

Research

Awareness and perceptions of career domains among pharmacy students: The TECVP (tasks, expertise, compensation, valuation, and prospects) framework

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ABSTRACT

Objective: Despite the expansion of pharmacists' roles beyond clinical practice, the career paths of pharmacy graduates remain concentrated in clinical fields. This study aimed to examine awareness and perceptions of career domains among pharmacy students in South Korea and to identify factors associated with their career awareness.

Methods: A nationwide cross-sectional online survey among pharmacy students was conducted from September to November 2025. Seven career fields, classified into clinical and nonclinical domains, were evaluated using the Tasks, Expertise, Compensation, Valuation, and Prospects (TECVP) framework, which comprises 10 items across 5 career-attribute categories. Multivariable logistic regression analysis was performed to identify factors influencing career awareness.

Results: A total of 825 students were included in the final analysis. "Don't know" responses were more frequent in the nonclinical domain than in the clinical domain, particularly for research pharmacists and public service pharmacists. Regarding career perceptions, the clinical domain was rated higher for financial compensation and job security, whereas the nonclinical domain was rated higher for professional expertise and growth opportunity. In regression analysis, students who reported sufficient career information and those with higher family economic status were less likely to demonstrate limited career awareness in both domains. In the nonclinical domain, transfer students were more likely to demonstrate limited career awareness compared to students admitted through early admission.

Conclusion: Career awareness among pharmacy students in South Korea showed a marked imbalance between clinical and nonclinical domains. Balanced provision of career information and systematic strengthening of career education for nonclinical fields are needed.

1. Introduction

The role of pharmacists is expanding beyond traditional clinical practice (dispensing and medication management) into diverse domains, including the pharmaceutical and biotechnology industries, research, and public health.^{1–3} As the demand for pharmacists' expertise in drug development, regulatory management, and health policy continues to grow, ensuring workforce diversity has become a key priority in adapting to the evolving health care landscape.^{4,5} This shift reflects

the evolution of pharmacists from patient-centered clinicians to multifaceted professionals contributing to the efficiency and safety of health care systems.^{2,6}

The period of pharmacy education is critical for students to recognize these changes and to explore and define their career paths. Rather than making decisions based on complete information, students tend to choose careers within a limited range of perceived options.^{7,8} Career decisions are shaped by access to information and experience,⁹ and limited exposure to a certain career path may lead students to

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exclude it from their consideration.^{7,8} Therefore, understanding students' career perceptions across different career domains and identifying the factors that shape them are essential for designing effective pharmacy education.

Globally, pharmacy education has evolved with a focus on strengthening clinical competencies, while also promoting entry into industrial, research, and other specialized sectors.^{10–13} Despite this, graduates in many countries continue to concentrate in traditional clinical roles.^{14,15} This imbalance contributes to a mismatch between workforce supply and the growing demand for diverse expertise, while simultaneously constraining the broader societal expansion of the pharmacists' role.¹⁶ In many countries, dispensing-focused tasks continue to account for a substantial share of pharmacist roles even within the clinical domain,^{17,18} a structure that may in turn influence students' career exposure and perceptions.

Recent graduate surveys by the American Association of Colleges of Pharmacy reported that approximately 85% to 90% of students felt that their schools provided adequate support for career planning and sufficient exposure to a diverse range of career options.¹⁹ This suggests that career exposure and support are recognized as meaningful educational outcomes in pharmacy education. However, these evaluations primarily focus on the support and exposure provided by schools and offer limited insight into students' actual awareness and perceptions of specific career domains. In particular, studies examining differences in awareness across career domains and limited career perceptions of specific career paths remain scarce.

Pharmacy education in South Korea, as in many high-income countries, seeks both to strengthen clinical competencies and to diversify career pathways for pharmacy students.²⁰ South Korea operates an integrated 6-year pharmacy curriculum, in which students complete an 800-hour common pharmacy practice experience followed by a 600-hour advanced practice experience. For the advanced practice experience, students may choose placements in hospitals, community pharmacies, pharmaceutical companies, government agencies, or university research laboratories according to their career interests.²¹ The curriculum thus formally offers elective exposure to career settings beyond community and hospital practice. However, the availability of placements in pharmaceutical companies and government agencies varies across pharmacy schools. As a result, some schools do not offer these placements, whereas others can accommodate only a limited number of students because of capacity constraints. Moreover, the pharmacist workforce remains heavily concentrated in community and hospital pharmacies,^{22,23} where many pharmacists are engaged primarily in dispensing-focused roles.²⁴ Taken together, these educational and workforce patterns may result in students being repeatedly exposed to clinical practice settings while having relatively limited opportunities to gain experience in or information about careers in industry, research, and the public sector.

