

RESEARCH ARTICLE

Perceptions of patient safety competency among graduating pharmacy, nursing, physiotherapy and medical imaging students: A cross-sectional study in Malaysia

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Keywords

Clinical competence
Graduate
Malaysia
Patient safety
Psychometric

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Abstract

Aim: The study aimed to investigate the perceptions of patient safety competency (PSC) among a sample of graduating healthcare professionals in a developing country. **Methods:** A cross-sectional survey on self-reported confidence in PSC was conducted among 469 graduands of pharmacy, nursing, physiotherapy and medical imaging at a private healthcare educational institution in Malaysia. Students' confidence in six core domains of competency in the validated Health Professional Education in Patient Safety Survey (H-PEPSS) questionnaire was evaluated in the classroom and clinical settings. **Results:** Nursing students were the most confident in PSC followed by pharmacy, physiotherapy and medical imaging students ($p < 0.05$) in both settings. The pharmacists' scores in both settings were equal in all the domains except for the learning on the 'Recognise and respond to reduce harm' domain ($p = 0.01$). **Conclusion:** Based on H-PEPSS, the pharmacy students attained equal high levels of confidence in patient safety competency from both classroom and clinical settings.

Introduction

Patient safety (PS) was highlighted as an important public health problem by the U.S. Institute of Medicine in its publication 'To Err is Human' (Institute of Medicine, 2000). The complexity of PS issues in health service delivery and the influence of culture and other factors on its outcomes have received a lot of attention (Davies *et al.*, 2000; Guldenmund, 2014). Dissecting the activities of organisations such as hospitals into structure, process and outcome, and defining errors into latent and active ones, helps to clarify areas of focus for safety interventions (Braithwaite *et al.*, 2017). However, the success of safety initiatives and interventions may be affected by morale, competency,

culture, workers' perceptions of the working environment, and leadership (Brown *et al.*, 2008; Braithwaite *et al.*, 2017).

Workers' perceptions of the safety of their environment have been teased into domains of safety culture by researchers, and many tools have been developed and used (Sexton *et al.*, 2006; J. Sorra *et al.*, 2016). Studies have evaluated safety culture in different healthcare settings including general wards, intensive care units, pharmacies, nursing homes, etc. (Etchegaray & Thomas, 2014; J. S. Sorra & Battles, 2014). Practicing healthcare workers as well as those undergoing training may be evaluated.

Healthcare professionals undergoing training should be taught skills in PS early in their courses, and not only after they have begun their clinical career. Worldwide, the amount of training exposure to PS issues may not be sufficient, and not much is known about PS competencies among trainee healthcare professionals (THCPs). Many healthcare quality organisations have called for the inclusion of PS curricula into training programmes and restructuring of thinking, policies and training methodology (American Association of Colleges of Nursing, 2006; Cronenwett *et al.*, 2007; Lucian Leape Institute, 2010). Several curricula have been designed and tried in educational interventions in medical and nursing school courses (L. Ginsburg *et al.*, 2005; Paine *et al.*, 2010; Nie *et al.*, 2011; Aboumatar *et al.*, 2012).

Studies have been performed to understand THCPs' competency in PS skills. Some authors have focused on specific skills in PS and trainees' ability to perform them (Jansma *et al.*, 2011). Others have examined the socio-cultural aspects of PS issues that may influence performance in teams and organisations, a more complex phenomenon akin to PS culture (L. Ginsburg *et al.*, 2012). To study students' perceptions of their experiences of PS learning, Ginsburg and colleagues 2012 produced and validated the Health Professional Education in Patient Safety Survey (H-PEPSS) questionnaire. This tool examines self-reported perceptions of competencies in PS in both clinical and classroom settings. Six core competencies have been evaluated and validated (L. Ginsburg *et al.*, 2012; L. Ginsburg *et al.*, 2013).

Many methodological issues in reporting studies involving perceptions of safety have been addressed (L. Ginsburg & Oore, 2016). For studies that examine perceptions of socio-cultural phenomena, Ginsburg and Oore in 2016 proposed a more rigorous methodology for statistical analysis and presentation of results which could highlight not only the levels of perceptions but also indicate the strength of perceptions within units or teams.

