

A pilot study on the knowledge, attitude, and perception of Filipino pharmacy students on pharmacist roles in the pharmaceutical industry

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ABSTRACT

Background: Amid recent efforts to strengthen industrial pharmacy education in the Philippines, limited data exist on pharmacy students' knowledge, attitudes, and perceptions (KAP) of pharmacists' roles in the pharmaceutical industry. This study aimed to assess the current KAP of Filipino pharmacy students and identify factors influencing their views on industry roles and career pathways. **Materials & Methods:** A two-phase design was employed: Phase 1 involved a cross-sectional online survey using a validated quantitative questionnaire, while Phase 2 explored students' undergraduate experiences through a qualitative follow-up. **Results & Discussion:** Findings revealed generally positive knowledge and attitude, but low perception and limited awareness of career options. Students involved in pharmaceutical industry organizations showed lower knowledge ($p = 0.035$) while those interested in postgraduate studies had lower attitude ($p = 0.016$) and perception ($p = 0.047$). **Conclusion:** This study effectively assessed the KAP of Filipino pharmacy students regarding pharmacists' roles in the pharmaceutical industry suggesting a disconnect between academic exposure and industry relevance. It highlights the need for immersive experiences and stronger industry engagement in pharmacy curricula.

Key words: knowledge, attitude, perception, pharmaceutical industry, undergraduate education

1. Introduction

Over the past decades, pharmacists' roles have significantly expanded beyond community and hospital settings to include industry, research, and academia. The World Health Organization (WHO) emphasized the importance of pharmacists in pharmaceutical companies even back in a 1997 report, stating that pharmaceutical companies should not operate without this role (WHO, 1997). Pharmacists in the industry are typically involved in research and development for drugs and biologics. The pharmaceutical industry has broadened opportunities for pharmacists, enabling them to contribute to drug discovery, regulatory affairs, medical affairs, manufacturing, and post-marketing surveillance. International efforts to enhance awareness and education in industrial pharmacy have been supported by organizations such as the International Pharmaceutical Federation (FIP). Through its Industrial Pharmacy Section (IPS), FIP has actively promoted professional development

via congress sessions, webinars, and annual industry site visits. These initiatives aim to bridge the gap between academic preparation and industry expectations, offering pharmacy students and professionals exposure to evolving roles in pharmaceutical manufacturing, regulatory affairs, and clinical research (FIP, 2025). Despite this broadening scope, interest in the pharmaceutical industry remains low. A 2011 PHARMINE report revealed that only 7% of 419,353 pharmacists in 25 EU member states considered careers in the pharmaceutical industry (Atkinson & Rombaut, 2011). Comparable data for Filipino pharmacists remain unavailable.

Career choices among pharmacy students are influenced by their exposure to various practice areas prior to graduation. In Malaysia, Ibrahim et al. (2022) found that Malaysian pharmacy students have a good understanding of career options in the pharmaceutical industry but lack familiarity with roles in medical affairs, clinical trials, and clinical research due to limited curricular exposure. Similarly, Mustafa et al. (2022) reported that South Indian health

sciences students (medical, dental, pharmacy, and nursing) had a positive attitude and perception towards clinical research but low interest in conducting research as a career highlighting barriers such as lack of skills or training, funding, facilities, and mentors. This demonstrates the need for greater availability of information to address these issues and alter strategies for research. Studies from the United Kingdom (Kirby-Smith et al., 2007), Australia (Tan et al., 2021), and the United States (Marrone & Ruble, 2010) also highlight pharmacy students' limited knowledge and understanding of career opportunities in the pharmaceutical industry, and the varying quality of career guidance provided by their academic institutions, which impacts students' access to information and experience in the industry.

In the Philippines, recent curricular improvements have been implemented in the pharmacy undergraduate degree. Several topics on pharmaceutical industry including Good x Practices (GxP), quality risk management, interprofessional education (IPE), counterfeit medicines, and supply chain management are required to be integrated throughout the degree program (Commission on Higher Education, 2021). The increase in required hours for experiential pharmacy practice in industrial pharmacy allows pharmacy students to gain more understanding of the professional role and responsibilities of pharmacists within the pharmaceutical industry (Commission on Higher Education, 2021). However, there is limited information on the knowledge, attitude, and perception (KAP) of Filipino pharmacy students regarding pharmacists' roles in the pharmaceutical industry. This study aimed to assess pharmacy students' knowledge, attitude, and perception of pharmacists' roles in the pharmaceutical industry. Specifically, this study determined the degree of KAP of pharmacy students regarding pharmacists' roles in the pharmaceutical industry through a survey and related the survey results with their actual experience during their undergraduate program.

2. Materials and Methods

The study implemented a 2-phase, observational, sequential design. Phase 1 was a cross-sectional, descriptive study using a validated online quantitative questionnaire (Appendix A) to assess the knowledge, attitude, and perception (KAP) of pharmacists' roles in the pharmaceutical industry. Phase 2 was a qualitative, descriptive study among volunteers from Phase 1 participants through an online qualitative survey (Appendix B) exploring their experiences in relation to their KAP. The questionnaires were developed by adapting validated questionnaires from previous research (Ibrahim et al., 2022; Kirby-Smith et al., 2008; Marrone & Ruble 2010).