Building on a prior single-institution study,²⁵ we extended the investigation to a nationwide sample encompassing students from diverse educational settings. Specifically, we compared career awareness between clinical and nonclinical domains and examined perceptions of key career attributes within each domain. The objective of this national study was to examine awareness and perceptions of career domains among pharmacy students in South Korea and to identify factors associated with their career awareness.

2. Methods

2.1. Study Design

This study is part of a nationwide cross-sectional online survey project designed to examine pharmacy students' career development and career choices. The present analysis focuses on students' career awareness and career perceptions. The survey was conducted between September 24 and November 21, 2025, using a self-administered, anonymous online questionnaire.

2.2. Setting and Participants

This study targeted pharmacy students enrolled in pharmacy schools nationwide. To ensure balanced representation of demographic characteristics, quota sampling was applied using year of study, sex, region, and school type as stratification variables.²⁶ Year of study was grouped into first to second, third to fourth, and fifth to sixth years; sex into male and female; region into 4 areas (Capital/Gangwon, Chungcheong, Jeolla/Jeju, and Gyeongsang); and school type into existing and newly established pharmacy schools. Crossing these 4 variables resulted in a total of 48 quota cells ($3 \times 2 \times 4 \times 2$).

The target sample size was set at 1000. Based on an estimated total enrollment of approximately 10,495 students from 37 pharmacy schools during the 2020–2025 academic years, this sample size corresponds to a margin of error of approximately $\pm 2.94\%$ points at a 95% confidence level. This meets the commonly accepted $\pm 3\%$ point precision used in social research. Given that further increases in sample size yield diminishing reductions in sampling error while proportionally increasing respondent burden,^{27,28} this sample size was considered cost-efficient and appropriate. Sample allocation was conducted proportionally based on regional population shares derived from 2024 pharmacy school admission data; for smaller subpopulations such as newly established pharmacy schools, minimum cell sizes were applied during quota allocation to ensure adequate representation. Throughout data collection, response distributions were continuously monitored against target quotas for each cell.

Participants were recruited in collaboration with the Korean Pharmacy Students' Association, a nationwide organization representing students from all 37 pharmacy schools in South Korea. To reduce the potential for perceived coercion, standardized survey invitations were posted by student representatives in their respective schools' online communities, rather than distributed directly to students by faculty members. Students participated voluntarily after reviewing the study purpose and procedures and providing consent. Participants who completed the survey received a coffee gift card worth 5000 Korean won (approximately \$3.50 as of October 22, 2025; source: Bank of Korea reference rate). This study was approved by the Institutional Review Board of Hanyang University (HYUIRB-202509–004) and conducted in accordance with relevant ethical guidelines, including the Declaration of Helsinki. The full text of the recruitment notice is provided in the Additional file.

2.3. Measures

The questionnaire was developed based on a survey by Noh and Son in a single pharmacy school.²⁵ Two advisory meetings were held to review the survey items. Nine student representatives were purposively selected from the 37 pharmacy schools in South Korea to ensure diversity in school characteristics (region and establishment status) and representative characteristics (sex, home region, age, and year of study). The meetings focused on clarity of wording, comprehensibility, and whether the items adequately reflected students' experiences. Based on this feedback, several items and response options were added or revised accordingly.

The final questionnaire comprised 2 sections: a sociodemographic section and a career section. The sociodemographic section included individual-level variables, such as admission pathway, sex, year of study, perceived family economic status, perceived academic achievement, family background in the health care sector, and perceived sufficiency of career information. Perceived family economic status was measured using a single 5-point item, in which respondents rated their family's economic position relative to other households in South Korea (1 = low, 2 = lower-middle, 3 = middle, 4 = upper-middle, and 5 = high). Perceived academic achievement was also measured using a single 5-point item, in which respondents evaluated their academic performance relative to their peers within the same

pharmacy school (1 = very low, 2 = low, 3 = average, 4 = high, and 5 = very high). The questionnaire also collected institution-level characteristics of the pharmacy school attended, including geographic region and pharmacy school type. The career section assessed students' perceptions of 7 career fields: community staff pharmacist, community pharmacy owner, hospital pharmacist, industrial pharmacist, research pharmacist, public service pharmacist, and professor.

For analysis, the 7 career fields were classified into clinical and nonclinical domains. The clinical domain (G1) included community staff pharmacist, community pharmacy owner, and hospital pharmacist, whereas the nonclinical domain (G2) included industrial pharmacist, research pharmacist, public service pharmacist, and professor. Here, "clinical" and "nonclinical" were defined operationally to distinguish career fields primarily involving direct patient care and medication dispensing (G1) from those primarily related to manufacturing, research, regulatory affairs, or education (G2). This classification was based on the prevailing workforce structure in South Korea, where public service pharmacists are mainly involved in pharmaceutical policy and regulation within governmental and public health institutions, and pharmacy professors are predominantly engaged in pharmaceutical sciences research and education rather than clinical practice. Although these roles may include direct patient care or clinical teaching responsibilities in other countries, particularly in the United States and the United Kingdom,^{29–33} they were classified according to their predominant functions in the South Korean context.