The H-PEPSS questionnaire has provided researchers with a validated tool to study perceptions of PS competency. However, there have only been a few published surveys using the H-PEPSS questionnaire, and these were mostly done in relatively well-developed countries with more advanced healthcare systems (L. Ginsburg *et al.*, 2013; Colet *et al.*, 2015; Hwang *et al.*, 2016; Usher *et al.*, 2017; Shanty & Gropelli, 2018; Castello *et al.*, 2019). Nursing students were the main focus of these studies, and they were consistently reported to have high levels of confidence and were the most confident when compared with other professional groups. However, there is little

information on how pharmacy trainees in developing countries perceive their competency in PS as compared to other trainee healthcare professionals. Therefore, this study's aim was to investigate the levels of confidence in PS competency among graduating pharmacy and other healthcare professional graduands, namely nursing, physiotherapy and medical imaging students.

Methods

Study design and subjects

This study was approved by KPJ Healthcare Clinical and Research Ethics Review Committee (kpj-001/2017). A cross-sectional study was conducted to examine PS learning experiences among THCPs who were graduating in December 2019 from a private healthcare higher education institution. In total, there were 667 graduands from pharmacy, nursing, physiotherapy and medical imaging disciplines. Data were collected in November and December 2019 using an online tool. Information on the study was written in detail at the beginning of the online survey form and informed consent was obtained once respondents clicked on the 'agree' button. Researchers followed up with cohorts' representatives to remind non-respondents of the online survey once, or a maximum of twice.

Survey instrument

The survey instrument was the generic validated H-PEPSS questionnaire, 2010 version (L. Ginsburg *et al.*, 2012). Permission to use the H-PEPSS was granted by its creators. The H-PEPSS assesses confidence levels of PS learning during respective programmes. There are a total of 27 questions which are categorised into seven domains of PS learning: 'Clinical safety' (four questions), 'Culture of safety' (four questions), 'Working in teams with other health professionals' (six questions), 'Communicating effectively' (three questions), 'Managing safety risk' (three questions), 'Understanding human and environmental factors' (three questions) and 'Recognise, respond to and disclose adverse events and close calls' (four questions). 'Clinical safety' was not included in the six-core domain of clinical safety as defined by Ginsburg and colleagues, as it is intended as an introduction to the subject of interest (L. Ginsburg *et al.*, 2012; L. Ginsburg *et al.*, 2013).

Every question begins with 'I feel confident in what I learned about...' and there are five choices of answers on the Likert scale in order to indicate the levels of agreement: 'Strongly disagree = one'; 'Disagree = two'; 'Neutral/unsure = three'; 'Agree = four'; and 'Strongly

agree = five'. Respondents were asked about their experiences in both classroom and clinical settings.

For the purpose of face validation, three versions of H-PEPSS were assessed: the original, modified English and translated Malay language versions. The translation of the questionnaire was done meticulously using the forward and backward translation methodology. The original English version was found to have words and phrases that might not be understood easily by some of the students. Thus, a "modified English" version was developed by minimally modifying the original English questionnaire to assist with the understanding of the questions. The word "fatigue" from the original English version was replaced with "tiredness". For the rest of the questions, the wordings of the original version were maintained, but alternative words or explanatory phrases were added in parentheses that could best capture the meanings in the local context where appropriate. For example:

Q19. the role of environmental factors such as workflow, ergonomics (i.e. human factors, user-friendly systems and equipment), and resources that affect patient safety.

Q20. recognising an adverse event (harmful incident) or close call (near-miss incident).

Selecting the questionnaire version

A focus group consisting of 26 students were asked to complete the original English, modified English and the translated version, in that order. The length of time taken to complete each version was recorded. A discussion about each version then followed. Participants were asked to enter their comments about any questions that they had problems with in the spaces provided. An analysis to assess the practicality, readability, and the clearness of the language in each questionnaire was made.

