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RESEARCH ARTICLE

Knowledge and perceptions of graduating BS pharmacy students in Metro Manila to counsel on the use of medical devices for diabetes management: A cross-sectional study

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Keywords
Glucometer
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Abstract

Background: Insulin syringe, insulin pen, and glucometers are crucial for diabetes management, but improper use can cause harm. Effective patient counselling by pharmacy professionals can reduce errors. This study evaluates the knowledge, perceived capability, and preparedness of graduating BS Pharmacy students in Metro Manila to counsel patients on diabetes management devices. **Methods:** A cross-sectional online survey (Google Forms) was conducted with 212 students from 7 Philippine Association of College of Pharmacy (PACOP) member pharmacy schools in Metro Manila, using stratified random sampling. The survey assessed knowledge and perceived capability regarding medical devices used for diabetes management. **Results:** A significant proportion of participants had low knowledge of insulin syringes (51.89%), insulin pens (26.89%), and glucometers (12.26%). Despite this, most participants reported high perceived capability in counselling on insulin syringes (77.36%), insulin pens (79.72%), and glucometers (85.38%). The presence of course hours was positively correlated with perceived capability: insulin syringe course hours ($p = 0.003$), insulin syringe practical course hours ($p = 0.049$), insulin pen course hours ($p = 0.032$), glucometer course hours ($p = 0.003$), and glucometer practical course hours ($p = 0.006$). Laboratory course hours negatively affected glucometer knowledge (coefficient = -0.53, $p = 0.029$). **Conclusion:** Graduating BS Pharmacy students in Metro Manila exhibit low knowledge but high perceived capability in counselling on diabetes management devices. Course hours enhance perceived counselling capability, indicating a need to review the BS Pharmacy curriculum in the Philippines.

Introduction

Pharmacists play a critical role in educating patients about medical devices, particularly in diabetes management especially, since they are one of the most accessible healthcare professionals (Valliant et al., 2022), and these devices are being made more accessible in pharmacies (Penm & Potter, 2019). However, issues related to improper device use persist, including user and device-related problems (Tase *et al*., 2022), especially in insulin administration (Bari *et al*., 2020).

Despite technological improvements, usability issues continue to lead to safety concerns (Weinhold *et al*., 2018), which is associated with a lack of patient education on device operation (Truong *et al*., 2017). Pharmacist-led patient counselling could improve knowledge and practices (Jittsue *et al*., 2016; Forough and Esfahani, 2017), but pharmacists themselves often lack the necessary knowledge and skills (Ng *et al*., 2015).

In the Philippines, patient counselling is not widely practised, affecting patient monitoring and compliance (Agaceta *et al*., 2014). Limited awareness exists about

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the counselling services provided by community pharmacists (Vreeland *et al*., 2022).

While pharmacists are expected to possess comprehensive knowledge and proficiency when counselling patients on device usage, the education and training of future pharmacists are equally vital in maintaining and advancing these competencies. These competencies include but are not limited to proper use, assessment and optimisation, storage and disposal of medical devices, and mitigation of side effects when misused (American Diabetes Association, 2020). Therefore, assessing the preparedness of graduating pharmacy students to counsel on medical devices represents a crucial step in understanding the effectiveness of pharmacy education programmes and identifying areas for improvement.

This study aimed to assess graduating BS pharmacy students in Metro Manila's knowledge, perceived capability, and preparedness to counsel on the use of medical devices for diabetes management. This could potentially influence future pharmacy education improvements, such as the incorporation of medical device counselling into licensing examinations (PhLE) (Fathelrahman, 2020) and focus on demonstration learnings like OSCE in courses included in the Philippine Pharmacy Curriculum such as Pharmaceutical Dosage Forms, Drug Delivery Systems and Medical Devices, Dispensing I (Dispensing Process, Reading & Interpreting the Prescription and Other Medicine Orders), and Dispensing II (Medication-related problems, Medication safety, Medication counselling and other Pharmacy services), which could help evaluate students' proficiency in device counselling better.