Perceptions of each career field were assessed using the Tasks, Expertise, Compensation, Valuation, and Prospects framework, which comprises 5 career-attribute categories represented by 10 items. The job Tasks category (T) consisted of task ease and working environment; the required Expertise category (E) consisted of professional expertise and growth opportunity; the Compensation category (C) consisted of financial compensation and job security; the external Valuation category (V) consisted of reputation and recommendation. The career Prospects category (P), newly added relative to the prior study, comprised 2 items: accessibility, defined as ease of entry in terms of time and cost, and outlook, defined as positive future prospects. All items were measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with an additional "don't know" response option provided to accommodate uncertainty. Higher scores reflected more favorable perceptions of these career attributes.

2.4. Variables

The career section was assessed across 2 dimensions: career awareness and career perceptions. The primary outcome was career awareness for each career field, measured at the item level based on selection of the "don't know" option. For descriptive analysis, the proportion of "don't know" responses was calculated for each item within each career field. To examine factors associated with career awareness in logistic regression analyses, awareness was further dichotomized based on the cumulative number of "don't know" responses across items within each domain. Specifically, respondents who selected "don't know" for 3 or more items in G1 (30 items) or 4 or more items in G2 (40 items) were coded as 1 (low career awareness), while those below these thresholds were coded as 0. These thresholds correspond to approximately 10% of the total items in each domain³⁴ and were applied as an operational cutoff to identify respondents with limited awareness across items. The secondary outcome was career perception scores for each career domain and item, derived as mean scores from Likert-scale responses. Responses of "don't know" were excluded from mean score calculations.

2.5. Statistical Analysis

Descriptive statistics were used to present the proportion of "don't know" responses and career perception scores for each career domain

and item. Career awareness was assessed using "don't know" responses and compared across the 7 career fields at 2 levels. First, at the career-field level, the proportion of "don't know" responses for each student was calculated for each career field based on the 10 attribute items. These proportions were analyzed using a linear mixed-effects model, with career field included as a fixed effect and student included as a random intercept. Pairwise comparisons with community staff pharmacist as the reference category were performed using Dunnett's correction. Second, at the attribute level, item-level "don't know" responses were treated as binary outcomes and analyzed using a generalized linear mixed-effects model with a logit link. Career field, attribute, and their interaction were included as fixed effects, and student was included as a random intercept. Within each attribute, pairwise comparisons with community staff pharmacist as the reference category were performed using Dunnett's correction.

Career perception scores were compared across career fields using item-level Likert-scale responses, excluding "don't know" responses. These scores were analyzed using a linear mixed-effects model with career field, attribute, and their interaction as fixed effects and student as a random intercept. Within each attribute, pairwise comparisons with community staff pharmacist as the reference category were performed using Dunnett's correction.

Logistic regression analysis was conducted to identify factors associated with career awareness. The dependent variable was career awareness level, and independent variables included student characteristics (sex, year of study, admission route, academic achievement, career information sufficiency, family economic status, and family background in health care) and school characteristics (region and pharmacy school type). Statistical significance was set at $p < .05$, and all analyses were conducted using R statistical software (version 4.3.3; R Foundation for Statistical Computing).

3. Results

3.1. Study Respondents

Table S1 presents the target and achieved sample sizes for each cell. Of the 1000 targeted respondents, 844 completed the survey, yielding an overall response rate of 84.4%. Of these, 19 respondents (2.2%) were admitted through out-of-quota admission pathways, a supplementary admission category in the South Korean higher education system that did not correspond to the 3 primary admission routes used in the analysis (early admission, regular admission, and transfer), and were therefore excluded from the analytical sample. This yielded a final analytical sample of 825 students. Some cells did not reach their target sample sizes. Nevertheless, the overall sample size was sufficient to conduct the planned analyses. Furthermore, as the analyses were performed at the level of major subgroups rather than individual cells, the impact of these shortfalls on study findings was considered minimal.

Table 1 presents student and school characteristics of the study respondents. Female respondents outnumbered males, with a relatively higher proportion of males among transfer students. The distribution of year of study also differed across admission-route subgroups, with transfer students concentrated in years 5 to 6. Most respondents reported middle or upper-middle levels of family economic status and academic achievement, and approximately one-third reported a family background in health care. Existing pharmacy schools accounted for most of the sample, with a somewhat lower proportion among transfer students. Overall, 55.8% of respondents reported having sufficient career information, with a slightly higher proportion among students admitted through early admission (57.9%; $p = .296$).