The modified English version took the shortest amount of time to be completed. As there were 27 questions in the seven domains of H-PEPSS, a total of 702 items were analysed. The comments were quantified into percentages where the numerator was the number of items with comments and the denominator was the total of 702 items. The Malay language translated H-PEPSS showed the highest percentages of comments. Comments were mainly regarding respondents' problems in understanding the translated version as a whole and the difficulty in understanding certain words and phrases in the original version. When the authors focused on the modified H-PEPSS for the clarity of each item (four scale points: 'very clear', 'clear', 'unclear' or 'very unclear'), most of the respondents (ranging from 84.6% to 100%) marked it as 'very clear' or 'clear' with

an excellent inter-rater agreement coefficient, kappa, ranging from 0.81 to 1.00. The general consensus was that the translated version was the hardest to understand while the modified version was the easiest. The majority of participants voted for the modified H-PEPSS for the survey. A pilot study used to evaluate it showed that for each H-PEPSS dimension, internal reliability (Cronbach's $\alpha > 0.70$) and relative test-retest reliability (intraclass correlation coefficient, $\tau = 0.51 - 0.85$) reached acceptable levels. Furthermore, the instrument was decided to have good construct validity as the correlation coefficient was 0.50 or higher.

Analysis

Analysis was done using SPSS software, version 25. To examine the perceptions of the six core domains of patient safety competency, data were analysed based on each domain (L. Ginsburg et al., 2013). For descriptive statistics, all domains' mean scores and standard deviations were calculated. Comparisons between the group means were made for each domain using a one-way analysis of variance (ANOVA). The paired t-test was used to examine the differences in mean responses between the classroom and clinical settings. Rwg(j) was used to assess inter-rater agreements within groups, which indicate the strength of responses (Biemann et al., 2012; L. Ginsburg & Oore, 2016).

Responses of four or five on the Likert scale were defined as positive responses. Rates of positive responses for all domains and both settings for all groups were calculated. The Chi-square statistic for trend was used to evaluate the pattern of differences in the rates among the groups. A positive response rate of > 60% was considered a desirable and important outcome (Schwendimann et al., 2013).

Results

Demography

There were no missing data as all questions had to be answered in the online survey tool. The response rate was 70.3% (469 out of 667). Table I summarises the participants' demographic data. Most were female, ranging from 21 to 25 years old, and graduands of the nursing programme.

Comparing modified H-PEPSS domains

Table II reports the mean scores (five-point Likert scale: one for 'strongly disagree' to five for 'strongly agree') of the respondents' confidence in PS learning in the clinical setting and in the classroom. All HP groups'

domain means are combined in Column B, and 95% confident intervals (CIs) were calculated to identify the significant differences across all the domains. Based on overlapping 95% CIs (not shown), it was confirmed that the respondents' self-reported PS competence in all

domains was not statistically significant. One-way ANOVA and paired t-tests were further conducted to compare programmes and learning settings (see Table II).

Table I: Demographic characteristics of respondents (n = 469)

Characteristic		N	Percentage
Gender	Female	406	86.6
	Male	63	13.4
Age	< 20	55	11.7
	21 - 25	399	85.1
	26 - 30	14	3.0
	31 - 40	1	0.2
Type of programme	Nursing	209	44.6
	Pharmacy	130	27.7
	Physiotherapy	81	17.3
	Medical Imaging	49	10.4

Table II: Summary statistics of Likert scale scores for all domains in both settings

Domain	A Learning setting	B All groups N = 469 Mean (SD)	C Nursing n = 209 Mean (SD)	D Pharmacy n = 130 Mean (SD)	E Physiotherapy n = 81 Mean (SD)	F Med Imaging n = 49 Mean (SD)	G p value†	H Cronbach's alpha‡
Working in teams with other health professionals	Classroom	3.75 (0.94)	3.85 (0.90)	3.71 (1.00)	3.69 (0.90)	3.59 (1.02)	0.033	0.79
	Clinical	3.79 (1.00)	3.93 (0.88)	3.63 (1.16)	3.79 (0.89)	3.65 (1.11)	0.000	0.84
Communicating effectively	Classroom	3.90 (0.93)	4.00 (0.91)	3.87 (0.95)	3.80 (0.90)	3.73 (0.95)	0.006	0.88
	Clinical	3.95 (1.00)*	4.09 (0.89)	3.79 (1.14)	3.93 (0.89)	3.84 (1.15)	0.000	0.90
Managing safety risks	Classroom	3.75 (0.96)	3.89 (0.90)	3.64 (1.03)	3.62 (0.83)	3.68 (0.92)	0.000	0.89
	Clinical	3.83 (0.99)*	4.02 (0.90)	3.62 (1.10)	3.73 (0.85)	3.71 (1.07)	0.000	0.87
Understanding human and environmental	Classroom	3.78 (1.02)	3.90 (0.90)	3.63 (1.14)	3.80 (1.00)	3.64 (1.18)	0.013	0.83
	Clinical	3.90 (0.99)***	4.05 (0.92)	3.72 (1.14)	3.89 (0.93)	3.69 (1.06)	0.000	0.82
Recognise and respond to reduce harm	Classroom	3.74 (1.01)	3.86 (0.90)	3.69 (1.20)	3.58 (0.91)	3.64 (1.07)	0.019	0.86
	Clinical	3.87 (1.00)***	4.00 (0.88)	3.83 (1.16)	3.67 (0.93)	3.76 (1.06)	0.004	0.84
Culture of safety	Classroom	3.77 (0.94)	3.83 (0.97)	3.67 (1.04)	3.74 (0.75)	3.80 (0.84)	0.135	0.85
	Clinical	3.89 (0.92)***	3.97 (0.96)	3.77 (0.97)	3.89 (0.75)	3.82 (0.89)	0.037	0.81