The study was conducted in two universities in the Philippines – one in Davao and another in Baguio City – within their undergraduate pharmacy departments. Both are major educational institutions within their respective regions with strong partnerships among industrial pharmacy

companies in the Philippines that provide students access to relevant experiential training environments. As private institutions accredited by Philippine Accrediting Association of Schools, Colleges, and Universities (PAASCU), they follow the same pharmacy curriculum, including an equal number of required internship hours in industrial pharmacy. Both universities consistently demonstrate high passing rates in the Pharmacy Licensure Examination (PLE), indicating comparable academic performance. Importantly, they also allow external researchers to conduct studies upon approval by their respective research committees which facilitate ethical and procedural alignment with their standards.

Participants were currently enrolled undergraduate pharmacy students within the period of this study's data collection aged 18 years or older. Pharmacy students who had prior or current employment in any field of pharmacy practice were excluded.

In Phase 1, eligible participants received a link to the online quantitative questionnaire through the research committees of both universities. Phase 2 recruitment was introduced through a section in the Phase 1 survey. Both questionnaires were placed in an online platform (MS® Forms), available in English with informed consent forms. The data collection period between April to May of 2024 was six (6) weeks from initial dissemination of the Phase 1 survey.

Sample size of Phase 1 was computed using OpenEpi (https://www.openepi.com/Menu/OE_Menu.htm) with the following equation for a descriptive study:

$$n = \frac{DEFF \times Np(1 - p)}{\frac{d^2}{Z^2} \times (N - 1) + p(1 - p)}$$

For the university in Davao, N = population size (48); p = hypothesized percent frequency of outcome factor in the population (50%); d = confidence limits (5%); Z = value from standard normal distribution corresponding to desired confidence level (1.96 for 95% CI); $DEFF$ = design effect (1.0). The computed sample size for the study was 43, but all students were invited to participate in the study to account for possible non-participation. For the university in Baguio City where population size is 1,511, the initial sample size of 307 was increased to 461, assuming 50% non-participation rate. However, due to the low response rate of 4% following initial survey dissemination, the researchers agreed with the college research committee to invite an additional 161 students increasing the final number of invited students to 522.

For Phase 1, the questionnaire used a five-point Likert scale to assess the attitude and perception of students with response options of *Strongly Agree*, *Agree*, *Disagree*, *Strongly Disagree*, and *I Don't Know*. The internal consistency and reliability of the quantitative questionnaire were verified using Cronbach alpha based on the pilot testing. The responses were converted to numerical values, with *Strongly Agree* assigned a score of 4 and *I Don't Know* assigned a

Table 1. Sociodemographic characteristics of the study participants, n=91.

Characteristic	University in Davao, n (%)	University in Baguio City, n (%)	Total, n
School			
University in Davao	–	–	47
University in Baguio City	–	–	44
Sex at Birth			
Female	39 (52)	36 (48)	75
Male	8 (50)	8 (50)	16
Age Group			
18 to 20 years old	31 (62)	19 (38)	50
21 to 23 years old	16 (40)	24 (60)	40
24 to 26 years old	0 (0)	1 (100)	1
Year Level			
1st year	12 (70.6)	5 (29.4)	17
2nd year	22 (73.3)	8 (26.7)	30
3rd year	10 (31.2)	22 (68.8)	32
4th year	3 (25)	9 (75)	12
Participation in Student Organization for the Pharmaceutical Industry			
YES	6 (46.2)	7 (53.8)	13
NO	41 (52.6)	37 (47.4)	78
Any Exposure in the Pharmaceutical Industry			
Yes, had internship/externship	0 (0)	5 (100)	5
Yes, attended tours/seminars/symposia	11 (78.6)	3 (21.4)	14
Yes, had internship/externship and attended tours/seminars/symposia	3 (50)	3 (50)	6
None	33 (50)	33 (50)	66
Any Personal Relations with Someone in the Pharmaceutical Industry			
YES	19 (51.4)	18 (48.6)	37
NO	28 (51.9)	26 (48.1)	54

score of 0. Quantitative data were analyzed using MS® Excel and Stat 13®. Frequency and descriptive statistics summarized the demographic characteristics and KAP scores on the roles of pharmacists in the pharmaceutical industry. Multiple linear regression, ANOVA, and MANOVA determined the relationships between demographic characteristics and KAP. For Phase 2, thematic analysis using an inductive approach was conducted on the valid open-ended responses, with transcription and coding done through MS® Word and Excel. Closed-ended responses were summarized by frequency and included in the analysis of the emerging themes. Incomplete responses were excluded in the analysis of both phases.

Ethical approval was obtained from each university's research offices. The study was only implemented after their formal approval, and informed consent was required for participation in both online survey questionnaires.

