b]
Chinese	0 (0)	59 (46.1)	
Indians	0 (0)	9 (7)	
Others	4 (2.6)	0 (0)	
Age, year			
Mean ± SD	23.91 ± 1.41	28.19 ± 4.9	<0.01[c]
Range	22 - 29	23 – 54	
Grade point average (CGPA) [d, e]			
2.6–3.0	46 (30.5)	-	-
3.1–3.5	100 (66.2)		
3.6–4.0	5 (3.3)		
Previous education[d, e]			
Matriculation	74 (49)	-	-
Foundation	21 (13.9)		
Diploma	56 (37.1)		
Highest qualification[f]			
Doctor of Philosophy/PhD	-	1 (0.8)	-
Masters degree		5 (3.9)	
Bachelor degree		122 (95.3)	
Working experience[f]			
More than 15 years	-	5 (3.9)	-
10 – 15 years		3 (2.3)	
5 –9 years		36 (28.1)	
Less than 5 years		84 (65.6)	

Results are expressed in numbers (percentages) unless stated otherwise
[a]Chi-squared test used.
[b]Fisher's exact test used.
[c]Mann-Whitney U test used.
[d]Grade point average on a scale of 0–4.
[e]Surveyed among pharmacy students only, thus no comparison was assessed.
[f]Surveyed among pharmacists only, thus no comparison was assessed.

Perceived importance of knowledge of GPT-related topics

The respondents were asked to rate (1 = not important at all, to 5 = very important) four GPT-related topics to perceive the importance of topics within GPT (Table III). In general, both the pharmacy students and pharmacists rated all four topics as important; (1) Pharmacokinetics and pharmacodynamics changes in the elderly (4.59 ± 0.52 vs. 4.27 ± 0.52; $p<0.01$); (2) Physiological changes in the elderly (4.66 ± 0.48 vs. 4.38 ± 0.58; $p<0.01$); (3) Potentially inappropriate medications (4.51 ± 0.54 vs. 4.38 ± 0.64; $p=0.10$); and (4) Common geriatric syndromes (4.60 ± 0.54 vs. 4.26 ± 0.61; $p<0.01$).

Preferred sources of information for GPT

Table IV outlines the respondents' preferred sources of information in respect to GPT. Clinical practice guidelines (CPGs) were preferred the most by the pharmacy students (98%, 148/151), followed by scientific journal articles (96%, 145/151) and textbooks (91.4%, 138/151). On the other hand, the majority of the pharmacists preferred medical and pharmacy software (93.8%, 120/128) as their sources of information followed by the CPGs (88.3%, 113/128) and scientific journal articles (78.7%, 100/128). The least preferred source of information for both respondent groups was medication advertisements (pharmacy students: 57%,

Table II: Perceptions of pharmacy students and pharmacists

Survey statement	Respondents	Agreement Mean ± SD[a]	*P*[b]
Student pharmacists' perceptions about GPT competency			
I believe that pharmacists should be competent in providing suggestions and opinions relating to medication appropriateness and to identify drug-related issues specific to the elderly population[c]	Pharmacy Students	4.64 ± 0.61	-
Pharmacists' self-perceived confidence in GPT			
I have confidence in my ability to provide suggestions and opinions relating to medication appropriateness and to identify drug-related issues specific to the elderly population[d]	Pharmacists	3.26 ± 0.71	-
Student pharmacists' and pharmacists' perceptions about GPT content in pharmacy curricula			
I have received sufficient geriatric pharmacotherapy education throughout my undergraduate study	Pharmacy Students Pharmacists	3.22 ± 0.86 2.84 ± 0.82	<0.01
More geriatric pharmacotherapy education should be included in the pharmacy curricula	Pharmacy Students Pharmacists	4.24 ± 0.73 4.15 ± 0.59	0.08

[a]Responses were based on a Likert-type scale ranging from 1 = strongly disagree, to 5 = strongly agree
[b]Statistical difference between groups was assessed using Mann-Whitney U test with 0.05 as the level of significance
[c]Surveyed among pharmacy students only
[d]Surveyed among pharmacists only

Table III: Perceived importance of GPT topics

Topics	Respondents	Agreement Mean ± SD[a]	*p*[b]
Pharmacokinetics and pharmacodynamics changes in the elderly	Pharmacy Students Pharmacists	4.59 ± 0.52 4.27 ± 0.52	<0.01
Physiological changes in the elderly	Pharmacy Students Pharmacists	4.66 ± 0.48 4.38 ± 0.58	<0.01
Potentially inappropriate medications in the elderly	Pharmacy Students Pharmacists	4.51 ± 0.54 4.38 ± 0.64	0.10
Common geriatric syndromes	Pharmacy Students Pharmacists	4.60 ± 0.54 4.26 ± 0.61	<0.01

[a]Responses were based on a Likert-type scale ranging from 1 = Not at all important, to 5 = Very important.
[b]Statistical difference between groups was assessed using Mann-Whitney U test with 0.05 as the level of significance.