The research was self-funded and followed a specific timeline set by the University of the Philippines Manila College of Pharmacy.

Methods

Study design

The study employed a quantitative, cross-sectional study design wherein the sample was divided into strata based on the school attended by the participant. The knowledge, perceived capability, and preparedness of the participants to counsel on the use of medical devices for diabetes management were gathered through the use of a self-administered Google Forms survey questionnaire.

Inclusion, exclusion, and withdrawal criteria

The following criteria were used to include, exclude, or withdraw participants from the study.

Inclusion criteria:

- *Participant was a graduating BS Pharmacy student as of second semester A.Y. 2022-23*
- *Participant agreed to join the study by signing the Informed Consent Form*
- *Participant was studying in one of fourteen PACOP pharmacy schools in Metro Manila*

Exclusion criteria:

- *Participant was unable to give informed consent*

Withdrawal criteria:

- Participant chose to withdraw their participation at any point in the study
- Participant was from a school with their own review board and ethics board from which necessary approval could not be obtained within the duration of the study
- Participant was from a school that did not approve the conduct of the study for their students

Population and sampling technique

The study population was graduating BS Pharmacy students enrolled for the second semester of the academic year (A.Y.) 2022-23 in the Philippine Association of College of Pharmacy (PACOP) member pharmacy schools in Metro Manila. Graduation in the second semester of A.Y. 2022-2023 entails that the participant is in their final semester of undergraduate school and has taken the majority of their curriculum's courses.

The exact population size of graduating BS pharmacy students cannot be identified due to privacy laws and regulations of schools; therefore, a population size of 1,000,000 was utilised in the sample size calculator from Open Source Epidemiologic Statistics for Public Health, also known as OpenEpi (Dean *et al*., 2022). This is the default population size used in the calculator when the exact number of the population is unidentifiable as a large population, whether 100,000 or 100,000,000, does not generally affect the sample size calculation. A sample of 384 participants was identified using the calculator (Figure 1).

A response rate of 65.5% was expected according to a previous study by Binos and colleagues (2011) that led to an adjusted sample size of 586 participants.

Sample Size for Frequency in a Population

Population size(for finite population correction factor or fpc)(N): 1000000
Hypothesized % frequency of outcome factor in the population (p): 50%+/-5
Confidence limits as % of 100(absolute +/- %)(d): 5%
Design effect (for cluster surveys-*DEFF*): 1

Sample Size(n) for Various Confidence Levels

ConfidenceLevel(%)	Sample Size
95%	384
80%	165
90%	271
97%	471
99%	664
99.9%	1082
99.99%	1512

Equation

Sample size $n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$

Results from OpenEpi, Version 3, open source calculator--SSPropor
Print from the browser with ctrl-P
or select text to copy and paste to other programs.

Figure 1: Sample size computation from open-source epidemiologic statistics for public health (OpenEpi)

Data collection

The study employed a self-administered Google Forms survey questionnaire distributed through PACOP member schools in Metro Manila from April to June 2023. Permission was sought from programme heads, and the questionnaire was shared with students online. Participants were randomly selected by the programme heads, received an informed consent form, and were assured of confidentiality. Reasons for non-participation of randomly selected participants, if any, were not identified. After data collection, no participant was asked to withdraw from the study.

A pilot test performed prior to the study involving 20 graduating BS Pharmacy students outside Metro Manila ensured question clarity and completeness before the official survey distribution. Responses were automatically recorded in a Google sheet for analysis.

Instrumentation

The study utilised a self-administered Google Forms survey developed based on Fathelrahman's (2020) questionnaire structure and Likert scale. Information was retrieved from Centers for Disease Control and Prevention (2021), Diabetes.co.uk (2022), and American Diabetes Association (n.d.) to formulate the objective questions. The survey focused on graduating BS Pharmacy students in Metro Manila, assessing their knowledge and counselling capabilities related to medical devices for diabetes management. Divided into four sections, the questionnaire covered (a) socio-demographic data, (b) curriculum details, (c) knowledge assessment (36 items on device identification, practices, and operation), and (d) self-rating questions on counselling ability (9 items). A consultation done with a diabetes management expert ensured content validity. The questionnaire's reliability and internal consistency were confirmed with a Cronbach's alpha of 0.727, indicating good reliability (> = 0.7 is good).