3. Results

For Phase 1, 91 participants consented and completely answered the quantitative survey with 47 (51.7%) participants from the university in Davao and 44 (48.3%) participants from the university in Baguio City. Most participants were female (82.4%), aged 18 to 20 (54.9%), and in their 3rd year level (35.2%) (Table 1). The top 3 pharmacy career choices from participants included pharmaceutical industry (n = 64),

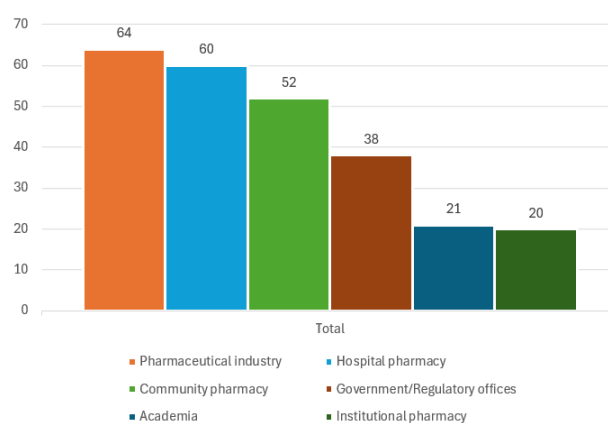


Figure 1. Distribution of top pharmacy career choices among the participants.

hospital pharmacy (n = 60), and community pharmacy (n = 52) (Figure 1). Interestingly, 52.7% participants indicated they were somewhat likely to pursue non-pharmacy post-graduate studies while 29.7% were likely and 17.6% were unlikely.

3.1. Knowledge of Pharmacy Students on Pharmacist's Roles in the Pharmaceutical Industry

The mean score in identifying the pharmacists' roles in the pharmaceutical industry was 7.19 ± 2.31 out of 10. There

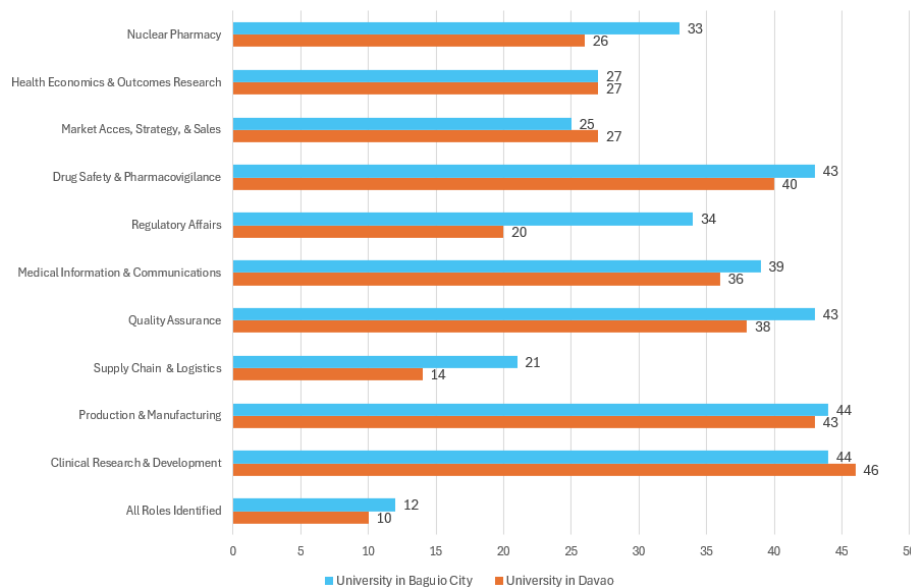


Figure 2. Distribution of correct answers to the areas where pharmacists have professional roles in the pharmaceutical industry.

were 22 participants (24.18%) who correctly identified all 10 areas in the pharmaceutical industry where pharmacists have professional roles. The most correctly identified roles included Clinical Research & Development ($n = 90$), Production and Manufacturing ($n = 87$), Drug Safety and Pharmacovigilance ($n = 83$), and Quality Assurance ($n = 81$). The least identified role was for Supply Chain & Logistics ($n = 35$) (Figure 2). Overall, participants from Baguio City had a higher average knowledge score on the roles of pharmacists in the pharmaceutical industry than participants from Davao, though this difference was not statistically significant.

A trend observed with the scores increasing as the year level progressed (Table 2). However, the mean score of 4th year students ($\bar{X} = 7.58 \pm 2.02$) was slightly lower than 3rd year students ($\bar{X} = 8.38 \pm 1.70$). Any form of exposure to the pharmaceutical industry slightly increases the average knowledge score of participants. Notably, when all sociodemographic characteristics were analyzed against knowledge, participation in a student organization focused on pharmaceutical industry is negatively associated with the participant's knowledge on the roles of pharmacists in the pharmaceutical industry ($\beta = -1.44$; $p = 0.035$).

3.2. Attitude of Pharmacy Students on Pharmacist's Roles in the Pharmaceutical Industry

Participants showed an overall favorable attitude towards pharmacists' roles in the pharmaceutical industry with a mean score of 3.16 ± 0.15 (Table 3). Participants from both schools have the highest favorability that working in the pharmaceutical industry will enhance their soft skills such as creativity, communication, and leadership. This is also consistent with the overall mean rating of all participants.

Participants from the university in Davao had high agreement that their career decision will be influenced by their preference on where to practice. On the other hand, they

Table 2. Summary of mean scores in identifying the correct roles of pharmacists in the pharmaceutical industry across the sociodemographic characteristics.

