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Original Research

Confidence and perceptions toward deprescribing among PharmD students in Saudi Arabian Universities

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Abstract

Background: Deprescribing is an essential patient safety process that remains underrepresented in pharmacy curricula. While many students may hold favorable perceptions toward deprescribing, their confidence in applying it in practice is often limited. In Saudi Arabia, there is limited data on the perceptions and confidence of PharmD students regarding deprescribing. Objective: To evaluate the confidence, perception, and educational exposure toward deprescribing among Saudi PharmD students across all professional years. **Methods:** A national cross-sectional survey was distributed using a convenience sampling approach. The instrument included demographic variables and two validated Likert scales measuring deprescribing confidence (5 items) and perception (8 items). Descriptive and multivariate analyses were conducted to investigate predictors of confidence and willingness to participate in deprescribing training. **Results:** A total of 253 PharmD students completed the questionnaire. While 70% were familiar with the concept of deprescribing, confidence remained moderate overall (mean: 3.26 ± 1.05), despite high perception scores (3.92 ± 1.05). Confidence increased significantly from P3 to P4 (2.62 vs. 3.73; $p < 0.001$). Multivariable analysis showed that confidence was the sole independent predictor of workshop enrollment (AOR = 0.66; 95% CI: 0.44–0.98; $p = 0.04$), even after adjusting for course exposure and perception. **Conclusion:** Although Saudi PharmD students have a positive perception of deprescribing, their confidence and intention to implement it in practice are lacking. A common trend observed in international research is that deprescribing is neither introduced early enough nor discussed frequently enough in pharmacy school curricula. National educational leaders are urged to integrate deprescribing competencies into core curricular frameworks, particularly within geriatrics and interprofessional learning, to align students' perceptions with their practical application.

Keywords: Deprescribing; PharmD students; Pharmacy education; Saudi Arabia; Medication safety; Confidence; Perception; Curriculum

INTRODUCTION

Polypharmacy is generally defined as the concurrent use of five or more medications[1], and such phenomena moved beyond a strictly geriatric problem to become a worldwide patient safety concern. The main driver behind polypharmacy is multimorbidity, where patients with multiple chronic conditions require multiple medications, often leading to a prescribing cascade. The negative consequences are well documented: higher rates of adverse drug events, emergency department visits, hospitalization, increased healthcare costs, and mortality[2,3]. Polypharmacy increases the risk for individuals to be exposed to potentially inappropriate medications (PIMs) for which any potential benefit is outweighed by risk[4,5]. A recent umbrella review involving 95 studies estimated the global prevalence of polypharmacy to be 37% in the general population and 45% among older adults aged 65 and above, rising to 59% among frail elders and over 70% in hospital settings[6]. The World Health Organization (WHO) estimates that preventable medication-related harm amounts to around USD 42 billion annually, underscoring the need for safe medication initiatives[7].

Strong evidence is currently present that deprescribing, a controlled, supervised tapering or stopping of unnecessary or high-risk medication, can limit medication burden without compromising clinical outcomes. A systematic review in 2021 of intervention trials among frail older adults noted a median decrease in two drugs per patient with corresponding statistically significant reductions in PIM therapy, without rises in hospitalization or mortality[8]. These efforts align with the WHO's *Medication Without Harm* challenge, which aims for a 50% reduction in severe, preventable medication harm by 50% by the year 2027 and considers polypharmacy a priority area[7]. There is a need to make sure that the Doctor of Pharmacy (PharmD) students possess confidence and competency in providing such deprescribing interventions, as this is one area in which they remain poorly prepared, especially in Saudi Arabia, for which there is no national data available.

Deprescribing is recognized as a key example of patient-centered care, requiring collaborative decision-making among the physician, pharmacist, and patient[9]. Given that pharmacists are considered the cornerstone in conducting medication reviews, reconciliations, and MTM services, this highlights the importance of their contribution to the deprescribing intervention[10,11]. Numerous studies have demonstrated the impact of pharmacist-led deprescribing interventions in reducing the number of potentially inappropriate medications (PIMs). Gonçalves et al. conducted a systematic review highlighting that pharmacist-led deprescribing initiatives have reduced PIMs by 32% and medication count by 1.5-3 per patient, with no increase in adverse events reported[12]. Moreover, two ongoing clinical trial studies extend this work to anticholinergic overuse[13] among the geriatric population: the Reducing the Risk