Data processing and analysis

Participant responses were automatically recorded in a Google Sheet. Personal identifiers, like email addresses, were stored separately for data analysis. The data from Google Sheets were transferred to Stata 12 SE for statistical analysis. The socio-demographic characteristics of sex and school were analysed by proportion, while age was analysed by mean description. Course details on medical devices for diabetes management were described using proportion, while knowledge was analysed using mean scores. Perceived counselling capabilities were analysed using a 5-point Likert scale, converted to numbers, and interpreted proportionally. Preparedness for counselling on medical devices was described using proportion analysis.

Multiple linear regression analysis was employed to assess factors influencing students' knowledge and perceived counselling capability on medical devices for diabetes management, including sex, age, school, presence of relevant courses, course hours, and internship setup. A significance level of 0.05 was used. Pearson’s correlation was utilised to analyse the correlation between knowledge and perceived capability to counsel on the use of medical devices for diabetes management.

Ethical consideration

The study, approved by the University of the Philippines - Manila University Research Ethics Board (UPMREB Code UPMREB 2023-0055-UND), required participants to provide informed consent through the online survey questionnaire. The consent form, presented alongside the study objectives and researchers’ contact information, was mandatory to proceed. Non-consenting participants were redirected to the end of the questionnaire. Respondents who agreed completed the survey anonymously. Email addresses were collected for raffle entry purposes only. Data was stored securely in a password-protected Google sheet, ensuring confidentiality. The study posed minimal risks, allowing participants to opt out while offering a chance to win cash prizes. Winners were announced via email on May 25, 2023. The authors declare no conflicts of interest in the study.

Results

Socio-demographic characteristics, presence of courses on medical devices, presence of lecture, laboratory, and practical course hours, and pharmacy internship set up

The following data is summarised in Table I. Students from 7 out of the 14 targeted schools were successfully recruited, resulting in a total of 212 participants, which represents 36.18% of the adjusted sample size of 586. The average age of the participants was 22.23 years, with the majority being female (81.60%). Notably, School 5 had the highest representation among the participants, accounting for 49.53%, followed by School 3 with 19.81%, while the remaining schools had smaller proportions ranging from 0.94% to 14.15%. These variations in participation rates were expected due to different participation quotas assigned to each school.

Regarding coursework on medical devices for diabetes management, a significant proportion of participants had taken courses on insulin syringes (79.72%), insulin pens (84.43%), and glucometers (80.66%). Furthermore, the majority of participants had lecture course hours (83.02%) and laboratory class hours (60.85%) focused on medical devices for diabetes management. However, less than half of the participants (43.40%) had practical course hours, with 56.60% not having practical course hours dedicated to these medical devices. For ease of data analysis and to handle outliers, responses regarding the number of course hours were simplified to determine whether participants had or did not have course hours covering the aforementioned medical devices.

The specific courses tackling medical device information were not asked to be identified due to expected differences in course nomenclature per school; however, based on the standardised BS Pharmacy curriculum in the Philippines, these are likely from: (1) Pharmaceutical Dosage Forms, Drug Delivery Systems and Medical Devices wherein students are taught the different methods and tools used to administer drugs to the patient, (2) Dispensing I wherein the process of dispensing, reading & interpreting of the prescription and other medicine orders are tackled, and (3) Dispensing II that covers medication-related problems, medication safety, medication counselling and other pharmacy services.

On pharmacy internship setups, a small proportion (4.25%) of participants had not yet commenced their hospital internships, likely due to scheduling. The majority (65.57%) had a full in-person internship setup, while a significant number (19.34%) experienced a hybrid/blended internship setup, and a smaller portion (10.85%) had a full remote (online) internship setup. Similarly, for community internships, a few participants (1.89%) had not yet initiated their internships, likely due to scheduling, while some (15.57%) reported full in-person internship setups. The majority (63.21%) had a hybrid/blended internship setup, and a notable number (19.34%) had a full remote (online) internship setup.