Characteristic	Mean	SD
School		
University in Davao	6.74	2.56
University in Baguio City	8.02	1.85
Sex at Birth		
Female	7.21	2.39
Male	8.06	1.88
Age Group		
18 to 20 years old	6.88	2.37
21 to 23 years old	8.00	2.15
24 to 26 years old*	6.00	0
Year Level		
1st year	6.29	3.02
2nd year	6.80	2.22
3rd year	8.38	1.70
4th year	7.58	2.02
Participation in Student Organization for the Pharmaceutical Industry		
YES	8.46	1.45
NO	7.18	2.39
Any Exposure in the Pharmaceutical Industry		
Yes, had internship/externship	7.40	1.95
Yes, attended tours/seminars/symposia	7.57	1.87
Yes, had internship/externship and attended tours/seminars/symposia	7.33	2.16
None	7.31	2.48
Any Personal Relations with Someone in the Pharmaceutical Industry		
YES	7.35	2.08
NO	7.37	2.49
Plans to Pursue Post-Graduate Studies		
Most likely	7.06	1.98
Somewhat likely	7.50	2.32
Not likely	7.31	2.57

*n=1

Table 3. Summary of mean scores measured for attitude of pharmacy students on pharmacists' roles in the pharmaceutical industry.

Statements	University in Davao		University in Baguio City		Combined Responses	
	Mean	SD	Mean	SD	Mean	SD
I feel that the pharmaceutical industry offers a good salary.	3.00	0.88	2.91	1.01	2.96	0.94
I feel that the pharmaceutical industry has a structured working environment for pharmacists.	3.43	0.58	3.09	0.60	3.26	0.61
I feel that I need to have a high GWA to secure a job in the pharmaceutical industry.	3.13	0.85	2.73	0.97	2.93	0.93
I feel that our current syllabus enables me to comprehend pharmaceutical sciences subject easily.	3.30	0.59	3.34	0.48	3.32	0.53
I feel that I will have more opportunities to utilize my clinical knowledge if I work in a pharmacy area other than the pharmaceutical industry.	3.26	0.64	2.98	0.63	3.12	0.65
I feel that working in the pharmaceutical industry does not suit me as it has strict job requirements and needs pharmacists to work in a highly regulated environment.	2.32	1.04	2.05	0.83	2.19	0.95
I feel that the inclusion of pharmacist roles in the pharmaceutical industry in our undergraduate pharmacy curriculum is adequate.	3.09	0.75	3.07	0.73	3.08	0.73
I feel that our undergraduate pharmacy curriculum sufficiently prepares us to be confident in entering the pharmaceutical industry.	3.21	0.62	3.36	0.69	3.29	0.65
I feel that working in the pharmaceutical industry will enhance my soft skills such as creativity, communication, and leadership skills.	3.47	0.58	3.41	0.54	3.44	0.56
I feel that working in the pharmaceutical industry involves routine work with little variety in the daily tasks.	3.30	0.69	3.09	0.80	3.20	0.75
I feel that my decision to pursue a career in the pharmaceutical industry will be influenced by my preference on where to practice (i.e., geographic location).	3.47	0.58	3.30	0.67	3.38	0.63
Overall Attitude	3.18	0.15	3.03	0.17	3.16	0.15

have the lowest favorability on how they feel that working in the pharmaceutical industry does not suit them due to strict job requirements and a highly regulated environment.

There is a significant difference in the attitude of participants between the two schools ($p = 0.030$) as well as their likelihood in pursuing non-pharmacy post-graduate studies ($p = 0.010$). Regression analysis revealed that increased interest in post-graduate studies is associated with having less favorable attitude towards roles of pharmacists in the pharmaceutical industry decreases ($\beta = -0.14$; $p = 0.016$).

Among the participants, 4th year students ($\bar{X} = 3.18 \pm 0.38$) had the highest attitude score towards the roles of pharmacists, closely followed by 1st year students ($\bar{X} = 3.16 \pm 0.47$). Comparing the mean scores of 3rd year and 4th year students, 4th year students still have a more positive attitude than 3rd year students ($\bar{X} = 3.09 \pm 0.41$). Although students not involved in a pharmaceutical industry organization or without personal industry relations have higher attitude scores, these are not statistically significantly. This suggests that alternative exposures to the pharmaceutical industry do not strongly influence their favorability toward the field.

3.3. Perception of Pharmacy Students on Pharmacist's Roles in the Pharmaceutical Industry

Participants showed an overall low perception of the pharmacist's roles in the pharmaceutical industry, with an average score of 2.83 ± 0.93 , indicating limited understanding of the career growth and opportunities for a pharmacist in the

pharmaceutical industry (Table 4). Participants from the university in Davao have a significantly more positive perception ($\bar{X} = 3.00 \pm 0.83$) than participants from the university in Baguio City ($\bar{X} = 2.65 \pm 0.98$; $p = 0.005$).

There is a negative association between plans to pursue non-pharmacy post-graduate studies and perception scores ($\beta = -0.15$; $p = 0.047$), suggesting that participants more likely to pursue further studies may have less favorable perception towards pharmacists in the pharmaceutical industry. A slight trend can be observed in the perception of participants across the year levels. Participants in their 1st year had the highest perception scores ($\bar{X} = 2.98 \pm 0.64$) while 3rd year participants have the lowest ($\bar{X} = 2.72 \pm 0.33$). Also, participants in their 4th year have a higher degree of perception ($\bar{X} = 2.91 \pm 0.54$) than 3rd year participants. Similar with their attitude, the lack of significant difference in the subgroups of participants belonging in a student organization or with personal industry connections suggest that these factors do not affect their perception.

Among the measured demographic variables, there is a significant difference in the combined knowledge, attitude, and perception between the two schools ($p = 0.0007$).

3.4. Qualitative Study

A total of 11 responses collected from Phase 2 qualitative survey were thematically coded to elaborate the quantitative findings in relation to the pharmacy students' undergraduate experiences.