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of Dementia through Deprescribing (R2D2) cluster-randomized trial, which examines cognitive outcomes after pharmacist-led deprescribing in primary care settings[14] and the Brain Safe App trial, which tests a consumer-facing mobile tool that guides the tapering of high-risk anticholinergics[15]. These efforts align with Saudi Arabia's Vision 2030 goal to increase its average lifespan to 78 years through its Health Sector Transformation Program 2025 and to enhance the quality of life through safer and more effective medication use[16]. Successful pharmacist-driven practice models already exist across various settings, including hospital-based medication reviews and reconciliation services, as well as within primary care pharmacists who partner with physicians through collaborative practice agreements to communicate and implement deprescribing plans[17,18].

Furthermore, deprescribing has been recognized by professional standards. The 2019 American College of Clinical Pharmacy (ACCP) Pharmacotherapy Didactic Curriculum Toolkit lists it as a Tier 1 competency[19] and the International Pharmaceutical Federation's Workforce Development Goal 7 (2022) calls for explicit deprescribing competence to be included within pharmacy curricula[20]. However, a noticeable educational gap exists. In a study conducted in the United Kingdom (UK), fewer than 20% of final-year pharmacy and medical students could define "deprescribing" and felt confident in implementing it[21]. Moreover, 91 pharmacy undergrad students from 12 schools in the United States (US) highlight that 65% of the students passed the deprescribing knowledge test; however, only 37% felt confident in implementing it[22]. Lastly, a study conducted in Jordan assessing the attitude and perception of Jordanian pharmacy students toward deprescribing confirmed the same pattern: only half of the respondents are familiar with the term deprescribing, and only 47% felt confident in recommending deprescribing interventions[23]. This finding highlights the knowledge and confidence gap regarding deprescribing and the readiness of pharmacy curricula to address these gaps.

The Kingdom of Saudi Arabia has more than 30 governmental and private PharmD programs, graduating approximately 2,500 students annually[24-26]. Which reflects the magnitude of the national medication safety mandate. The Health Sector Transformation Program (Vision 2030) specifically targets a reduction in preventable harm, including polypharmacy[16]. The newly released Saudi Pharmacotherapy Didactic Curriculum Toolkit (2024) integrates deprescribing within the geriatric, chronic disease, and patient safety modules[27]. However, the extent to which the concept of deprescribing has been included in lectures and during experiential training for undergraduate PharmD students remains unknown. To fill the gap, the current cross-sectional survey measures confidence, perception, and curricular exposure to deprescribing among PharmD students across Saudi Arabian universities. Specifically, we describe the overall confidence and perception scores related to deprescribing, compare confidence and perception scores regarding deprescribing across different student demographics and educational strata, and explore predictors of willingness to participate in a deprescribing training workshop. The study findings will provide the first national benchmark and guide curricular improvement, aligning pharmacy education with the Vision 2030 goal for medication safety.

METHOD

Study design and setting

This was a descriptive cross-sectional survey design among PharmD students enrolled in Saudi universities. Survey data were collected during 2024-2025 Academic year, using REDCap (version 14.1.5, Vanderbilt University© 2025) hosted on the Imam Abdulrahman Bin Faisal University (IAU) server.

Participants and recruitment

All professional years of PharmD students, from the P2 level to internship years, studying in Saudi universities were deemed eligible for the study. Due to the exploratory national snapshot scope of the study, we employed convenience recruitment. Where possible, lecturers posted a QR code after classes. Participation was anonymous and voluntary. We received a total of 254 complete questionnaires. Since we use the open link feature in REDCap, we were unable to ascertain the number of students who viewed the invitation and, therefore, could not calculate the response rate.

Instrument development and content validity

The questionnaire items were derived from existing literature on deprescribing attitudes and perceptions, as well as confidence. Following the screening, a 28-item survey was divided into four sections: (1) demographics and education; (2) a five-item confidence questionnaire; (3) an eight-item perception questionnaire; and (4) a one-item question about the desire to participate in a deprescribing workshop. Each Likert item was scored on a 5point scale (1 = strongly disagree to 5 = strongly agree). Two researchers with extensive experience in deprescribing reviewed the initial draft of the survey for clarity, relevance, and completeness. No items were eliminated, but minor changes were made.