Note:

Mean scores as measured on a five-point Likert scale ranging from one ('strongly disagree') to five ('strongly agree')

Paired t-test for significance within domains compared between learning settings (* $p < 0.05$, ** $p < 0.005$, *** $p < 0.0005$)

†One-way ANOVA for significance within learning settings compared between other trainee groups ($p < 0.05$)

‡ Most items appeared to be closely related as a group in each domain, i.e. reached good reliability ($0.90 > \alpha \geq 0.80$) and acceptable reliability ($0.80 > \alpha \geq 0.70$)

Bold: Not significant within group (Column D, E and F) compared with learning settings ($p < 0.05$)

Differences between trainee healthcare professionals on the modified H-PEPSS

The study showed that the modified H-PEPSS had an overall high internal reliability with Cronbach's α values in all domains and both settings ranging from 0.79 to 0.90 (Table II, column H). A one-way analysis of variance (ANOVA) showed significant differences among the four professional groups in all domains and in both settings, except for 'Culture of safety' in the classroom setting (Table II, column G). Nurses scored significantly higher than the other three THCP groups in all domains, for both learning in the classroom (F ranges from 2.61 to 11.99, $df = 3$, $p < 0.05$) and clinical settings (F ranges from 3.82 to 13.05, $df = 3$, $p < 0.05$).

Differences among trainee healthcare professional groups in the modified H-PEPSS

The overall mean responses (Table II, column B) of the whole group were higher in the clinical setting than in the classroom setting, achieving statistical significance in five domains but not for 'Working in teams with other healthcare professionals' on paired t-test analysis. The trend in the data for nursing (Table II, column C) is that confidence in all domains in PS learning was significantly higher for the clinical setting than the classroom setting ($p < 0.05$). The pharmacists' scores based on both settings did not differ in all the domains (Table II, column D shown in bold text), except for the learning on 'Recognise and respond to reduce harm' ($p = 0.01$). In contrast to the pharmacy group, the physiotherapist group's scores based on both settings differ in all the domains, except for the learning on 'Recognise and respond to reduce harm' ($p = 0.09$; Table II, column E in bold text). Interestingly, the medical imaging group demonstrated no difference in all the domains in both settings (Table II, column F shown in bold text).

Proportions with positive responses

A clearer view of the differences in responses can be obtained by looking at graphical representations of response data (Figure 1). Percentages of positive responses (Likert four or five) for all six core domains are shown.

In the classroom setting, the differences in positive responses or high confidence of learning on PS can be seen in Figure 1a. In all domains, nursing students had the highest rates of positive responses. Nursing and pharmacy students had positive responses $> 60\%$, in all domains, indicating satisfactory learning experiences in both programmes. Physiotherapy did not achieve $> 60\%$ in three domains, namely 'Working in teams with

other health professionals', 'Managing safety risk' and 'Recognise, respond to and disclose adverse events and close calls'. Medical imaging trailed the others with only two domains barely receiving positive responses $> 60\%$, namely 'Communicating effectively' and 'Recognise, respond to and disclose adverse events and close calls'. The observed trends in the differences among the groups were statistically significant according to the Chi-square test for trends for all domains except for 'Culture of safety'.