Table 4. Summary of mean scores measured for perception of pharmacy students on pharmacists roles in the pharmaceutical industry.

Statements	University in Davao		University in Baguio City		Combined Responses	
	Mean	SD	Mean	SD	Mean	SD
Having an educational background of the pharmaceutical industry will directly impact my pharmacy career in the future.	3.62	0.53	3.64	0.49	3.63	0.51
There are appropriate credit hours allocated for pharmaceutical industry in my degree.	3.30	0.86	3.23	0.94	3.26	0.89
There is an adequate duration of pharmaceutical industry internship during my degree study.	3.47	0.50	3.00	1.29	3.24	0.99
During my study, school events related to future career opportunities in the pharmaceutical industry were not sufficiently provided to the students.	2.26	1.01	2.00	0.86	2.13	0.95
Those in the health care field perceive the pharmaceutical industry positively.	2.89	0.96	2.75	1.06	2.82	1.01
The general public perceives the pharmaceutical industry positively.	2.79	1.04	2.27	0.92	2.54	1.01
The pharmaceutical industry is not a common area chosen by pharmacists for employment due to the lack of competitive salary and benefits package.	2.81	0.82	2.48	1.11	2.65	0.98
There is a variety of work set-ups in the pharmaceutical industry for pharmacists (e.g., onsite, remote, hybrid, on-call, flexible working hours).	3.13	0.88	3.07	0.93	3.10	0.90
The pharmaceutical industry offers limited opportunities for pharmacists to apply their clinical knowledge.	2.74	0.99	2.30	1.11	2.53	1.07
Pharmacist's roles in the pharmaceutical industry only entail laboratory-based work and research.	2.72	0.90	1.95	0.81	2.35	0.94
Pharmacists working in the pharmaceutical industry have more opportunities to collaborate with colleagues in pharmacy and other professions.	3.17	0.76	2.73	1.04	2.96	0.93
The pharmaceutical industry offers clear pathways of career progression for pharmacists.	3.30	0.62	2.86	1.09	3.09	0.90
The pharmaceutical industry restricts entry-level pharmacists to perform in a diverse and inclusive work environment.	2.79	0.93	2.23	1.12	2.52	1.06
Overall Perception	3.00	0.83	2.65	0.98	2.83	0.93

3.5. Factors affecting the likelihood of pharmacy students pursuing pharmaceutical industry as a career

Survey results show that majority of pharmacy students (45.5%) intend to pursue non-pharmacy postgraduate studies, while 27.3% would somewhat likely, and 27.3% were not likely to continue with any postgraduate studies. Possible key factors for reluctance in pursuing a career in the pharmaceutical industry included (1) taking a postgraduate degree, (2) academic pressure and stress in the pharmaceutical industry, (3) lack of opportunities and low compensation when working in the pharmaceutical industry, and (4) lack of work-life balance and flexibility in work the pharmaceutical industry.

In spite of this, 81.8% of pharmacy students were somewhat likely and 18.2% most likely to pursue a career in the pharmaceutical industry, considering roles in manufacturing and/or industrial pharmacy, quality assurance, community pharmacy, clinical and/or hospital pharmacy and research and development if they pursue their pharmacy career after graduation. Similarly, participants mainly perceive that pharmacists would be engaged in areas such as quality assurance, clinical research and development, regulatory affairs, and manufacturing and production when

working in the pharmaceutical industry. Participants also perceive pharmacists in the pharmaceutical industry to be in close collaboration with other health care providers and involved in direct pharmacist-to-patient interactions through medication dispensing and counselling.

More than half of the participants (54.6%) have personal relations (e.g., having family members, friends, mentors) with someone who has experience or exposure to the pharmaceutical industry. In contrast, 45.5% indicated they lacked personal connections.

When asked how the pharmaceutical industry impacts their career preference, only 36.4% felt highly influenced by it, whereas 63.6% believed that they are somewhat influenced by the pharmaceutical industry.

3.6. Perception of the undergraduate experience towards the pharmaceutical industry

Participants believe their current pharmacy curriculum is sufficient in providing the necessary foundation on the pharmaceutical industry and they have adequate direct experience to gain practical skills needed in becoming pharmacists.

“My institution has taught us well enough to be prepared in becoming a pharmacist. They provided not only theoretical knowledge but also skills and made sure to always bring the values needed.”

“Our current curriculum equips us with enough knowledge and right attitude and perception by providing the necessary information about the field of pharmaceutical and other science so we are supported in any of the pharmaceutical field that we would pursue.”

However, one student believed that the curriculum can be improved by providing more immersive real-life experiences on pharmaceutical industry.

“Knowledge was based from our experiences by doing laboratory activities and practical exams could be better, should be more immersive in real-life setting of work in the field of pharma and not just pure theoretical teachings.”

In terms of indirect experiences (i.e., personal relationships, exposure to externships, internships, tours, seminars and/or symposia), participants perceive that these provide support on the actual practice and positive insights on the pharmaceutical industry.

“It provided practical insights into various facets of the pharmaceutical industry, fostering a deeper understanding of pharmacists’ roles in the multifaceted contributions within the industry.”

“My indirect experiences provide me additional information about the actual practice in the pharmaceutical industry imparting me with knowledge, attitude, and perception on the pharmacist’s role in alongside from what I’ve learned from our curriculum.”