Data-collection procedures

The survey instrument was delivered via REDCap® (version 14.1.5, Vanderbilt University© 2025) on a secure Imam Abdulrahman Bin Faisal University server. One open-link project with REDCap's "prevent multiple submissions" feature was created, which deposited a browser-based cookie to reject duplicate entries. Device IDs and IP addresses were not recorded by the platform, maintaining total anonymity. Items were delivered once per page with a progress indicator; automatic timestamping indicated a median duration of less than five minutes. Upon the end of data collection, an export of de-identified response data was downloaded as a CSV file and saved on an encrypted, password-protected drive for analysis.

Study Measures

Three primary outcomes were examined: (i) a composite confidence score, the average of five Likert items (1 = strongly disagree to 5 = strongly agree); (ii) a composite perception score: the average of eight items on the same scale; and (iii) intention to attend a deprescribing workshop, coded as Yes,

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Maybe, or No and dichotomized to Yes vs. otherwise. Predictor factors were academic year, gender, GPA category, previous deprescribing coverage in core and/or elective courses, self-reported familiarity with the term "deprescribing," and experiential experience through Introductory Pharmacy Practice Experience (IPPE) or Advanced Pharmacy Practice Experience (APPE) verses (community, institutional, academia, industry). Reverse-worded items were reversed before totals on the scales were determined. Questionnaires with more than 10% of items missing were omitted, and the remaining dataset, with fewer than 2% item-level missingness, was managed using listwise deletion.

Statistical analysis

Analysis was conducted using IBM SPSS Version 27. Categorical variables were presented as frequency and percentages, while continuous variables (age, confidence score, perception score) were presented as mean ± Std. Deviation "SD" or median [IQR] when the Shapiro–Wilk test reveals a non-normal distribution. Complementary group comparisons employed independent-sample t-tests for two categories and one-way ANOVA with Bonferroni adjustment for three or more categories; the parametric approaches were replaced with Mann–Whitney or Kruskal–Wallis tests where the assumptions were not met. Internal reliability was good (confidence Cronbach's $\alpha = 0.91$; perception Cronbach's $\alpha = 0.97$). Multiple linear regression was used to determine the predictors of each composite measure. A binary logistic regression model with all predictors entered in one block was used to test factors predicting a definite intention to attend a deprescribing workshop (Yes = 1, Maybe/No = 0); adjusted odds ratios and 95% confidence intervals are provided. All tests were two-tailed, with $p < 0.05$ considered significant.

Ethical considerations

The study protocol received expedited approval from the Institutional Review Board of the IAU (IRB No. IRB-2025-05-0144). The opening screen of the survey had an electronic statement of consent, and movement to the initial question was taken as confirmation of consent. De-identified information is stored on secure university servers that may only be accessed by the investigators.

RESULTS

Of the 254 PharmD students who completed the survey (Table 1), the modest majority (58%) were female. Respondents were relatively evenly spread through the professional years, with 26.8% in the P4, 27.2% in the P5, 22.0% in the P2, 15.4% in the P3, and 8.7% in the internship year. Academic performance was high: 35.9% had a GPA of ≥3.75, but only 22.0% had a GPA of <2.00. Pharmaceutical industry or government employment was the most popular career goal (42.9%), followed by hospital practice (32.1%); community practice drew only 4.0%. Experience with deprescribing was prevalent (69.7%), and slightly less than half of the learners stated that the subject had been included in a core course (53.4%). However, elective experience was decidedly less common (25.4%). As might be expected of such a widely taught topic, by far the most common teaching method was the lecture (60.9% of those exposed), with experiential contact (IPPE and APPE) consuming ≤11% of cases. Notably, competence enhancement intentions were considerable: the survey found that 54.7% of learners would participate in a deprescribing workshop and that a further 42.0% would do so given the opportunity. Full frequencies and percentages for all demographic, academic, and teaching variables are presented in Table 1.

The composite confidence score had a mean ± SD of 3.26 ± 1.05 and a median of 3.40, ranging across the entire response spectrum (1–5). The composite perception score had a mean ± SD of 3.92 ± 1.05, a median of 4.13, and the same observed response spectrum (1–5) (Table 2).