3.2. Awareness Gaps Across Career Domains and Attributes

Table S2 presents career-field-level comparisons of "don't know" response proportions against community staff pharmacists as the

Table 1
Characteristics of Survey Respondents.

Characteristics	Overall (n = 825)	New admissions (n = 511)		Transfer (n = 314)	p value
		Early admission (n = 330)	Regular admission (n = 181)		
Sex					< .001
Female	594 (72%)	266 (80.6%)	123 (68%)	205 (65.3%)	
Male	231 (28%)	64 (19.4%)	58 (32%)	109 (34.7%)	
Year of study					< .001
Y 1-2	262 (31.8%)	164 (49.7%)	94 (51.9%)	4 (1.3%)	
Y 3-4	286 (34.7%)	166 (50.3%)	87 (48.1%)	33 (10.5%)	
Y 5-6	277 (33.6%)	—	—	277 (88.2%)	
Economic status					< .001
Low	23 (2.8%)	7 (2.1%)	3 (1.7%)	13 (4.1%)	
Lower-middle	70 (8.5%)	33 (10.0%)	13 (7.2%)	24 (7.6%)	
Middle	297 (36%)	133 (40.3%)	55 (30.4%)	109 (34.7%)	
Upper-middle	328 (39.8%)	124 (37.6%)	67 (37%)	137 (43.6%)	
High	107 (13%)	33 (10%)	43 (23.8%)	31 (9.9%)	
Mean ± SD	3.52 ± 0.92	3.43 ± 0.88	3.74 ± 0.96	3.47 ± 0.92	
Academic achievement					.166
Low	52 (6.3%)	22 (6.7%)	13 (7.2%)	17 (5.4%)	
Lower-middle	146 (17.7%)	54 (16.4%)	37 (20.4%)	55 (17.5%)	
Middle	238 (28.8%)	98 (29.7%)	61 (33.7%)	79 (25.2%)	
Upper-middle	228 (27.6%)	88 (26.7%)	43 (23.8%)	97 (30.9%)	
High	161 (19.5%)	68 (20.6%)	27 (14.9%)	66 (21%)	
Mean ± SD	3.36 ± 1.16	3.38 ± 1.17	3.19 ± 1.14	3.45 ± 1.16	
Family background in health care					.020
No	574 (69.6%)	245 (74.2%)	113 (62.4%)	216 (68.8%)	
Yes	251 (30.4%)	85 (25.8%)	68 (37.6%)	98 (31.2%)	
Region					< .001
Capital/Gangwon	409 (49.6%)	132 (40%)	117 (64.6%)	160 (51%)	
Chungcheong	95 (11.5%)	35 (10.6%)	15 (8.3%)	45 (14.3%)	
Jeolla/Jeju	166 (20.1%)	88 (26.7%)	18 (9.9%)	60 (19.1%)	
Gyeongsang	155 (18.8%)	75 (22.7%)	31 (17.1%)	49 (15.6%)	
Pharmacy school type					.001
Existing school	565 (68.5%)	227 (68.8%)	142 (78.5%)	196 (62.4%)	
Newly established school	260 (31.5%)	103 (31.2%)	39 (21.5%)	118 (37.6%)	
Career information sufficient					.296
No	365 (44.2%)	139 (42.1%)	89 (49.2%)	137 (43.6%)	
Yes	460 (55.8%)	191 (57.9%)	92 (50.8%)	177 (56.4%)	

Note. Data are presented as *n* (%) unless otherwise indicated. *p* values were derived from χ^2 tests comparing the distribution of each characteristic across admission-route subgroups (early admission, regular admission, and transfer). A dash (—) indicates not applicable; students in years 5 to 6 at the time of the survey had entered pharmacy school through the transfer route under the previous 2+4-year system.

reference category. Community staff pharmacists had the lowest overall proportion of “don’t know” responses (3.3%). Compared with community staff pharmacists, community pharmacy owners (3.8%; +0.46% points) and hospital pharmacists (4.3%; +1.02% points) did not differ significantly ($p = .902$ and $p = .398$, respectively). In contrast, all 4 nonclinical career fields showed significantly higher proportions: industrial pharmacists (8.5%; +5.16% points), research pharmacists (10.1%; +6.81% points), public service pharmacists (9.1%; +5.76% points), and professors (7.0%; +3.73% points; all $p < .001$).