In the clinical setting, the general trends of the different groups' rates of positive responses were similar to those in the classroom setting, with nursing and pharmacy reporting the highest rates and achieving $> 60\%$ positive responses in all domains (Figure 1b). Importantly, the rates of positive responses were higher than in the classroom setting for physiotherapy and medical imaging too. Physiotherapy reported $> 60\%$ rates of positive responses in all domains, a difference of three domains from the classroom setting. Medical imaging achieved $> 60\%$ positives in three domains, a difference of one domain. The observed trends in the different responses among the groups were statistically significant in all domains.

The ranking of positivity in all domains in both settings can be summarised, in descending order, as nursing, pharmacy, physiotherapy and medical imaging. The clinical setting appears to have given more positive experiences in learning about PS than the classroom setting.

Strength of responses

The within-group agreements for all participants for all domains were strong, as shown by values of Rwg(j) ranging from 0.74 to 0.84 (Table III).

Discussion

Until now, the study by Ginsburg and colleagues in 2013, was the only one that surveyed self-reported patient safety competency among pharmacy students using a validated H-PEPSS questionnaire in the classroom and clinical settings. Other studies using H-PEPSS focused only on nursing students (Colet *et al.*, 2015; Usher *et al.*, 2017). One study compared final year students from medicine, nursing, and traditional medicine in Seoul (Hwang *et al.*, 2016). A study from the U.S. included nurses, respiratory therapists and nuclear medicine technologists (Shanty & Gropelli, 2018). A multicentre Italian study utilised H-PEPSS to compare nursing degree students with cardio-circulatory pathophysiology and cardiovascular perfusion techniques (CPCPT) degrees (Castello *et al.*, 2019).

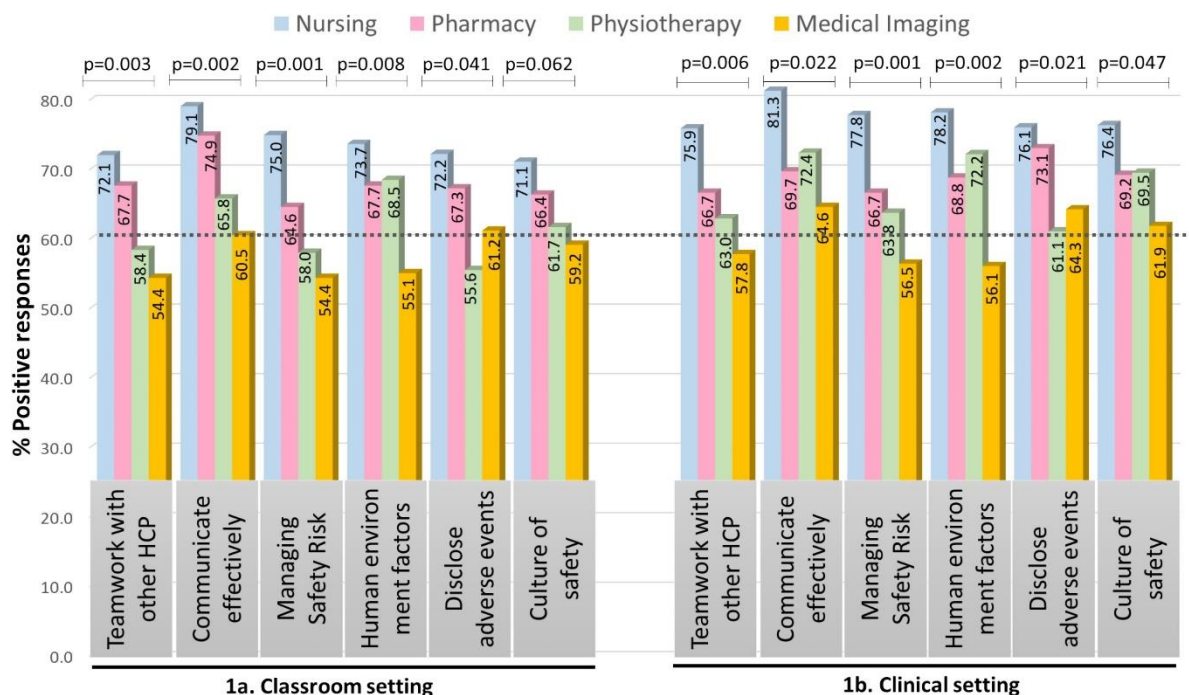


Figure 1: Proportions of positive responses by domains and settings (n = 469)