Table 3 outlines IPPE and APPE experience in the planned practice site. IPPE experience was highest in community pharmacy, with 47.2% of the student population indicating experience in this site. APPE experience varied across all sites but was lower, ranging from 11.8% in community pharmacies to 22.4% in roles affiliated with drug companies or the government.

Independent-samples *t*-tests showed no statistically significant gender differences in either domain. Mean confidence scores were virtually identical for male and female students (3.26 ± 1.09 vs 3.25 ± 1.02; p=0.983). Perception scores likewise did not differ (3.88 ± 1.03 vs 3.98 ± 1.06; p=0.700) (Table 4).

One-way ANOVA indicated that confidence scores varied by year of study (range = 2.62–3.73), with the highest confidence being reported by the fourth-year students and the lowest by the third year ($F(4, 238) = 9.13$, $p < 0.001$, $\eta^2 = 0.14$). Variation by GPA ranges was on the boundary ($F(3, 218) = 2.31$, $p = 0.078$, $\eta^2 = 0.03$), and no significant differences were apparent for intended career plan ($F(4, 238) = 0.70$, $p = .594$, $\eta^2 = 0.01$). Full means and standard deviations are presented in Table 5. Additionally, another One-way ANOVA showed that perceptions differed by academic year, with fourth-year students reporting the most favorable perception toward deprescribing (M = 4.21) and third-year students the least (M = 3.48; $F(4, 239) = 3.26$, $p = 0.013$, $\eta^2 = 0.05$). No significant differences emerged across GPA ranges ($p = 0.264$) or intended career plans ($p = 0.878$). Full values appear in Table 6.

In the multivariable linear-regression model predicting the composite confidence score (Table 8), the overall equation was significant ($F(7, 210) = 23.15$, $p < 0.001$) and explained 44 % of the variance (adjusted $R^2 = 0.44$). Perception score (B = 0.55, 95 % CI 0.44–0.65, $p < 0.001$) and prior coverage of deprescribing in a core course (B = 0.15, 95 % CI 0.02–0.59, $p = 0.040$) were positive, independent predictors of confidence. Academic year, gender, GPA range, elective-course exposure, and familiarity with the term "deprescribing" were not significant (all $p > 0.05$) (Table.7). Additional multivariable linear-regression model for perception was significant overall ($F(7, 210) = 17.21$, $p < 0.001$) and accounted for 37 % of the variance (adjusted $R^2 = 0.37$; Table 8). Of the seven predictors entered, only the composite confidence score was independently associated with perception

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Table 1. Descriptive Characteristics of Respondents (N = 254)

Variables	Categories	N	Valid %	
Gender	Male	105	41.3	
	Female	148	58.3	
Academic year	Second Year (P2)	56	22	
	Third Year (P3)	39	15.4	
	Fourth Year (P4)	68	26.8	
	Fifth Year (P5)	69	27.2	
	Internship Year	22	8.7	
GPA range	Below 2.00	56	22	
	2.00 - 2.74	39	15.4	
	2.75 - 3.74	68	26.8	
	3.75 - 4.49	69	27.2	
	4.50 - 5.00	22	8.7	
Planned primary employment	Community Pharmacy	10	4	
	Hospital Pharmacy	81	32.1	
	Academia	27	10.7	
	Pharmaceutical Industry/Government Agency	108	42.9	
	Other Pharmacy-Related Field	26	10.3	
Familiar with the term “deprescribing”	No	77	30.3	
	Yes	177	69.7	
Covered deprescribing in core course	No	117	46.6	
	Yes	134	53.4	
Covered deprescribing in elective course	No	188	74.6	
	Yes	64	25.4	
Willingness to attend workshop focused on deprescribing	No	8	3.3	
	Maybe	103	42	
	Yes	134	54.7	
		N	**%**	**% Of cases**
If instruction on deprescribing was part of the curriculum (didactic or experiential), during what curricular activities did this occur? (Select all that apply.)	Did not cover deprescribing in any educational activities	72	16.40%	30.60%
	Lectures	143	32.60%	60.90%
	Patient-Centered Case Problems	63	14.40%	26.80%
	Clinical Simulations	45	10.30%	19.10%
	Community Projects, Service Learning	19	4.30%	8.10%
	Online Coursework	20	4.60%	8.50%
	Clinical Labs	22	5.00%	9.40%
	IPPE	25	5.70%	10.60%
	APPE	14	3.20%	6.00%
	Research or Capstone Projects	16	3.60%	6.80%
Upon your graduation from your College/School of Pharmacy, which of the following do you plan to pursue? (Select all that apply.)	Pharmacy Residency Program	143	31.60%	56.30%
	Post Graduate program in a pharmacy-related field, for example. MS or PhD	134	29.60%	52.80%
	Non-Pharmacy Graduate Program	69	15.20%	27.20%
	Fellowship	47	10.40%	18.50%
	No plans for further education in the coming year	60	13.20%	23.60%