Table I: Summary statistics of participants' sociodemographic characteristics (n=212)

Variable	x̄	σ
Age	22.23	1.51
Variable	**n (%)**	
Sex:		
Male	39 (18.40%)	
Female	173 (81.60%)	
School:		
School 1	17 (8.02%)	
School 2	2 (0.94%)	
School 3	42 (19.81%)	
School 4	6 (2.83%)	
School 5	105 (49.53%)	
School 6	10 (4.72%)	
School 7	30 (14.15%)	
Courses on:		
Insulin pen		
No	33 (15.57%)	
Yes	179 (84.43%)	
Glucometer		
No	41 (19.34%)	
Yes	171 (80.66%)	
Lecture course hours*		
No	36 (16.98%)	
Yes	176 (83.02%)	
Laboratory course hours*		
No	43 (20.28%)	
Yes	169 (79.72%)	
Hospital internship setup:		
No internship yet	9 (4.25%)	
Full-in person	139 (65.57%)	
Hybrid/blended	41 (19.34%)	
Full remote (online)	23 (10.85%)	
Community internship setup:		
No internship yet	4 (1.89%)	
Full-in person	33 (15.57%)	
Hybrid/blended	134 (63.21%)	
Full remote (online)	41 (19.34%)	

Knowledge, perceived capability, and preparedness to counsel on the use of medical devices for diabetes management

It was found that the majority of participants correctly identified insulin pens (91.04%) and glucometers (98.11%), while 74.06% accurately identified insulin syringes (Table II). However, misconceptions were prevalent in various aspects of these medical devices. For instance, a significant number of respondents held misconceptions, such as believing insulin shouldn't appear cloudy (57.08%) and that insulin syringes should be injected at a 45-degree angle (67.92%).

Table II: Summary statistics of participants' knowledge, perceived capability, and preparedness

Identification question	**n (%)**	
Insulin syringe		
Wrong answer	55 (25.94%)	
Right answer	157 74.06%	
Insulin pen		
Wrong answer	19 (8.96%)	
Right answer	193 (91.04%)	
Glucometer		
Wrong answer	4 (1.89%)	
Right answer	208 (98.11%)	
Question:	**Right n (%)**	**Wrong n (%)**
For insulin syringe:		
It is normal for insulin to sometimes appear cloudy. (T)	91 (42.92)	121 (57.08)
The syringe should be pushed into the skin at a 45 degree angle. (F)	68 (32.08)	144 (67.92)
It is okay for the syringe to have air bubbles when injecting the insulin into the patient. (F)	196 (92.45)	16 (7.55)
For insulin syringe & insulin pen		
The belly, the top of the thighs and the buttocks can be used for insulin injections. (T)	202 (95.28)	10 (4.72)
For insulin pen		
Certain insulin pens are disposable while others can be reused once a new cartridge is inserted. (T)	164 (77.36)	48 (22.64)
The maximum dosage of insulin varies among pens (T)	183 (86.32)	29 (13.68)
The syringe of the insulin pen should hit the muscle underneath the skin. (F)	124 (58.49)	88 (41.51)
Insulin pens should be stored in frozen (-10°C to -20°C) conditions. (F)	142 (66.98)	70 (33.02)
For glucometer:		
The value of blood sugar should not change when eating different foods, being physically active, or taking medicine. (F)	194 (91.51)	18 (8.49)
Alcohol should not be used to clean the finger as it dries the skin too much. (T)	45 (21.23)	167 (78.78)
Glucometer test strips can be damaged if they're exposed to moisture. (T)	188 (88.68)	24 (11.32)
Blood sugar readings are absolute and the values should always be in a specific range at any given point of time. (F)	73 (34.43)	139 (65.57)
Steps in:	**Score x̄ (%)**	**σ**
Insulin syringe - Preparation (4 items)	2.35 (58.84%)	1.38
Insulin syringe - Administration (4 items)	2.83 (70.64%)	1.40
Insulin syringe disposal (3 items)	2.44 (81.60%)	0.9
Insulin pen (5 items)	2.64 (52.83%)	1.17
Glucometer (5 items)	2.72 (54.43%)	1.12
Knowledge on:		**n (%)**
Insulin syringe (16 items)	Low Knowledge (<75%)	102 (48.11%)
Mean sore = 10.99528	High Knowledge (>= 75%)	110 (51.89%)
Insulin pen (11 items)	Low Knowledge (<75%)	155 (73.11%)
Mean score = 7.496226	High Knowledge (>= 75%)	57 (26.89%)
Glucometer (10 items)	Low Knowledge (<75%)	186 (87.74%)
Mean score = 6.061321	High Knowledge (>= 75%)	26 (12.26%)
Perceived capability mean:		**n (%)**
Insulin syringe	Low P. Capability (<3)	48 (22.64%)