Overall, most participants assessed their knowledge, attitude, and perception on the pharmacist’s roles in the pharmaceutical industry to be good (72.7%). The remaining participants assessed it as fair (18.2%) and excellent (9.1%).

3.7. Assumptions and expectations on pharmacist’s roles in the pharmaceutical industry

Majority of the participants (81.8%) felt strongly positive toward pharmacists’ roles in the pharmaceutical industry, while 18.2% felt somewhat positive. They identified factors that may have contributed to their positive feelings including (1) participants’ knowledge about pharmacists in the pharmaceutical industry, (2) pharmacists are seen as important in the health care field given their expertise with medications, and (3) perception on the work environment and the career opportunities of pharmacists in the pharmaceutical industry.

Participants have the assumptions on the required

qualifications of a pharmacist in the pharmaceutical industry. These included a degree in pharmacy, passing the licensure examination for pharmacists, having multiple years of experience in pharmacy practice or any health care-related field, and actively pursuing continuing education as a pharmacist. They also believe that pharmacists in the pharmaceutical industry should be agile and adaptable with strong interpersonal skills to promote collaboration with colleagues and patients.

There were varying expectations on the career opportunities and working environment as perceived by the participants. Most participants believed that pharmacists in the pharmaceutical industry have opportunities to gain experience through collaboration with various colleagues in a diverse work environment, competitive compensation and a good work-life balance. However, some of the participants believed the work setting as potentially with restrictive hours, in a poor working environment, and heavy workload.

4. Discussion

Only 26% of the total computed sample size (n = 350) was analyzed. There was a higher response rate of 97.9% from the invited participants at the university in Davao compared with participants at the university in Baguio City (8.4%). The more consistent and proactive interaction by the university staff from Davao likely contributed to the higher response rate, highlighting the impact of support from the institution during recruitment.

The knowledge of participants based on their mean score was high. However, only a small percentage of participants correctly identified all pharmacists’ roles in the pharmaceutical industry despite having many participants in their 3rd- and 4th-year level. Notably, the higher scores of these participants suggest that exposure to pharmacy-focused subjects and internship programs enhance understanding on the opportunities for a pharmacist in the pharmaceutical industry. These results were consistent with Malaysian pharmacy students (Ibrahim et al., 2022). Additionally, most of the correctly identified areas for pharmacists in the industry are consistent with previous studies (Ibrahim et al., 2022; Tan et al., 2022). As these are commonly included in subjects of the Philippine pharmacy curriculum, it suggests its effectiveness in improving the pharmacy students’ understanding and familiarity. Increasing the immersive opportunities in the pharmaceutical industry aside from their internship program can further strengthen their understanding on this field. These opportunities should expand across all year levels so pharmacy students would be equipped for critical decision-making in determining a future career in the pharmaceutical industry.

The indirect relationship between knowledge and belonging in a student organization is contrary to findings by Zeeman et al. (2019) which emphasized the importance of developing and assessing how co-curricular activities

complement the learnings in the formal pharmacy curriculum. There is an underlying assumption that membership in student organizations provides easier access to resources and professional networks with the pharmaceutical industry. However, the study's results suggest that such advantage does not necessarily translate into increased knowledge on pharmacist roles in the pharmaceutical industry. Participation in organizational activities does not guarantee meaningful learning, particularly when the scope of organizational activities is limited or lacks alignment with pharmaceutical industry-relevant topics. Importantly, the research team had limited insight into the duration and depth of pharmacy students' engagement in student organizations, as well as the specific nature of the activities they participate in or are exposed to. Given that pharmacy students often begin their academic journey with minimal awareness to the range of pharmacist roles within the pharmaceutical industry, their ability to identify and engage with relevant learning opportunities through student organization involvement may be constrained thereby limiting the potential depth and relevance of professional development gained from such experiences. This observation suggests a more in-depth analysis of the factors that impact the effectiveness of student organizations and a need to map opportunities for pharmacy students who join student organizations in aligning with professional competencies.

Although pharmacy students expressed a positive attitude on the pharmacist's roles in the pharmaceutical industry, some responses reflect limited awareness on career opportunities and its working environment. With the participants viewing the pharmaceutical industry as rigid and routinized, it implies misconceptions on having minimal opportunities for flexibility, collaboration with other colleagues, and variety of areas when working in the industry. While participants believe they are prepared to enter pharmaceutical industry, there are gaps on their knowledge which may discourage them from pursuing careers in this field of pharmacy practice while contributing to the likelihood of pursuing a career outside of pharmacy. These gaps are consistent with previous studies validating the need and opportunity for industry pharmacists to promote their practice and increase student interest in this field (Ibrahim et al., 2022; Saleh et al., 2015).

The overall low perception scores of participants on pharmacist's roles in the pharmaceutical industry further support the findings on their attitude. External opportunities that can improve their understanding and interest in the industry practice appear to be limited in both universities. A contradictory observation with the knowledge is how the perception decreases as the year level progresses even though participants in their 3rd- and 4th-year level have more exposure and better understanding of the pharmaceutical industry. It suggests limitations on their observations in practice or unmet expectations based on their increased

understanding both leading to a poor perception (Tan et al., 2022). The results of the study support that providing more information and opportunities to learn more about the pharmaceutical industry across all year levels can be maximized to improve their perception. Given that the pharmaceutical industry is the top career choice among participants, improving their perception through continuous and effective exposure could increase the likelihood of pursuing a career as a pharmacist in the pharmaceutical industry. These findings highlight the need for further curriculum enhancements, stronger partnerships of the academia and pharmaceutical industry, and target career guidance.