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Table 2. Descriptive Statistics for Confidence and Perception Scales

	Confidence	Perception Toward Deprescribing
Mean	3.2552	3.9177
Median	3.4	4.125
Std. Deviation "SD"	1.04839	1.04838
Range	4	4
Minimum	1	1
Maximum	5	5

Table 3. IPPE and APPE Exposure by Intended Practice Setting

Practice setting	IPPE: No	IPPE: Yes	APPE: No	APPE: Yes
Community Pharmacy	134 (52.8 %)	120 (47.2 %)	224 (88.2 %)	30 (11.8 %)
Drug Co./Manufacturing/Gov.	207 (81.5 %)	47 (18.5 %)	197 (77.6 %)	57 (22.4 %)
Institutional Pharmacy	181 (71.3 %)	73 (28.7 %)	198 (78.0 %)	56 (22.0 %)
Academia	218 (85.8 %)	36 (14.2 %)	203 (79.9 %)	51 (20.1 %)

Table 4. Confidence and Perception by Gender (Independent t-Test)

Groups	Gender				Key Result			
	Male		Female					
	Mean	SD	Mean	SD	t	df	p	*η2*
Confidence	3.26	1.09	3.25	1.02	0.021	237	0.983	0.003
Perception	3.88	1.03	3.98	1.06	-0.386	238	0.7	0.05

Table 5. One-way ANOVA of Composite Confidence Scores by Academic Year, GPA range, and Intended Career Plan among PharmD Students

Domain	Factor level	N	Mean	SD	p
Academic year	Second Year (P2)	49	2.951	1.00626	<0.001
	Third Year (P3)	35	2.6171	1.02138	
	Fourth Year (P4)	65	3.7262	0.95431	
	Fifth Year (P5)	68	3.4059	0.91942	
	Internship Year	22	3.0909	1.1393	
GPA range	2.00 - 2.74	5	3.64	1.71697	0.078
	2.75 - 3.74	27	3.4889	1.08604	
	3.75 - 4.49	124	3.1177	1.01245	
	4.50 - 5.00	63	3.473	1.00534	
Planned primary employment	Community Pharmacy	9	3.4222	1.1893	0.594
	Hospital Pharmacy	75	3.1467	1.10885	
	Academia	26	3.3692	0.95949	
	Pharmaceutical Industry/Government Agency	104	3.2308	0.97014	
	Other Pharmacy-Related Field	25	3.504	1.22898	

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Table 6. One-way ANOVA of Composite Perception Scores by Academic Year, GPA range, and Intended Career Plan among PharmD Students

Domain	Factor level	N	Mean	SD	p
Academic year	Second Year (P2)	51	3.7574	0.90637	0.013
	Third Year (P3)	33	3.4773	0.94758	
	Fourth Year (P4)	66	4.2121	1.20774	
	Fifth Year (P5)	68	3.9228	0.98851	
	Internship Year	22	4.0511	0.94543	
GPA range	2.00 - 2.74	5	4.225	0.50312	0.264
	2.75 - 3.74	27	4.1528	0.92724	
	3.75 - 4.49	121	3.8161	1.08698	
	4.50 - 5.00	64	4.0605	1.05174	
Planned primary employment	Community Pharmacy	10	4.1125	0.76478	0.878
	Hospital Pharmacy	76	3.8783	1.02571	
	Academia	26	4.0865	0.92586	
	Pharmaceutical Industry/Government Agency	103	3.8883	1.05776	
	Other Pharmacy-Related Field	25	3.905	1.3171	

Table 7. Multivariable Linear Regression of Factors Associated with the Composite Confidence Score