Fig. 1 presents the proportion of “don’t know” responses by career field and item. Compared with community staff pharmacists, the highest proportions of “don’t know” responses were observed for ease of job task among public service pharmacists (14.9%; odds ratio [OR] = 8.82, $p < .001$), working environment among research pharmacists (14.5%; OR = 12.72, $p < .001$), and ease of job task among research pharmacists (13.0%; OR = 6.83, $p < .001$). Table S3 presents the full attribute-stratified comparisons.

3.3. Perceptions of Career Attributes Across Clinical and Nonclinical Domains

Fig. 2 presents mean career perception scores by career field and item, based on responses from students who reported being aware of each field. All pairwise comparisons used community staff pharmacists

as the reference category. Regarding compensation, financial compensation received the highest ratings for community pharmacy owners (4.57, $p < .001$) and community staff pharmacists (4.25), while it was rated lowest for public service pharmacists (2.23, $p < .001$). Regarding required expertise, professors scored highest on both professional expertise (4.72, $p < .001$) and growth opportunity (4.57, $p < .001$), followed by research pharmacists (4.56 and 4.42, respectively; both $p < .001$). Regarding career prospects, the accessibility item was rated lowest for professors (1.98, $p < .001$) and community pharmacy owners (2.28, $p < .001$). The outlook item received the lowest scores for community staff pharmacists (2.87) and community pharmacy owners (3.12, $p < .001$). Table S4 presents the full attribute-stratified comparisons.

3.4. Determinants of Limited Awareness Across Career Domains

Table 2 presents the results of multivariable logistic regression analyses examining factors associated with “don’t know” responses in G1 and G2. In both domains, students who reported sufficient career information and those with higher family economic status were less likely to report “don’t know”. Differences between the 2 career domains were observed for admission route. While no significant association was found in G1, transfer students in G2 had significantly higher odds of responding “don’t know” than those admitted through early admission (OR = 2.27, $p = .041$).

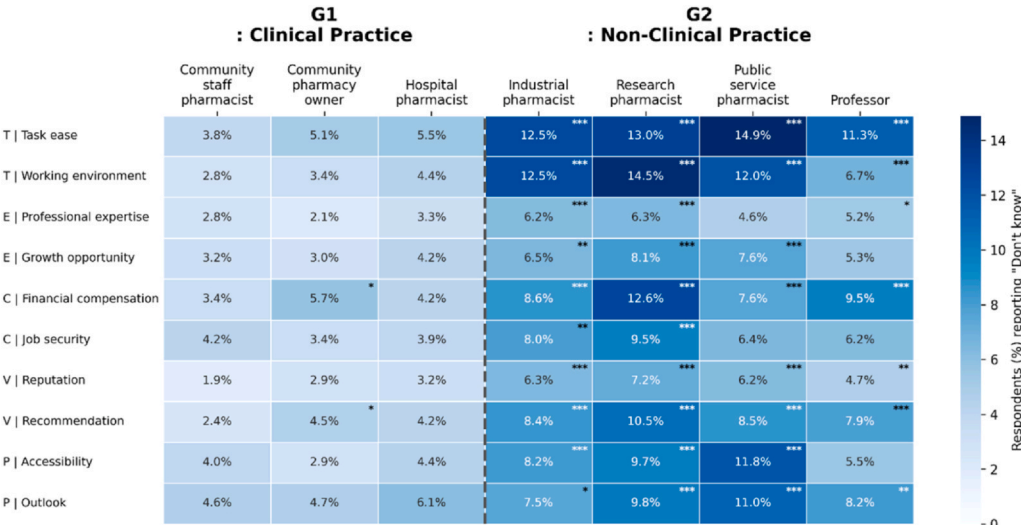


Fig. 1. Career awareness across career domains and attributes measured by prevalence of “don’t know” responses. Note. T | Task ease (ease of job task); T | Working environment (working environment); E | Professional expertise (level of required expertise); E | Growth opportunity (opportunities for required expertise growth); C | Financial compensation (financial compensation); C | Job security (job security); V | Reputation (professional reputation); V | Recommendation (willingness to recommend the job to others); P | Accessibility (low time and cost to enter); P | Outlook (positive future prospects). Pairwise comparisons were conducted against community staff pharmacist as the reference category based on a generalized linear mixed-effects model with Dunnett’s correction. * $p < .05$; ** $p < .01$; *** $p < .001$. Abbreviations: C, Compensation; E, required Expertise; P, career Prospects; T, job Tasks; V, external Valuation.