Table III: Inter-rater agreements (Rwg(j)) for all domains by group

Domain	Learning setting	All groups N = 469	Nursing n = 209	Pharmacy n = 130	Physiotherapy n = 81	Medical Imaging n = 49
Working in teams with other health professionals	Class	0.80	0.84	0.70	0.72	0.74
	Clinical	0.79	0.85	0.63	0.73	0.72
Communicating effectively	Class	0.84	0.87	0.80	0.75	0.72
	Clinical	0.81	0.87	0.69	0.76	0.70
Managing safety risks	Class	0.83	0.85	0.76	0.88	0.84
	Clinical	0.80	0.86	0.68	0.86	0.76
Understanding human and environmental factor	Class	0.74	0.72	0.63	0.78	0.62
	Clinical	0.74	0.82	0.61	0.81	0.63
Recognise and respond to reduce harm	Class	0.75	0.81	0.62	0.80	0.73
	Clinical	0.75	0.82	0.63	0.80	0.67
Culture of safety	Class	0.82	0.83	0.74	0.88	0.86
	Clinical	0.82	0.82	0.77	0.88	0.82

Note: All (Rwg(j)) are based on a uniform distribution; 0 – 0.30 (lack of agreement), 0.31 – 0.50 (weak agreement), 0.51 – 0.70 (moderate agreement), 0.71 – 0.90 (strong agreement), and 0.91 – 1.0 (very strong agreement)

There were no other reports on how physiotherapy and imaging (radiography) students responded to the H-PEPPS questionnaire. The current study’s results were compared with those of earlier studies among pharmacy students (L. Ginsburg et al., 2013) and nursing students (L. Ginsburg et al., 2013; Shanty & Gropelli, 2018; Castello et al., 2019) that utilised the H-PEPPS questionnaire. Additionally, physiotherapy and medical imaging students were included in this study,

who had not previously been studied. This study confirmed that the modified English H-PEPPS questionnaire attained excellent internal reliability with high Cronbach’s α values for all domains. Inter-rater agreement statistics were also generally good, giving strength to the findings.

Overall, students’ self-reported PS competence in all six socio-cultural domains was equal; hence, all

respondents as one group had similar learning experiences with all domains in both classroom and clinical settings. This is in contrast with a Canadian study (L. Ginsburg *et al.*, 2013) in which students showed significantly higher self-reported PS competence around '*Communicating effectively*' than the other domains. Further data analyses were performed to clarify the differences between THCP groups and between learning settings. It is crucial in this context that the interest is to further elaborate on the curriculum and learning experience for pharmacy students in Malaysia.

A comparison of the mean scores of all THCP groups in this study suggested that the clinical setting may provide a better learning experience than the classroom setting, with one exception, namely '*Working in teams with other health professionals*'. This pattern holds true for all the THCP groups except for pharmacy and medical imaging students, who had similar learning experiences with learning '*Working in teams with other health professionals*' in both settings. In contrast, Hasan and colleagues in 2013 reported that the confidence level of the undergraduate pharmacy students in Malaysia in aspects of patient-centred care increased significantly after their clinical posting. It is reasonable that learning PS culture in a real-life setting such as a hospital (J. S. Sorra & Battles, 2014) benefits students. The above-mentioned finding from this study suggested that a multidisciplinary healthcare educational institution may be one of the contributing factors to a higher level of confidence in PSC around learning '*Working in teams with other health professionals*' within the campus.

When comparing mean scores within the classroom setting in the current study, nursing students reported significantly higher levels of confidence in competency in all PS skills compared to pharmacy students and other THCPs. This result is similar to the aforementioned Canadian study (L. Ginsburg *et al.*, 2013), with one exception, namely that the learning experience around the '*Culture of safety*' domain in the classroom setting was equal for both nursing and pharmacy students ($p = 0.135$). Additionally, in the current study, a comparison of the mean scores suggests that the nursing students had significantly higher levels of confidence in competency in PS skills within the clinical setting, compared to pharmacy students and other THCP groups. The similarities between the findings from this study with those of others (L. Ginsburg *et al.*, 2013; Colet *et al.*, 2015; Hwang *et al.*, 2016) on the higher levels of confidence reported by nurses may indicate that there is a common thread or culture in nursing training that is shared around the world. An understanding of what is done right in nursing training may benefit other