Variables	Coefficient (B)	95% CI	t	*p*	Tolerance	VIF
Constant	0.87	[0.07, 1.68]	2.13	0.03	–	–
Academic year	0.01	[–0.09, 0.11]	0.16	0.87	0.78	1.29
Gender	–0.00	[–0.23, 0.21]	–0.06	0.95	0.97	1.03
GPA range	–0.02	[–0.18, 0.13]	–0.33	0.75	0.92	1.09
Familiar with the term “deprescribing”	0.1	[–0.10, 0.54]	1.36	0.18	0.55	1.81
Covered deprescribing in core course	0.15	[0.02, 0.59]	2.07	0.04	0.56	1.78
Covered deprescribing in elective course	0.11	[–0.01, 0.54]	1.9	0.06	0.8	1.25
Perception Toward Deprescribing	0.55	[0.44, 0.65]	2.13	<.001	0.95	1.05

Note: Outcome Variable: Confidence, Model Summary: R^2=.66, Adj R^2=.44, DW: 2.27, ANOVA: F (7,210) =23.15, P<.001

Table 8. Multivariable Linear Regression of Factors Associated with the Composite Perception Score

Variables	Coefficient (B)	95% CI	t	*p*	Tolerance	VIF
Constant	1.86	[1.03, 2.70]	4.39	<0.001	–	–
Academic year	0.03	[–0.08, 0.13]	0.54	0.59	0.78	1.29
Gender	0.01	[–0.22, 0.26]	0.18	0.86	0.97	1.03
GPA range	–0.01	[–0.19, 0.15]	–0.24	0.81	0.92	1.09
Familiar with the term “deprescribing”	0.04	[–0.25, 0.45]	0.56	0.58	0.55	1.82
Covered deprescribing in core course	–0.06	[–0.44, 0.20]	–0.75	0.46	0.55	1.81
Covered deprescribing in elective course	–0.06	[–0.44, 0.16]	–0.95	0.35	0.79	1.27
Confidence Toward Deprescribing	0.62	[0.51, 0.75]	10.2	<0.001	0.84	1.19

Note: Outcome Variable: Perception, Model Summary: R^2=.61, Adj R^2=.37, DW:2.26, ANOVA: F (7,210) =17.21, P<.001

(B = 0.62, 95 % CI 0.51–0.75, $p < 0.001$). Academic year, gender, GPA range, familiarity with the term “deprescribing,” and prior coverage in either core or elective courses were not significant ($p > 0.35$ for all) (Table.8).

In the unadjusted (univariate) analyses, only fourth-year students were associated with definite workshop attendance (OR = 1.99, 95 % CI 0.95–4.19, p = 0.04). After adjustment for all predictors, this association weakened (AOR = 2.95, 95 % CI 0.95–9.20, p = 0.06), and the composite confidence score emerged as the sole independent predictor: each one-point increase in confidence was linked to lower odds of choosing to attend the for the workshop (AOR = 0.66, 95 % CI 0.44–0.98, p = 0.04). Sex, GPA range, career plan, academic familiarity,

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and prior curricular exposure were not significant in either the univariate or multivariable models (all p > 0.05) Table 9.

DISCUSSION

This study provides the first national snapshot of Saudi PharmD students' confidence, perceptions, and educational exposure to deprescribing. Students view deprescribing positively, with a mean perception score of 3.92 ± 1.05 on an 8-item scale (where items are rated 1–5), yet report only moderate confidence (3.26 ± 1.05 on a 5-item scale). About two-thirds of respondents were familiar with the term, and deprescribing had been covered in at least one core course for 53.4%, while 25.4% had encountered it in an elective. Just over half of students (54.7%) would definitely attend a deprescribing workshop, and a further 42% were open to doing so. Confidence increased across the program, rising from 2.62 in P3 to 3.73 in P4 ($p < 0.001$), while neither GPA nor intended career plan affected confidence or perception. Multivariable analysis revealed that prior core-course exposure and higher perception scores together accounted for 44% of the variance in confidence. Although core-course exposure was associated with workshop interest in univariate analysis, this association lost significance after adjustment; confidence remained the sole independent predictor of definitive workshop enrollment (AOR = 0.66, 95% CI 0.44–0.98, $p = 0.04$).