Mean = 3.11 out of 5	High P. Capability (>=3)	164 (77.36%)
Insulin Pen	Low P. Capability (<3)	43 (20.28%)
Mean = 3.13 out of 5	High P. Capability (>=3)	169 (79.72%)
Glucometer	Low P. Capability (<3)	31 (14.62%)
Mean = 3.31 out of 5	High P. Capability (>=3)	181 (85.38%)
Preparedness to counsel on:		**n (%)**
Insulin syringe:		
Low preparedness		133 (62.74%)
High Preparedness		79 (37.26%)
Insulin pen:		
Low preparedness		189 (89.15%)
High preparedness		23 (10.85%)
Glucometer:		
Low preparedness		192 (90.57%)
High preparedness		20 (9.43%)

When assessing the proper use of these devices, participants excelled in arranging the steps for insulin syringe disposal (81.6% accuracy). However, they faced challenges in arranging the steps for insulin syringe preparation (58.84% accuracy), insulin syringe administration (70.64% accuracy), insulin pen use (52.83% accuracy), and glucometer use (54.44% accuracy). More than half (51.89%) exhibited high knowledge of insulin syringe use, while a significant proportion demonstrated high knowledge of insulin pens (26.89%), and a smaller number exhibited high knowledge of glucometers (12.26%).

In terms of perceived capability to counsel, most participants demonstrated high perceived capability for insulin syringe (77.36%) and insulin pen use (79.72%). For glucometer usage, 85.38% had a high perceived capability. The mean scores for perceived capability were 3.11 for insulin syringe, 3.13 for insulin pen, and 3.31 for glucometer, all falling under the "Average" category on the Likert scale descriptions.

Among the participants, a majority (62.74%) showed low preparedness to counsel on using insulin syringes, while a smaller proportion (37.26%) demonstrated high preparedness. Similarly, most respondents (89.15%) displayed low preparedness for insulin pens, with only a small proportion (10.85%) showing high preparedness. Regarding the glucometer, the majority (90.57%) exhibited low preparedness, while a minority (9.43%) displayed high preparedness.

Factors affecting knowledge and perceived capability for counselling on medical devices for diabetes management

In predicting the participants' Insulin Syringe Knowledge Score, none of the independent variables, including Age, Sex, School, Insulin Syringe Course Hours, Lecture Course Hours, Laboratory Course Hours, Practical Course Hours, Community Internship Setup, and Hospital Internship Setup, reached statistical significance.

For Perceived Capability to Counsel on Insulin Syringe use (Table III), Insulin Syringe Course Hours (Coef = 0.57, $p = 0.002$) and Practical Course Hours (Coef = 0.29, $p = 0.047$) emerged as significant predictors. Their positive coefficients indicated that having courses on Insulin Syringe and practical course hours in medical devices for diabetes management increased participants' perceived capability to counsel.