This study had several limitations. The number of participants was below the computed sample size affecting the generalizability of its findings. Additionally, the voluntary and online administration of the questionnaire during both quantitative and qualitative phases reduced control over the academic year level of participants resulting in the uneven number of participants and limiting opportunity to gather deeper insights through follow-up questions. Data from the professors and instructors of both universities that could have added context on the responses of their participants were not collected. Moreover, the timing of data collection during the semester was based on the academic calendar of the two universities which may have affected the quality and quantity of responses. Lastly, co-variables and confounding factors such as length of stay in the university, degree of exposure to other fields of pharmacy practice, timing of exposure to subjects related to pharmaceutical industry, teaching strategies used, and variety of pharmacy alumna speakers invited to the university were not established and analyzed.

5. Conclusion

This pilot study assessed the knowledge, attitudes, and practices (KAP) of Filipino pharmacy students regarding pharmacists' roles in the pharmaceutical industry. The results revealed a strong interest among undergraduate pharmacy students in pursuing careers in this field. While students demonstrated a high level of knowledge on the various roles pharmacists in the industry, there are notable gaps in their understanding of the opportunities and workplace environments within these roles. Overall, students showed a favorable attitude but limited perception of the pharmacist's roles in the industry. These gaps and misconceptions may have influenced their KAP affecting their interest in pursuing careers in the pharmaceutical industry.

To address these issues, it is essential for pharmacy schools in the Philippines to enhance their curricula by incorporating more immersive and practical experiences related to the pharmaceutical industry. This could include increased industry engagement, internships, and exposure to real-world pharmaceutical practices. Additionally, pharmacists currently

working in the industry could actively engage with students to provide insights into their roles and responsibilities, thereby fostering greater interest, exposure and understanding.

Future research should aim to expand the sample size and include a more diverse range of participants to improve the generalizability of the findings. Longitudinal studies could also be conducted to track changes in students' knowledge, attitudes, and perceptions over time. By addressing these gaps and providing more comprehensive educational experiences, we can better prepare Filipino pharmacy students for successful careers in the pharmaceutical industry.

COI

The authors declare no conflicts of interest associated with this study.

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Appendix A. PHASE 1 - QUESTIONNAIRE

	Demographics & Characteristics	
	Sex at birth	• Male • Female
	Age	• < 18 years old • 18 to 20 years old • 21 to 23 years old • 24 to 26 years old • > 26 years old
	Undergraduate program enrolled in	• BS Pharmacy (4 years) • Other undergraduate program
	Current year-level standing (Based on units passed)	• 1st year • 2nd year • 3rd year • 4th year
	Do you belong to any student organization for the pharmaceutical industry?	• Yes • No
	If yes, please specify	• [free text]
	Do you have any exposure/immersion/experience in the pharmaceutical industry? (Select all that apply)	• Yes, I am/was employed in the pharmaceutical industry • Yes, I had an internship/externship in the pharmaceutical industry • Yes, I have attended tours, seminars, and/or symposia on the pharmaceutical industry • No, I do not have any
	If yes, please specify the area/s of pharmaceutical industry you were exposed/immersed/employed in.	• [free text]
	Do you have any personal relationships with someone who has an exposure, experience, or affiliation in the pharmaceutical industry?	• Yes • No
	Do you have any plans to pursue post-graduate studies that will not permit you to practice as a pharmacist (e.g., medicine, law)?	• Most likely • Somewhat likely • Not likely
	What are your current pharmacy career choices? (Choose your top 3 choices)	• Hospital pharmacy • Community pharmacy • Pharmaceutical industry • Institutional pharmacy • Academia • Government/Regulatory offices (e.g., FDA, DOH, DOST, BNB/BNBi)
	Knowledge	
1	Based on your knowledge, in what areas do pharmacists have professional roles within the pharmaceutical industry? (Select all that apply)	• Clinical Research and Development • Production and Manufacturing • Supply Chain and Logistics • Quality Assurance • Accounting and Finance • Medical Information and Communications • Regulatory Affairs • Human Resource • Drug Safety and Pharmacovigilance • Market Access, Strategy, and Sales • HEOR (Health Economics and Outcomes Research) • Nuclear pharmacy