professional groups as well. Interestingly, when comparing mean scores among the pharmacy students, they were found to be equally confident in their competencies in both learning environments, with one exception, namely learning around '*Recognise and respond to reduce harm*'. This is probably because some pharmacy students' perception of reporting adverse events could be improved when they are able to access patient information in clinical and community pharmacy settings (Kalari *et al.*, 2011). The finding from this group of pharmacy students was similar to those from a study in Malaysia (Hasan *et al.*, 2013) that showed that there were significantly increased feelings of preparedness after the clinical posting. It is noted that the '*Recognise and respond to reduce harm*' (domain number four as shown in Table I) has been discussed. Hereafter, the other domains will be elaborated upon sequentially, starting with domain number 1 ('*Working in teams with other health professionals*').

In the aforementioned Canadian study (L. Ginsburg *et al.*, 2013), nursing students reported significantly lower levels of confidence in regards to learning in the clinical setting, while pharmacy students had greater confidence learning around the domain '*Working in teams with other health professionals*' in the clinical setting. In the current study, the pharmacy students reported high positive responses, second after the nursing students, and the level of confidence in learning was equal in both settings. In contrast, a study in Malaysia (Hasan *et al.*, 2013) suggested that pharmacy students may be more confident in their learning around '*Working in teams with other health professionals*' after they had completed their clinical posting. Interprofessional education should be implemented in order to encourage effective learning of PS skills. One private university in Malaysia (Brock *et al.*, 2020) reported its experiences. Their settings and research findings may benefit other pharmacy programmes in Malaysia and other developing countries.

With regard to specific domains of competencies, all groups were most confident in '*communicating effectively*' in the Canadian study (L. Ginsburg *et al.*, 2013). Similarly, all the graduating students in the current study were most confident in the same domain. It was the only domain that received > 60% ratings in both settings throughout all the THCP groups. This could be a reflection of similarities in the training and practices among healthcare professionals worldwide, where effective communication is often emphasised (World Health Organization, 2010). A study by Hasan and colleagues in 2013 was carried out on Malaysian pharmacy students and confirmed that the preparedness of the students to communicate with

patients and with other healthcare providers increased significantly after their clinical posting. However, the pharmacy students in this study reported a high response rate around this domain with equal learning experience confidence levels in both classroom and clinical settings. This is possibly because the current setting of pharmacy programmes includes lecturers from the School of Medicine and School of Nursing, teaching some specialised modules such as Anatomy, Physiology and First Aid.

In the domain of '*Managing safety risks*', the pharmacy students had the second-highest ranking of positive responses, after nursing students. A study by L. Ginsburg and colleagues in 2013 found that the respondents had lower levels of confidence in PS learning around this domain, and another study (Castello *et al.*, 2019) reported that 46.1% of students with a nursing degree and CPCPT degree did not feel confident in their competence in '*managing safety risk*'. In the current study, medical imaging students showed the lowest confidence in this domain in both settings, but none of the THCP groups reported confidence of lower than 50%. In the perspectives on educating pharmacy students related to '*Managing safety risks*', the pharmacy educational institutions trained the students extensively on medication safety (Warholak *et al.*, 2011). This is aligned with the result from the current study that the pharmacy students had equal confidence from their learning experience in '*Managing safety risks*' in classroom and clinical settings. Furthermore, one study among pharmacy students in Malaysia showed they had acquired sufficient knowledge on adverse drug reaction reporting (Rajiah *et al.*, 2016), which may impact their attitude toward issues of patient safety in terms of managing the safety risks.

Regarding the trend of '*Understanding human and environmental factors*', all THCP groups except medical imaging students showed high rates of positive responses, while the respondents in the aforementioned Canadian study (L. Ginsburg *et al.*, 2013) showed low levels of confidence in PS learning around this domain. The pharmacy students scored third place on the positive response rate, after nursing and physiotherapy students. Results show that for pharmacy students, the level of learning confidence around this domain was equal in both clinical and classroom settings. The pharmacy practice module may provide exposure for the students around the '*Understanding human and environmental factors*' domain. In the pharmacy practice module, one of the soft skills is '*leadership*', which is an important component for tackling the challenges in the healthcare system in order to ensure the safety of patients in relation to medication. Based on a setting of one study

in Malaysia (Hassali *et al.*, 2016), the students need to have both hierarchical thinking and systemic thinking in leadership in order to survive, perform and sustain service delivery that may impact patient safety.