Table III: Multiple linear regression results of participants' insulin syringe perceived capability to counsel *vs*. independent variables (α = 0.05)

Independent variables	Coefficient	*p*-value
Constant	2.64	0.004
Insulin syringe knowledge score	-0.01	0.578
Age	0.01	0.946
Sex	-0.09	0.566
School	0.02	0.712
Insulin syringe course hours	0.57	0.002
Lecture course hours	0.01	0.918
Laboratory course hours	0.01	0.976
Practical course hours	0.29	0.047
Community internship setup	-0.05	0.718
Hospital internship setup	-0.05	0.577

*N = 212, $R^2 = 0.125$, $F(9, 202) = 2.87$

None of the independent variables (Age, Sex, School, Insulin Pen Course Hours, Lecture Course Hours, Laboratory Course Hours, Practical Course Hours) reached statistical significance in predicting Insulin Pen Knowledge Scores.

However, in predicting Perceived Capability for Insulin Pen use (Table IV), only Insulin Pen Course Hours (Coef = 0.48, *p* = 0.033) were statistically significant, indicating a corresponding increase in capability with the presence of Insulin Pen Course Hours.

Table IV: Multiple linear regression results of participants' insulin pen perceived capability to counsel *vs*. independent variables (α = 0.05)

Independent variables:	Coefficient	*p*-value
Constant	1.80	0.065
Insulin pen knowledge score	0.05	0.145
Age	0.02	0.699
Sex	0.50	0.758
School	0.02	0.646
Insulin pen course hours	0.48	0.033
Lecture course hours	0.10	0.661
Laboratory course hours	-0.05	0.751
Practical course hours	0.25	0.092
Community internship setup	-0.06	0.640
Hospital internship setup	-0.01	0.931

*N = 212, R^2 = 0.102, F(9, 202) = 2.27

For Glucometer Knowledge Scores (Table V), only Laboratory Course Hours (B = -0.50, *p* = 0.039) were significant, with a negative coefficient, suggesting that the presence of laboratory course hours was associated with a decrease in participants' scores.

Table V: Multiple linear regression results of participants' glucometer knowledge scores *vs*. independent variables (α = 0.05)

Independent variables	Coefficient	*p*-value
Constant	4.04	0.006
Glucometer perceived capability mean	0.16	0.164
Age	0.02	0.725
Sex	0.32	0.178
School	0.01	0.891
Glucometer course hours	-0.05	0.859
Lecture course hours	0.55	0.083
Laboratory course hours	-0.50	0.039
Practical course hours	0.25	0.254
Community internship setup	0.23	0.230
Hospital internship setup	0.02	0.874

*N = 212. R^2 = 0.064, F(9, 202) = 1.38

Regarding Perceived Capability to Counsel on Glucometer use (Table VI), Glucometer Course Hours (Coef = 0.54, *p* = 0.003) and Practical Course Hours (Coef = 0.36, *p* = 0.009) emerged as significant predictors with positive coefficients, indicating that more hours spent on Glucometer and Practical courses corresponded to an increase in the perceived capability.

Table VI: Multiple Linear regression results of participants' glucometer perceived capability to counsel *vs*. independent variables (α = 0.05)

Independent variables	Coefficient	p-value
Constant	3.12	0.001
Glucometer knowledge score	0.06	0.164
Age	-0.03	0.473
Sex	0.06	0.710
School	0.03	0.553
Glucometer course hours	0.54	0.003
Lecture course hours	0.01	0.949
Laboratory course hours	-0.14	0.359
Practical course hours	0.36	0.009
Community internship setup	-0.08	0.515
Hospital internship setup	-0.06	0.481

*N = 212, R^2 = 0.133, F(9, 202) = 3.09

Correlation between participants' knowledge and perceived capability to counsel on the use of medical devices for diabetes management

The results of Pearson's correlation (Table VII) revealed that only participants' insulin pen knowledge and their perceived capability to counsel on insulin pen use had a significant relationship, indicating a weak correlation (Pearson's r = 0.16, *p* = 0.02). However, for the glucometer knowledge score and perceived capability to counsel on its use, while a weak relationship was observed, the results did not reach statistical significance (Pearson's r = 0.12, *p* = 0).