	Attitude	
	For the following statements, choose your degree of agreement that reflects your favorability towards the pharmaceutical industry:	• Strongly agree • Agree • Disagree • Strongly disagree • I don't know
1	I feel that the pharmaceutical industry offers a good salary.	
2	I feel that the pharmaceutical industry has a structured working environment for pharmacists.	
3	I feel that I need to have a high GWA to secure a job in the pharmaceutical industry.	
4	I feel that our current syllabus enables me to comprehend pharmaceutical sciences subject easily.	
5	I feel that I will have more opportunities to utilize my clinical knowledge if I work in a pharmacy area other than the pharmaceutical industry.	
6	I feel that working in the pharmaceutical industry does not suit me as it has strict job requirements and needs pharmacists to work in a highly regulated environment.	
7	I feel that the inclusion of pharmacist roles in the pharmaceutical industry in our undergraduate pharmacy curriculum is adequate.	
8	I feel that our undergraduate pharmacy curriculum sufficiently prepares us to be confident in entering the pharmaceutical industry.	
9	I feel that working in the pharmaceutical industry will enhance my soft skills such as creativity, communication, and leadership skills.	
10	I feel that working in the pharmaceutical industry involves routine work with little variety in the daily tasks.	
11	I feel that my decision to pursue a career in the pharmaceutical industry will be influenced by my preference on where to practice (i.e., geographic location).	
	Perception	
	For the following statements, choose your degree of agreement that reflects your understanding towards the pharmaceutical industry:	• Strongly agree • Agree • Disagree • Strongly disagree • I don't know
1	Having an educational background of the pharmaceutical industry will directly impact my pharmacy career in the future.	
2	There are appropriate credit hours allocated for pharmaceutical industry subjects in my degree.	
3	There is an adequate duration of pharmaceutical industry internship during my degree study.	
4	During my study, school events related to future career opportunities in the pharmaceutical industry were not sufficiently provided to the students.	
5	Those in the health care field perceive the pharmaceutical industry positively.	
6	The general public perceives the pharmaceutical industry positively.	
7	The pharmaceutical industry is not a common area chosen by pharmacists for employment due to the lack of competitive salary and benefits package.	
8	There is a variety of work set-ups in the pharmaceutical industry for pharmacists (e.g., onsite, remote, hybrid, on-call, flexible working hours)	
9	The pharmaceutical industry offers limited opportunities for pharmacists to apply their clinical knowledge.	

10	Pharmacist roles in the pharmaceutical industry only entail laboratory-based work and research.	
11	Pharmacists working in the pharmaceutical industry have more opportunities to collaborate with colleagues in pharmacy and other professions.	
12	The pharmaceutical industry offers clear pathways of career progression for pharmacists.	

Appendix B. PHASE 2 - QUESTIONNAIRE

Part I. Demographics & Characteristics		
1	Sex at birth	• Male • Female
2	Age	• < 18 years old • 18 to 20 years old • 21 to 23 years old • 24 to 26 years old • > 26 years old
3	Undergraduate program enrolled in	• BS Pharmacy (4 years) • Other undergraduate program
4	Current year-level standing (Based on units passed)	• 1st year • 2nd year • 3rd year • 4th year
5	Do you belong to any student organization for the pharmaceutical industry?	• Yes • No
5a	If yes, please specify	• [free text]
6	What are the subjects you have taken or currently taking that provide context related to pharmaceutical industry? Kindly enumerate up to three subjects	• [free text]
7	As of now, what are your direct or indirect experiences or connections in the pharmaceutical industry:	
7a	Family (Select all that apply)	• Immediate family member • Extended family member • Distant family member • None
7b	Friends or acquaintances (Select all that apply)	• Friend • Acquaintance • Mentor/Professor • None
7c	Internship/Externship (please specify industry)	• [free text]
7d	Tours, seminars, and/or symposia (please specify event)	• [free text]
7e	Social media (Select all that apply)	• Facebook • Instagram • Twitter • YouTube • LinkedIn • TikTok • Emails • Others
8	Do you have any personal relationships with someone who has an exposure, experience, or affiliation in the pharmaceutical industry?	• Yes • No
9	Do you have any plans to pursue post-graduate studies that will not permit you to practice as a pharmacist (e.g., medicine, law)?	• Most likely • Somewhat likely • Not likely

Part II. KAP of Students on Pharmacist's Roles in the Pharmaceutical Industry		
10	Based on your knowledge, what are the areas you know that pharmacists mainly engage in the pharmaceutical industry?	• [free text]
11	How do you feel about pharmacists being in the pharmaceutical industry?	• Strongly positive • Somewhat positive • Somewhat negative • Strongly negative • I don't know
12	What may be the factors that contributed to your feelings?	• [free text]
13	What are your expectations if you will be a pharmacist in the pharmaceutical industry? Kindly provide at least 1 positive and negative expectation. (e.g., work environment/culture, career progression/opportunities, compensation, work location, societal norms/expectations, work-life balance, etc.)	• [free text]
14	What are your assumptions on pharmacists in the pharmaceutical industry on the following:	
14a	Qualifications, credentials, or experience needed	• [free text]
14b	Roles & responsibilities	• [free text]
Part III. Agreement of Phase I Results to Actual Experiences of Students		
15	How do you think the pharmaceutical industry influences your interest in career preference?	• Highly influences • Somewhat influences • Somewhat does not influence • Highly does not influence • No pharmaceutical industry background
16	As of now, what is the likelihood that you will pursue a career in the pharmaceutical industry as a pharmacist?	• Most likely • Somewhat likely • Not likely • Not interested
16a	If likely to pursue, what areas of pharmaceutical industry are you currently interested in?	• [free text]
16b	If not likely or not interested, what are the factors that prevent you from considering a career in the pharmaceutical industry?	• [free text]
17	How do you think your current curriculum supports your knowledge, attitude, and perception on the pharmacist's role in the pharmaceutical industry?	• [free text]
18	How do you think the indirect experiences may have supported your knowledge, attitude, and perception on the pharmacist's role in the pharmaceutical industry?	• [free text]
19	Overall, how would you assess your knowledge, attitude, and perception on the pharmacist's roles in the pharmaceutical industry?	• Excellent • Good • Fair • Poor