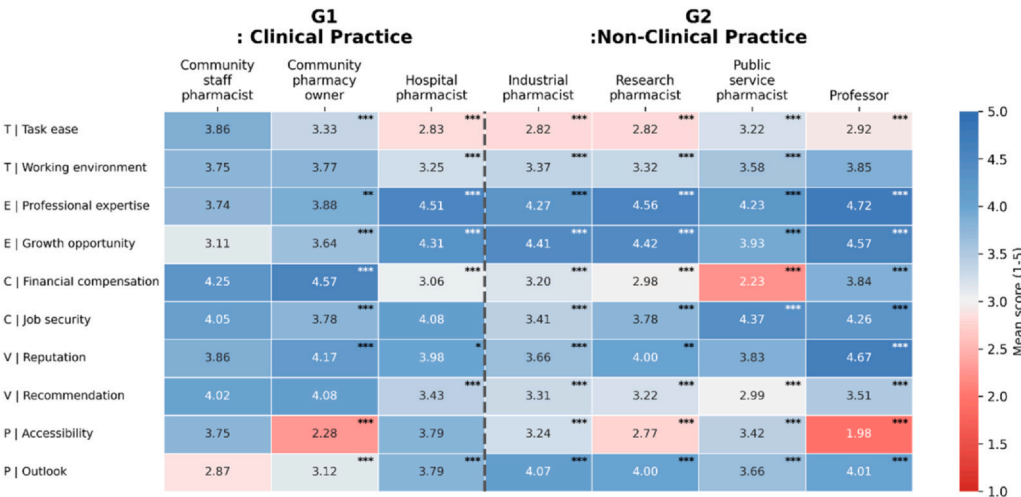


Fig. 2. Career perception scores by attribute and career domain among respondents. Note. T | Task ease (ease of job task); T | Working environment (working environment); E | Professional expertise (level of required expertise); E | Growth opportunity (opportunities for required expertise growth); C | Financial compensation (financial compensation); C | Job security (job security); V | Reputation (professional reputation); V | Recommendation (willingness to recommend the job to others); P | Accessibility (low time and cost to enter); P | Outlook (positive future prospects). Pairwise comparisons were conducted against community staff pharmacist as the reference category based on a linear mixed-effects model

with Dunnett’s correction. * $p < .05$; ** $p < .01$; *** $p < .001$. Abbreviations: C, Compensation; E, required Expertise; P, career Prospects; T, job Tasks; V, external Valuation.

4. Discussion

4.1. Imbalance in Career Awareness

This study is notable for analyzing pharmacy students’ career perceptions using a nationally representative sample and for examining the issue in terms of disparities in awareness and access to information across career domains. Prior studies on pharmacy students’ careers have primarily focused on career preference, motivations for entering pharmacy school, or job satisfaction, with comparatively limited attention paid to students’ awareness and perceptions of diverse career options.^{14,35,36} Most studies have also been limited to single institutions or focused on specific career domains.^{35,37,38} In contrast, this study comprehensively compared clinical and nonclinical career fields using nationwide data and simultaneously examined career awareness and perceptions of career attributes, suggesting that pharmacy students’ career awareness and perceptions may be disproportionately concentrated in certain domains. The findings are consistent with the expectation that awareness of clinical careers would exceed that of non-clinical careers, but contribute meaningfully by quantifying the extent and nature of this gap across specific career attributes.

Students generally showed high awareness of clinical practice careers, while exhibiting substantial awareness gaps across nonclinical domains, including research, industry, public service, and academia. The career attributes students evaluated positively also differed by domain. Clinical careers were perceived more positively in terms of financial compensation and job security, whereas nonclinical careers were viewed more favorably with respect to professional expertise and opportunities for growth. Notably, although students perceived non-clinical careers as offering high levels of professional expertise and substantial opportunities for growth, their understanding of the actual work environment and accessibility of these career pathways remained limited. This suggests that career perceptions may be shaped by differences in exposure and experience across career domains.

This imbalance in career awareness and perception is also important in relation to diversification of the pharmacist workforce. Students are more likely to pursue careers that are familiar and socially visible rather than those they do not fully understand, which may help explain why graduates continue to concentrate in traditional clinical roles despite the expanding scope of pharmacy practice.^{7,39,40} While nonclinical domains such as industry, research, policy, and public health are becoming increasingly important in the evolving pharmacy landscape,

Table 2

Multivariable Logistic Regression Analyses of Factors Associated With Low Career Awareness in the Clinical (G1) and Nonclinical (G2) Practice Domains.