86/151 vs. pharmacists: 23.4%, 30/128; $p<0.01$). It was also worth noting that although many pharmacy students regarded pharmacists and physicians as a source of information for GPT, the proportion of pharmacists who preferred to rely on other pharmacists and physicians for information was much lower (just over 60% in each case, compared to in the region of 90% for the students). Moreover, significantly fewer pharmacists referred to pharmaceutical representatives for GPT compared to the pharmacy students (pharmacy students: 74.8%, 113/151 vs. pharmacists: 38.3%, 49/128; $p<0.01$).

Table IV: Preferred sources of information for GPT

Sources of information/ Respondents	Proportions of respondents indicating "agree" and "strongly agree", n (%)		
	Pharmacy Students (n = 151)	Pharmacists (n = 128)	All respondents (n = 279)
Clinical practice guidelines*	148 (98)	113 (88.3)	261 (93.5)
Medical or pharmacy software*	127 (84.1)	120 (93.8)	247 (88.5)
Medication advertisements*	86 (57)	30 (23.4)	116 (41.6)
Online computer search *	127 (84.1)	86 (67.2)	213 (76.3)
Pharmaceutical representatives*	113 (74.8)	49 (38.3)	162 (58.1)
Pharmacists*	131 (86.8)	78 (60.9)	209 (74.9)
Physicians*	136 (90.1)	80 (62.5)	216 (77.4)
Product leaflets	112 (74.2)	96 (75)	208 (74.6)
Scientific journal articles*	145 (96)	100 (78.7)	245 (87.8)
Textbooks*	138 (91.4)	91 (71.1)	229 (82.1)

*Significant difference ($p<0.05$)

Perceptions on measures that can enhance competency and knowledge of GPT

Table V summarises the responses with regard to measures that could enhance competency and knowledge of GPT. A huge proportion of the pharmacy students perceived a clinical attachment to a geriatric ward or unit with geriatricians (99.3%, 150/151), the pupillage or provisionally registered pharmacist (PRP) training programme (94%, 142/151) and the incorporation of GPT education as core or elective courses in their curricula (94%, 142/151) as measures that can enhance their knowledge of GPT. Similarly, the majority of the pharmacists also perceived training with geriatricians during a clinical attachment as an effective way to improve their knowledge of GPT (91.4%, 117/128), with the same percentage (91.4%, 117/128) favouring continuous professional development (CPD) followed by participation in GPT-related conferences or meetings (89.1%, 114/128).

Table V: Perceptions on measures that can enhance competency and knowledge of GPT

Pharmacy students (n = 151), proportions of respondents indicating "agree" and "strongly agree", n (%)*	
Clinical attachment at geriatric ward or unit with geriatricians	150 (99.3)
Incorporation of geriatric pharmacotherapy education as core or elective courses	142 (94)
Postgraduate education in geriatric pharmacotherapy	141 (93.4)
Pupillage or provisionally registered pharmacist training	142 (94)
Research project in geriatric pharmacotherapy/issues	125 (82.8)
Pharmacists (n = 128), proportions of respondents indicating "agree" and "strongly agree", n (%)*	
Certification in geriatric pharmacy	83 (64.8)
Clinical attachment at geriatric ward/unit with geriatrician	117 (91.4)
Continuous professional development courses on geriatric pharmacotherapy	117 (91.4)
Participation in geriatric pharmacotherapy-related conference or meeting	114 (89.1)
Postgraduate education in geriatric pharmacotherapy	103 (80.5)
Research project in geriatric pharmacotherapy / issues	100 (78.1)

*Comparison was not assessed because of variations of survey items between pharmacy students and pharmacists

Discussion

In the present study, the majority of the pharmacy students agreed that pharmacists need competency in GPT. Previous findings have shown that pharmacists' interventions in geriatric patient care have resulted in dose corrections, improvement in medication reconciliations, reduction of PIMs, resolution of drug-drug and drug-disease interactions, improvement in medication knowledge, and decreased re-admission rates among elderly patients (Makowsky *et al*., 2009; Reilly *et al*., 2012). Despite the known benefits of the involvement of pharmacists in geriatric patient care, findings from our study showed that the surveyed pharmacists only moderately agreed that they were confident in providing GPT.