Table VII: Pearson's correlation for knowledge of medical devices for diabetes management and perceived capability to counsel on the use of medical devices for diabetes management

Variables:	Insulin syringe	
	Knowledge	Perceived capability
Insulin syringe		
Knowledge	1	
Perceived capability	0.01 (*p* = 0.84)	1
Variables:	**Insulin pen**	
	Knowledge	**Perceived capability**
Insuline pen		
Knowledge	1	
Perceived capability	0.16 (*p* = 0.02)	1
Variables:	**Glucometer**	
	Knowledge	**Perceived capability**
Glucometer		
Knowledge	1	
Perceived capability	0.12 (*p* = 0.07)	1

Discussion

This study assessed the knowledge, perceived capability, and preparedness of graduating BS Pharmacy students in Metro Manila to counsel patients on diabetes management devices, and it was identified that they had low knowledge but high perceived capability. The factors that affected students' knowledge of medical devices for diabetes management and their perceived capability to counsel on the use of such devices were the presence of courses tackling medical device information. The study determined the correlation between knowledge and perceived capability, an approach not previously explored in studies with a similar focus (Fathelrahman, 2020; Kurnia *et al*., 2020; Mane *et al*., 2019; Alghadeer *et al*., 2019).

Study participants' socio-demographic profile:

The respondents in this study were drawn from only 7 out of the 14 PACOP schools in Metro Manila. This limited representation may potentially lead to an understatement of the study's intended generalisation. Time constraints prevented the researchers from including participants from all PACOP schools in the area. Extending the data collection period could have provided a more robust foundation for conclusions regarding knowledge and perceived capability in counselling on the use of medical devices for diabetes management.

The finding that school did not emerge as a significant predictor of participants' knowledge and perceived capability suggests that, among the PACOP schools in Metro Manila, the current curriculum across institutions yielded similar levels of knowledge and perceived capability in counselling on the use of medical devices for diabetes management. However, a more detailed analysis of the curriculum of each school could further enhance this conclusion.

Moreover, this study did not aim to rank pharmacy schools in the Philippines but rather aimed to assess students' perceived preparedness to counsel on medical devices considering the standardised curriculum in the Philippines (CHED).

Knowledge of diabetes management devices:

For the medical devices included in this study, the focus was on glucometers, insulin syringes, and insulin pens due to their prevalence in diabetes management (Brown & Grobbelaar, 2019). Continuous glucometers were excluded due to their limited availability and cost. Participants were also not asked to demonstrate device use due to logistical constraints.

A significant portion of the participants grappled with achieving a passing grade (≥75%) in their knowledge of all three devices. This finding aligns with Mane and colleagues(2019), which assessed the knowledge of experienced medical professionals and revealed an average score of 57.5%, indicating that educational background may influence health professionals' assessment performance. Furthermore, it is consistent with Bain and colleagues' (2019) study among healthcare professionals, including pharmacists, where the highest score for proper insulin administration and regimen questions was 49%. This collectively underscores that training and courses for medical professionals in diabetes management may have limitations.

In the context of insulin syringe and insulin pen knowledge, the study identified no significant predictors among the factors explored. To enhance understanding, future research could investigate additional contributors to knowledge that did not fall within the study's scope, such as specific topics within pharmacy curricula, laboratory setups, and teaching methods. This broader approach is consistent with the findings of Kilgour and colleagues (2016) on healthcare students' proficiency.

The study yielded unexpected results concerning glucometer knowledge. It was observed that an increase in the number of laboratory course hours corresponded with decreased glucometer knowledge scores.

A potential factor contributing to the lower glucometer knowledge scores may be the variations in glucometer brands and the absence of a standardised teaching approach for their use. Different brands of glucometers have unique features and operating instructions. Limited exposure to various glucometer brands during training without a standardised teaching approach could lead to confusion and hinder comprehension. This aligns with the study's results where insulin pen and insulin syringe did not have laboratory course hours as predictors for knowledge, as they have established standardised teaching and usage methods. Differences in the availability of glucometers and other medical devices for teaching and training may have also influenced the students' learning experience. Limited access to glucometers during their coursework could restrict hands-on practice opportunities, hindering students' proficiency in using the devices and, consequently, lowering their knowledge scores.