The pharmacy students reported significantly high positive response rates in both clinical and classroom settings around the '*Culture of safety*' domain, scoring second after nursing students. This result was consistent with the Canadian study (L. Ginsburg *et al.*, 2013) for the pharmacy students but in contrast with Canadian nursing students that reported significantly lower levels of confidence learning around '*Culture of safety*' in the clinical setting. The emphasis around '*Culture of safety*' entails that pharmacy students should be able to speak out if they encounter any issues that may lead to medication errors or adverse drug events. The pharmacy programmes in Malaysia deal with issues related to medication errors and adverse drug events in the pharmacovigilance module, within epidemiology and/or pharmacoepidemiology courses (Elkalmi *et al.*, 2013). This pharmacovigilance module helps to educate pharmacy students on drug safety, thus improving patient safety in relation to pharmacists' main role as healthcare professionals.

All higher education institution healthcare programmes in Malaysia are accredited by the Malaysian Qualifications Agency (MQA), which applies the Malaysian Qualifications Framework (MQF) to ensure the quality of these programmes. The course accreditation is a rigorous process that necessarily includes stakeholders such as assessors from other universities, professional bodies and industry representatives. This enforcement is to regulate the curriculum and operational standards of higher learning institutions in Malaysia. In addition to the mandatory requirements, further improvement can be made by adopting high-quality international curricula on PS skills (Stevens, 2002; Tregunno *et al.*, 2014), and by working to enhance the climate of teaching and learning in the organisation. This supports the belief that high standards of care can be provided to local and international patients through interprofessional training at graduate level.

The main limitation of this study is that it was a one-centre study, meaning the results may not be generalisable to other centres. The findings were based on the students' perspectives by using only a validated questionnaire. Furthermore, the students' self-reported confidence in PS skills does not necessarily correspond to their actual competencies and grades.

The strength of this study is that the findings are presented to highlight not only statistically significant results but also '*clinically important*' results that can help stakeholders make appropriate decisions.

To the best of the authors' knowledge, this is the first study in Malaysia using a well-known validated questionnaire to identify THCP groups' perceptions of their own PS competence when they start clinical practice. However, to have a full picture of this, other stakeholders' perspectives need to be explored by conducting qualitative studies. Other stakeholders include programme coordinators, lecturers, preceptors and management from educational institutes and hospitals. It would be interesting to further study factors that may affect the learning confidence level in both clinical and classroom settings.

Conclusion

The results from this study add to the knowledge of the socio-cultural perspectives of pharmacy and other THCPs' learning of PS competencies from various parts of the world. Additionally, the physiotherapy and medical imaging programmes could take the preliminary findings on these groups of students as a reference. The pharmacy students had high levels of confidence in PS competency, comparable with nursing students. Furthermore, they are comparable with results from students in developed countries surveyed using the H-PEPPS questionnaire. If it is proven that students acquire equal levels of confidence from both classroom and clinical settings, it would be a motivational factor for the pharmacy programme educators to move forward on the right track with consideration for some improvements. This study, conducted on the class of 2019 who entered service at the beginning of the Covid-19 pandemic in 2020, is a timely reminder of the importance of PS competency training and its significance in disease prevention.

Acknowledgements

The authors would like to thank Dr Liane Ginsburg for granting them permission to use the H-PEPSS questionnaire. The authors are also grateful to Logesheeni Paulraj, Norul Huda Mohd Nasir and Aida Norshamzila for their assistance in data collection and management. The authors would like to thank the class of 2019 for participating in this important study.

Authors' Note

BHOA designed the concept of the overall work, determined and approved the data presentation, interpreted data and mainly drafted the manuscript. FSB jointly drafted the manuscript. FSB, NY, AKK

designed and coordinated the pilot testing including face validation, reliability and validity test of survey instrument. VA, HH translated questionnaire for face validation purposes. YT, SB, JS involved in data acquisition of pilot and real study. FSB, NY conducted the data analysis and checked by BHOA. NY, AKK, YT, SB, JS, VA, HH reviewed the manuscript and suggested improvements. LS jointly designed the concept of the overall work and approved the manuscript to be published.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The study was internally funded by KPJ University College.

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