Confidence grows significantly at the transition between P3 and P4 ($p < 0.001$), a change that align with the Saudi PharmD curricula. During P2 and P3, coursework focuses on basic pharmaceuticals science including pharmacology, medicinal chemistry, and other biomedical sciences, with little emphasis on medication safety or deprescribing concept. During P4, student will be introduced to integrated pharmaceutical-care and therapeutics courses, where special patient population such as geriatric and guidelines-directed management of high-risk medication such as anticholinergic and benzodiazepines are taught, in which these modules provide the first opportunities for students to be introduced to deprescribing algorithms and shared-decision modules. However, the lack of such a peak for

Table 9. Logistic Regression Predicting Definite Willingness to Attend a Deprescribing Workshop (Yes = 1, Maybe/No = 0)

		Univariate Unadjusted LR			Multivariate Analysis		
Variables	***Groups***	***ODDS***	***95% CI***	***p***	***ODDS***	***95% CI***	***p***
Gender	Male (Ref.)	–	–	–			
	Female	1.08	[0.65, 1.80]	0.77	1.69	[0.92, 3.12]	0.09
Academic year	Second Year (Ref.)	–	–	–	–	–	–
	Third Year	1.5	[0.63, 3.59]	0.36	2.37	[0.75, 7.45]	0.14
	Fourth Year	1.99	[0.95, 4.19]	0.04	2.95	[0.95, 9.20]	0.06
	Fifth Year	0.67	[0.33, 1.38]	0.28	0.97	[0.35, 2.73]	0.96
	Internship Year	0.93	[0.34, 2.50]	0.88	1.41	[0.40, 4.95]	0.59
GPA range	Below 2.00	–	–	–	–	–	–
	2.00 - 2.74	0.27	[0.03, 2.73]	0.27	0.19	[0.02, 2.26]	0.19
	2.75 - 3.74	0.36	[0.04, 3.28]	0.36	0.23	[0.02, 2.30]	0.21
	3.75 - 4.49	0.26	[0.03, 2.44]	0.24	0.15	[0.01, 1.58]	0.11
	4.50 - 5.00	-	-	-	–	–	–
Planned primary employment	Community Pharmacy	–	–	–	–	–	–
	Hospital Pharmacy	0.48	[0.11, 1.97]	0.31	0.27	[0.04, 1.80]	0.18
	Academia	0.73	[0.15, 3.47]	0.69	0.39	[0.05, 2.81]	0.35
	Pharmaceutical Industry/Government Agency	0.55	[0.14, 2.24]	0.4	0.32	[0.05, 1.99]	0.22
	Other Pharmacy-Related Field	0.29	[0.06, 1.38]	0.12	0.13	[0.02, 1.01]	0.05
Familiar with the term "deprescribing"	No (Ref.)	–	–	–	–	–	–
	Yes	1.07	[0.61, 1.86]	0.81	0.73	[0.30, 1.78]	0.49
Covered deprescribing in core course	No (Ref.)	–	–	–	–	–	–
	Yes	1.57	[0.95, 2.62]	0.08	1.75	[0.69, 4.40]	0.24
Covered deprescribing in elective course	No (Ref.)	–	–	–	–	–	–
	Yes	1.25	[0.70, 2.23]	0.46	1.55	[0.71, 3.38]	0.27
Confidence score		0.81	[0.63, 1.04]	0.09	0.66	[0.44, 0.98]	0.04
Perception score		0.99	[0.77, 1.26]	0.92	1.1	[0.77, 1.58]	0.59

DV: Would you be interested in participating in a workshop or training session focused on deprescribing?

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P4 and P5, following additional clinical placements, indicates subsequent improvements rely less on simple curricular progression and more on specialized practice experience after introducing basic concepts. In addition, we observe a notable discrepancy, with only 10.6% reporting having experienced deprescribing within an IPPE rotation and just 6.0% within an APPE, implying that reinforcement of learning from class is rare. Strengthening IPPE and APPE with focused deprescribing case discussions, trigger tools (e.g., Beer's criteria[28], STOPP/START[4]), and supervised medication review assignments could transform the P4 confidence peak into lasting advancement for the remainder of the PharmD program.