Characteristics	G1 (clinical practice)		G2 (nonclinical practice)	
	OR (95% CI)	p Value	OR (95% CI)	p Value
Sex				
Female	Ref		Ref	
Male	0.906 (0.521-1.530)	.718	0.860 (0.585-1.250)	.435
Year of study				
Y 1-2	Ref		Ref	
Y 3-4	0.667 (0.364-1.205)	.183	0.846 (0.554-1.289)	.437
Y 5-6	0.423 (0.144-1.380)	.132	0.594 (0.257-1.422)	.230
Admission route				
Early admission	Ref		Ref	
Regular admission	1.519 (0.792-2.887)	.203	1.364 (0.854-2.169)	.191
Transfer	2.234 (0.740-6.002)	.127	2.271 (1.008-4.922)	.041
Economic status				
Low and Lower-middle	Ref		Ref	
Middle	0.577 (0.292-1.180)	.121	0.688 (0.415-1.150)	.149
Upper-middle	0.496 (0.248-1.021)	.050	0.526 (0.314-0.890)	.016
High	0.343 (0.124-0.887)	.031	0.342 (0.164-0.689)	.003
Academic achievement				
Low and Lower-middle	Ref		Ref	
Middle	0.913 (0.457-1.828)	.794	0.755 (0.484-1.175)	.212
Upper-middle	1.467 (0.775-2.842)	.245	0.802 (0.512-1.254)	.333
High	1.322 (0.639-2.729)	.448	0.636 (0.379-1.055)	.083
Family background in health care				
No	Ref		Ref	
Yes	1.454 (0.869-2.397)	.147	0.822 (0.560-1.194)	.309
Region				
Capital/Gangwon	Ref		Ref	
Chungcheong	0.996 (0.427-2.115)	.992	0.870 (0.483-1.512)	.631
Jeolla/Jeju	1.273 (0.689-2.295)	.429	1.201 (0.771-1.854)	.412
Gyeongsang	0.854 (0.420-1.638)	.646	1.269 (0.810-1.970)	.293
Pharmacy school type				
Existing school	Ref		Ref	
Newly established school	1.091 (0.645-1.810)	.739	1.021 (0.709-1.459)	.912
Career information sufficient				
No	Ref		Ref	
Yes	0.468 (0.288-0.752)	.002	0.576 (0.414-0.800)	.001
McFadden's Pseudo R ²	0.0474		0.0423	
Hosmer-Lemeshow χ^2 (p value)	1.826 (.9859)		11.775 (.1615)	

Note. Domain-specific cutoffs were applied to define the outcome variable: ≥ 3 “don't know” responses for G1 (30 items) and ≥ 4 responses for G2 (40 items), reflecting approximately 10% of items in each domain.

Abbreviations: OR, odds ratio; Ref, reference category.

their relatively low visibility may limit students' awareness and consideration of these pathways.^{3,41} This phenomenon of “clinical role visibility dominance” may not be limited to a single country,^{42,43} but rather represents a broader issue relevant to many countries seeking to diversify the pharmacist workforce.

4.2. Why Do Clinical Careers Dominate?

The imbalance in career awareness may be linked to professional socialization occurring during pharmacy education. Students do not simply acquire occupational information; rather, they are repeatedly exposed to particular images of pharmacists through education, practice, and everyday experiences. Within current pharmacy education and the broader social environment, the most visible professional identity is that of the clinical pharmacist working in community and hospital pharmacies.^{44–46} Such repeated exposure may lead students to perceive pharmacists primarily in clinical and dispensing-oriented roles.⁴⁰ In contrast, nonclinical fields such as research, industry, and public service are relatively underrepresented in educational and practice experiences.^{3,47,48} As a result, students may have difficulty developing a concrete understanding of the actual work environment or entry pathways in these fields.¹¹

To systematically examine how this imbalance is reflected in students' career perceptions, this study built upon and extended career perception items from the prior study by Noh and Son.²⁵ Unlike

previous studies, the present framework additionally incorporated career prospects, including accessibility and future outlook, allowing a more comprehensive understanding of how students evaluate the feasibility and long-term potential of different pharmacy career paths. When considering careers, students weigh factors such as job security, financial compensation, external valuation, growth opportunities, and practical accessibility. Clinical careers may therefore be perceived as realistic and attainable options because they provide relatively clear employment pathways, stable labor market structures, and immediate financial return after graduation. In addition, community and hospital pharmacy careers are the most familiar pathways encountered during pharmacy education and are associated with sustained workforce demand, making them appear more predictable and accessible to students.

By contrast, information on entry pathways and job characteristics in nonclinical fields such as research, industry, and public service may be comparatively limited and less accessible to students.^{49,50} These careers may also require additional graduate education, research training, or specialized qualifications. In South Korea, nonclinical positions that use a pharmacy license remain relatively limited, with most pharmacists concentrated in community and hospital pharmacy settings.⁵¹ This contrasts with countries such as the United States and Ireland, where pharmacists are more broadly distributed across non-clinical sectors, including the pharmaceutical and biopharmaceutical industries, government regulatory agencies, and academia.^{14,52,53} Such

labor market structures may contribute to fewer opportunities and greater competition in nonclinical fields, leading students to prioritize more immediate and accessible career options over pathways with longer-term professional growth potential.