It is recommended that future studies look into the content and quality of courses taken by students in order to assess the optimisation of laboratory courses for medical devices.

Perceived capability to counsel on medical devices:

The mean perceived capability for all devices exceeded 3 (out of 5), aligning with a previous study in Metro Manila (Binos *et al*., 2011). However, this perceived capability was lower compared to a study in the USA, indicating potential underlying factors affecting students' perceived capability (Axon *et al*., 2022).

Among the three devices, the insulin syringe had the lowest perceived capability. This could be attributed to the higher precision and manual accuracy required for insulin syringes compared to insulin pens and glucometers. Insulin pens and glucometers are considered simpler and more automated, with features that enhance user confidence.

The study identified significant predictors for insulin syringe, including course hours and practical hours. These predictors align with the need for high precision in insulin syringe usage, which can be learned through specific course hours and hands-on experience.

Similarly, course hours dedicated to insulin pens and glucometers were significant predictors for increasing participants' perceived capability for these devices. These dedicated course hours play a crucial role in enhancing students' confidence and ability to counsel on medical devices.

While no additional predictors were found for insulin pens, practical hours were identified as a significant predictor of increased perceived capability for glucometers. Practical sessions offer a simulated environment for students to apply theoretical knowledge, ultimately boosting their confidence and counselling skills.

Overall knowledge and perceived capability of pharmacy students:

The majority of respondents demonstrated low knowledge and preparedness, aligning with previous studies by Fathelrahman (2020), Kurnia and colleagues (2020), Mane and colleagues (2019), and Alghadeer and colleagues (2019). These studies emphasise the need for targeted experiential training tailored to medical devices to address gaps and enhance graduates' preparedness. It underscores the importance of dedicated course hours covering various therapeutic categories structured to enhance knowledge, capability, and preparedness.

Interestingly, lecture course hours, as well as community and hospital internships, did not significantly contribute to participants' knowledge and perceived capability in counselling on medical devices for diabetes management, in contrast to Bhandari and colleagues' findings (2022). Future studies should further explore this discrepancy.

One limitation of the study is the absence of specific details regarding the topics covered in dedicated course hours on medical devices for diabetes management. Future research with a larger sample size and a mixed-methods approach, including questionnaires and interviews, could identify the specific course topics that significantly predict students' knowledge, capability, and preparedness.

Impact on pharmacy education

The study suggests that courses should be optimised to effectively contribute to students' preparedness to counsel on the use of medical devices, in addition to medicine management. Practical sessions should be incorporated to familiarise students with medical device operation and counselling aspects (Fathelrahman, 2021) in order to enhance their understanding and counselling skills.

For pharmacy licensure examinations and other qualifying examinations, patient counselling practical examinations that are focused on medical devices should be explored. These will help ascertain that pharmacist competencies for medical device counselling are integrated into the curriculum and pharmacists are equipped with appropriate knowledge to counsel patients regarding their medical devices.

Conclusion

Graduating BS Pharmacy students in Metro Manila showed low knowledge but high perceived capability in counselling on medical devices for diabetes management. Sociodemographics, lecture course hours, and internship setups did not significantly affect their knowledge and counselling skills. Insulin Syringe, Insulin Pen, and Glucometer Course Hours were significant predictors of participants' perceived capability to counsel on the use of the respective medical devices for diabetes management. Practical course hours influenced participants' perceived capability to counsel on the use of both Insulin Syringe and Glucometer. However, no predictors for knowledge of Insulin Syringe and Pen were found. Laboratory course hours positively impacted glucometer knowledge but negatively affected overall knowledge, requiring further investigation. Weak positive correlation was found between knowledge and perceived capability to counsel on the use of insulin pen, while no significant correlation was observed for knowledge and perceived capability to counsel on the use of insulin syringe and glucometer.

Conflict of interest

The authors declare no conflict of interest.

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