The low self-perceived confidence in GPT among the pharmacists in our survey may be due to limited experience in pharmacy practice. The authors noted that the pharmacists in the present study were relatively young with an average age of 28.19 ± 4.9 years old, with most of them (65.6%, 84/128) having less than five years of working experience. A positive but weak correlation was also found between the age of pharmacists and years of working experience in respect to self-perceived confidence in GPT. In addition, pharmacists' moderate self-perceived confidence in GPT could also be due to insufficient training in their previous undergraduate studies. This is supported by the other findings which showed that both the pharmacy students and pharmacists were somewhat neutral when asked to reflect whether they had received enough GPT education during their undergraduate studies.

The characteristics of the previous undergraduate GPT education received by the pharmacist respondents were not obtained in the survey and therefore it is not possible to identify the method of instruction which appeared to be less effective. The pharmacy curriculum followed by the students in the survey does not include a required or elective course in GPT, although GPT components are integrated in several required courses (*e.g.* hospital pharmacy, pharmaceutical care, pharmacokinetics, and pharmacotherapeutics). Through this integration, lectures about drug therapy for diseases that are common in the elderly such as Alzheimer's and Parkinson' diseases are given. Several lectures about basic GPT (*e.g.* influences of ageing on the pharmacokinetics and pharmacodynamics of drugs, PIMs, *etc*.) were also provided. In addition, clinical cases of elderly patients are often reviewed and discussed in problem-based learning and during the clinical pharmacy attachment. Nevertheless, even with this effort to integrate GPT education across courses in the curriculum, the pharmacy students in the survey perceived it to be insufficient.

There is no consensus as to the best approach for GPT education. Apart from integrating GPT components throughout the pharmacy curriculum, required or elective courses with a didactic or experiential content in GPT could be offered to pharmacy students (Odegard *et al*., 2007). Regardless of the specific approaches to or instruction in GPT education, pharmacy schools and faculties should strive to equip their students with a baseline minimum competency in GPT in order to enable them to meet the healthcare demands of the growing elderly population. Furthermore, the positive acceptance of GPT education by both pharmacy students and pharmacists in this survey should support its implementation.

In the present study, the majority of the respondents perceived the GPT-related topics listed in the survey as important. Although the listed topics did not comprehensively represent all aspects of GPT, our findings showed that the respondents saw the value of GPT knowledge. Odegard *et al*. (2007) suggested that, in addition to knowledge of basic and clinical sciences as listed in the present study, other core pharmacist competencies in geriatrics, such as attitudes and values towards the elderly (*e.g*. awareness of stereotypes about the elderly, understanding of the ethical issues in geriatric patient care) and skills (*e.g*. GPT assessment, interpretation of physical and laboratory test results) should be considered in GPT education.

Medical or pharmacy software was regarded by most of the pharmacists as their source of GPT information. The use of software has been documented to be common among pharmacists, especially for detecting drug-drug interactions, for calculating drug dosage regimens, and for therapeutic drug monitoring (Fischer *et al*., 2003; Cassano, 2006; Mirtallo *et al.,* 2009). Software such as the ePocrates RX Formulary has been shown to be effective as a tool to rule out the risk of clinically relevant ADRs, thus improving patients' safety (Dallenbach *et al*., 2007). The popularity of medical or pharmacy software as a source of GPT information amongst pharmacists suggests that software products with a strong GPT focus could be developed by pharmaceutical educators and software producers.

On the other hand, the majority of the pharmacy student respondents preferred CPGs as their source of information for GPT. This could possibly be due to the widespread use of CPGs in classroom teaching. A huge proportion of the pharmacists also preferred CPGs as a source of information for GPT (88.3%, 113/128). Nevertheless, applying CPGs especially for the elderly with multiple co-morbidities may be difficult (Boyd *et al*., 2005; Mutasingwa *et al*., 2011). This is because elderly patients are seldom included in the randomised controlled trials or meta-analyses from which the recommendations of CPGs are normally obtained. Problems with medicine use among the elderly such as polypharmacy, age-related changes of pharmacokinetics and pharmacodynamics of drugs, multiple co-morbidities and drug-drug or drug-disease interactions, are generally not adequately addressed in CPGs.

The preference for scientific journal articles as a source of information by both the pharmacy students and pharmacists was not surprising due to its wide application as a source of information, but both pharmacy students and pharmacists should be trained in methods to critically appraise scientific journal articles; thereby allowing them to effectively evaluate the validity and usefulness of the scientific research findings. Textbooks, which were preferred by 91.4% (138/151) of the pharmacy students, could be a good source of information for GPT. Nonetheless, it has been reported that even major textbooks, namely Applied Therapeutics: The Clinical Use of Drug; Pharmacotherapy: A Pathophysiologic Approach and Textbook of Therapeutics: Drug and Disease Management do not contain adequately geriatric information for common illnesses. Therefore general pharmacotherapy textbooks should be complemented by primary literature or other geriatric-focused textbooks (Mort *et al*., 2006).