Studies from the UK, USA, and Jordan examining PharmD students' attitudes and confidence toward deprescribing have all reported an attitude-confidence gap; their respondents positively view deprescribing but express less confidence in implementing it[21-23]. Our result reproduces the same pattern. However, our cohort reported the highest familiarity with the term deprescribing compared to another study cohort (≈ approximately 70 % vs. 52% in Jordan[23]). However, their self-rated confidence was moderate, reflecting that perception alone is insufficient to yield competence. Furthermore, confidence in our sample was driven by structured coverage in core pharmaceutical care and therapeutic courses rather than elective ones, which was consistent with previous studies. Demand for supplementary skills training was also similar across settings; approximately half of the students were willing to sign up for an extracurricular deprescribing workshop, comparable to the enrollment rates of electively included participants in North American pilots[22]. Aggregating cross-national evidence implies a shared gap in education. Pharmacy schools expose students to deprescribing too late and reinforce it sporadically, leaving graduates who appreciate the practice but are only partially ready to implement it in everyday practice.

To the best of our knowledge, this is the first national survey of Saudi PharmD confidence and perception regarding deprescribing, encompassing all professional years and utilizing highly reliable scales ($\alpha > 0.90$). However, the results should be viewed considering several key limitations. Recruitment was conducted using an open-link convenience strategy, and the actual response rate could not be calculated, which may have led to self-selection bias. All responses were self-reported, allowing for scope for recall error and social-desirability bias when reporting confidence or willingness to train. Institutional identifiers were not obtained, so the regional response cannot be confirmed. A lack of objective standards means that confidence may not necessarily equate with demonstrable competence. Finally, the survey was not piloted with students or subjected to cognitive interviewing; item clarity was confirmed only through expert review, which may limit responseprocess validity. Despite limitations, the results highlight a persistent gap in curricula and underscore the need for earlier and compulsory deprescribing content, complemented by structured APPE and IPPE activities that are evaluable by objective measures.

Based on our findings, several targeted recommendations can enhance deprescribing education in Saudi Arabia. First, deprescribing skills must be officially integrated into the learning objectives of the Jāhiziyah Program, in line with accreditation standards from NCAAA[29]. Second, all healthcare educators must shift their mindset beyond traditional prescribing and begin promoting deprescribing as an essential patient safety skill[30]. Third, geriatric rotations should be made core APPE rotations, given their underrepresentation today and the strong evidence for their value[31.32]. Fourth, deprescribing principles must be integrated into interprofessional education so that pharmacy, medicine, nursing, and allied health students share a common understanding of medication safety[33]. Finally, national healthcare conferences must devote more attention to deprescribing, in line with Saudi Vision 2030 objectives for improved health outcomes and greater longevity.

Future work evaluating PharmD student perception and competency toward deprescribing should pair self-confidence with implantation-based metrics. Objective Structured Clinical Examinations (OSCEs) and high-fidelity clinical simulation methods have demonstrated safer prescribing practices among trainees[34,35]. These can verify whether students with high self-reported confidence in deprescribing can recommend and implement deprescribing plans for high-risk and potentially inappropriate medications. An early, required deprescribing module based on the successful flipped-classroom model, which significantly boosted knowledge and confidence among third-year pharmacy students[36], should be piloted and evaluated through pre- and post-OSCE scores to assess its impact on practical skills. Follow-up on internship is equally crucial, with multi-school data from the United States indicating that gains are reduced when reinforcement is absent[22]. Incorporating booster activities into IPPE and APPE would both maintain competence and provide objective evidence of skill transfer. These actions complement Saudi Arabia's Vision 2030 medication safety key performance indicators[37,38] and promote the WHO's "Medication Without Harm" aim[7].

CONCLUSION

Saudi PharmD students reflect positive perception toward deprescribing but express only moderate confidence on assessing their own ability to practice it. To close this gap between perception and confidence, it would be helpful to incorporate deprescribing content earlier within the curriculum and reinforce it with structured, performance-measured activities within Introductory Pharmacy Practice Experiences (IPPEs) and Advanced Pharmacy Practice Experiences (APPEs). This would close this gap and better prepare future practitioners to manage polypharmacy safely within everyday practice.

AUTHOR CONTRIBUTIONS

Khalid A. Alamer: Conceptualization, study design, survey development, data analysis, manuscript writing, and final approval of the submitted version.

CONFLICT OF INTEREST

The author declares no conflicts of interest relevant to the content of this manuscript.

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