4.3. Educational and Policy Implications

The findings of this study have important implications for pharmacy education and pharmacist workforce policy. The results demonstrate that students' career perceptions are not simply a matter of individual preference but are closely tied to exposure during the educational program, access to information, and labor market structure. This indicates that pharmacy education should move beyond a system focused solely on clinical competency training and expand toward supporting students in understanding and exploring diverse pharmacist roles and career pathways. In particular, experience-based educational approaches are needed so that students can develop a concrete understanding of the work environments, roles, and entry pathways associated with each career domain.

This perspective aligns with the emphasis in Accreditation Council for Pharmacy Education Standards 2025 on expanding diverse experiential opportunities through elective curricula, introductory pharmacy practice experiences, and advanced pharmacy practice experiences.¹³ However, current experiential education standards still emphasize minimum requirements centered on direct patient care, which may limit students' opportunities to sufficiently experience nonclinical fields.⁵⁴ Therefore, there is a need to more systematically expand elective courses, selective experiential rotations, and career exploration opportunities for students interested in nonclinical areas. In addition, pharmacy schools should consider developing courses focused on nonclinical career pathways and adopting active learning approaches, such as industry-coupled problem-based learning,⁵⁵ to provide students with a better understanding of these career options and potentially stimulate their interest in pursuing them. Such initiatives could include site visits to pharmaceutical companies and regulatory agencies, placements in research institutes, job shadowing, credit-bearing career exploration courses, and alumni mentoring. Increasing meaningful exposure to nonclinical domains, in particular, may help students perceive these fields as more realistic and accessible career options.

In addition, the finding that transfer students showed greater awareness gaps in nonclinical fields suggests that career awareness may be influenced not only by students' individual interests or competencies but also by differences in access to information and informal professional networks.^{56,57} This implies that some students may have comparatively limited access to informal career information, mentoring, or role models related to diverse career pathways. Pharmacy education programs should therefore strengthen student support services by providing more structured career mentoring, alumni networking, and career seminars to reduce disparities in access to career information. Beyond these student-level supports, pharmacy schools and professional organizations should periodically monitor workforce demand and evolving competency requirements across patient care and non-patient care sectors, and reflect these trends in curricula, experiential placements, and career guidance. Ultimately, such efforts may support not only individual career exploration but also the diversity and long-term sustainability of the pharmacist workforce.

4.4. Limitations

This study has some limitations. First, although the target sample size was set at 1000, only 844 responses were collected, leaving some quota cells below their targets. The voluntary nature of online survey participation made it difficult to fully control for differential response rates across subgroups, which may limit the representativeness of certain subpopulations. Second, the self-selected online survey design raises the possibility of response bias. If students with greater interest in

career planning were more likely to participate, the findings may overestimate the level of career awareness in the overall population. Third, the cross-sectional design precludes direct assessment of causal relationships between student characteristics and career awareness. Longitudinal research is needed to track changes in career awareness and career perceptions over the course of pharmacy education. Fourth, this study focused on differences in the level of career awareness and career perceptions across career fields, but did not fully examine how these perceptions are formed. In particular, the mechanisms of information access were not explored in detail. Future research should examine how educational experiences, mentoring, practical training, and exposure to different work settings influence the development of career perceptions. Fifth, this study was conducted during the transition to the integrated 6-year pharmacy education system, a period in which students with different entry pathways and educational trajectories coexisted. The differences observed by admission route may therefore partly reflect this transitional context. Replication after the 6-year system is fully established would help clarify whether the gaps in career awareness and the differences by admission route persist.

5. Conclusion

Using nationwide data, this study quantitatively identified gaps in career awareness between clinical and nonclinical domains among pharmacy students in South Korea. Although lower awareness of non-clinical careers has long been expected, this study is meaningful in that it measured this gap systematically across multiple career attributes. Students perceived nonclinical fields as areas with high expertise and growth potential, yet their concrete understanding of these careers remained relatively limited. This suggests that career perceptions may be shaped by exposure within the curriculum and by labor market structures. Pharmacy education should therefore expand hands-on experience and career mentoring in nonclinical fields to support students' balanced career exploration and promote diversification of the pharmacist workforce.

CRedit authorship contribution statement

Kyung-Bok Son: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Hyun-taek Ahn:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis. **Youran Noh:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis.

Ethics Approval and Consent to Participate

This study was approved by the Institutional Review Board of Hanyang University (HYUIRB-202509-004).

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Data Availability

Data may be provided upon reasonable request to the corresponding author.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Kyung-Bok Son reports financial support was provided by National Research Foundation of South Korea. The other authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.ajpe.2026.102078](https://doi.org/10.1016/j.ajpe.2026.102078).

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