It is worth pointing out the substantial difference of opinion regarding "pharmacists" and "physicians" as a source of GPT information. The authors noted that although more than 85% of the pharmacy students would refer to pharmacists and physicians for GPT information, less than 65% of the pharmacist respondents were of the same opinion. Further investigations should explore how pharmacists perceived their peers and physicians in geriatric care and what the reasons are for this low confidence towards both categories of healthcare professional as a reference source for GPT. It was also observed that a significantly higher percentage of the pharmacy students would refer to pharmaceutical representatives for GPT information (pharmacy students: 74.8%, 113/151 vs. pharmacists: 38.3%, 49/128; $p<0.01$). This should be a cause for concern since the quality of information provided by pharmaceutical representatives may not be comprehensive. Certain information such as adverse drug reactions and contraindications are often not disclosed by pharmaceutical representatives (Mintzes *et al*., 2013).

A clinical attachment to a geriatric ward, or a unit with geriatricians, was perceived by the vast majority of the respondents to be useful in enhancing their knowledge of GPT. Generally, clinical attachments can enhance learning by combining the three domains of education namely: cognitive, affective and psychomotor, and provide the opportunity to apply knowledge and skills in real scenarios, as well as assisting in professionalism development (Woelfel *et al*., 2011). The limited availability of geriatric clinical training sites and geriatricians could limit the implementation of such experiential training, however.

A huge percentage of the pharmacy students (94%, 142/151) also perceived the one-year pupillage or provisionally registered pharmacists (PRP) training programme (Wahab *et al*., 2013) that they are compulsorily required to complete in practice settings after finishing their degree (*e.g*., in hospitals or community pharmacies) as a good way of enhancing their knowledge of GPT. This also depends greatly, however, on whether the clinical training premises can provide GPT training and expertise. Currently, a geriatric rotation is not compulsory in the Malaysian PRP training programme. In this case, a commitment by the training bodies to provide continuing education in GPT for young pharmacists should be necessary. In fact, the survey findings showed that continuing education in GPT was favoured by most of the pharmacists (91.4%, 117/128) as a means to enhance their knowledge of GPT, warranting its implementation. Furthermore, results from a previous survey showed that pharmacists who had continuing education in GPT were two to three times more likely to deliver better geriatric care (Zou & Tannenbaum, 2014).

Certification in geriatric pharmacy was regarded as a means to enhance GPT competency by only 64.8% (83/128) of the pharmacists, a much lower endorsement than other listed measures. This finding was possibly because of limited exposure to the credential programme, high cost, or lack of recognition. At the point of writing, there was no certified geriatric pharmacist in Malaysia (Commission for Certification in Geriatric Pharmacy, 2016). Despite its unpopularity among our pharmacist respondents, certification in geriatric pharmacy, such as that offered by the Commission for Certification in Geriatric Pharmacy, has been recognised in the United States, Canada, Singapore and Australia as a geriatrics training module and verification method to validate pharmacists' competencies in geriatrics (Odegard *et al*., 2007; Marriott *et al*., 2008; Commission for Certification in Geriatric Pharmacy, 2016;).

The present study has several limitations. The authors used a convenience sample of pharmacy students and pharmacists that could potentially be subject to selection bias. Furthermore the pharmacy students and pharmacists in the present study were recruited from one university and four public hospitals, respectively, and therefore our findings may reflect only the opinions from one particular region and may not be generalised to the whole population of pharmacy students and pharmacists in the country. It is also possible that only pharmacy students and pharmacists who were personally interested in GPT responded to our survey. Moreover, the study did not include any community-based pharmacists, and therefore, this study could not provide the whole picture of pharmacists' perceptions on the issues.

Conclusion

Despite the limitations, the findings do suggest a need for increased GPT education in the Malaysian pharmacy curricula in order to better prepare pharmacy students and pharmacists for geriatric patient care. In addition continuous updates of the knowledge of practising pharmacists should be encouraged so that they can keep pace with the growing demands of healthcare for elderly patients (Wahab, 2015). An effort to equip pharmacy students and pharmacists with adequate competency and knowledge of GPT may help to ensure that they are not left out from interdisciplinary teams in geriatric patient care (Delafuente, 2009). Future research directions should focus on establishing the best way to provide GPT education to both the pharmacy students and pharmacists. The content and focus of GPT education should also be further investigated.

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