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## Original Research

# Descriptive assessment of graduates' perceptions of pharmacy-related competencies based on the Lebanese pharmacy core competencies framework

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### Abstract

**Background:** Pharmacists possess a unique and complex body of knowledge, skills, attitudes, and behaviors necessary to enable them to optimize health outcomes. Pharmacy organizations publish routinely updated versions of professional competencies that help pharmacy schools integrate advances into their curricula. In Lebanon, no national framework for pharmacy education is officially adopted yet. In 2017, the Official Pharmacists' Association in Lebanon [OPL - Order of Pharmacists of Lebanon] took the initiative to develop a pharmacy core competency framework.

**Objective:** The primary objective of this survey was to evaluate graduates' perceptions of pharmacy-related competencies "taught" across Lebanese pharmacy schools/faculties, based on the suggested Lebanese Pharmacy Competencies Framework. This study also explored the association between graduates' demographics, university attributes, and self-assessed competency performance.

**Methods:** A cross-sectional study involving pharmacists who graduated from Lebanese universities was performed through a 40-minute online questionnaire distributed over social media platforms and groups of pharmacists.

**Results:** Pharmacists perceived their competence as moderate upon graduation, the lowest scores being in fundamental knowledge and medicine supply; the highest reported scores were in personal skills and safe/rational use of medicines. Moreover, females, younger graduates, PharmD holders, and pharmacists working in hospitals/clinical settings and academia had the highest perception of their competencies. Pharmacists in the public sector and medical laboratory directors had the lowest perception of competence.

**Conclusions:** When comparing the taught curriculum to the suggested Lebanese Pharmacy Competency Framework, all domains need to be improved to optimize the perception, education, and practice of pharmacists. It is essential to emphasize fundamental knowledge, medicines supply, and public health competencies in undergraduate curricula and improve continuing professional education.

### Keywords

Education, Pharmacy; Schools, Pharmacy; Students, Pharmacy; Curriculum; Pharmacists; Perception; Attitude; Competency-Based Education; Professional Competence; Cross-Sectional Studies; Lebanon

## INTRODUCTION

As front-line health professionals, pharmacists should ensure that patients receive proper medications and treatments for their health conditions. Thus, they possess a unique and complex body of knowledge, skills, attitudes, and behaviors earned through a mixed classwork curriculum and required training, differing in duration across schools and countries.<sup>1</sup> Traditionally, the role of the pharmacist consisted of compounding medications, then dispensing them, and counseling patients on the appropriate use and administration of these medications.<sup>2</sup> However, this role has evolved to a more clinical one,

providing direct patient care, including medication management, disease prevention, and public health improvement.<sup>2</sup>

Professional pharmacy competence describes the individual skills, attitudes, and attributes (e.g., values and beliefs) of practitioners based on knowledge (gained through study) and experience (gained through practice), altogether considered sufficient to enable the individual to practice effectively as a pharmacist, and fulfill the abovementioned roles. The necessary attributes may be expressed primarily as an entry-level set of competencies.<sup>13,14</sup> Undeniably, as the professional practice evolves, competencies should follow, which sometimes require drastic changes in pharmacy education.<sup>1,13,14</sup>

Maintaining a high level of clinical knowledge does not make pharmacists competent practitioners; it is how they apply this knowledge in conjunction with other skills that determine their competence.<sup>1,14,15</sup> For example, as the practice changed, the readiness of entry-level pharmacists working in hospitals has caused some concern for pharmacy administrators. This issue has surfaced after pharmacy schools have changed their curricula to relay good general clinical knowledge among students, yet, not all graduates have adequate preparedness to practice in a hospital/clinical setting, as changes were not practice-based.<sup>14</sup>

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Sequentially, in developed countries, several professional organizations and boards of pharmacy have updated or published a set of professional competencies, including the Accreditation Council for Pharmacy Education (ACPE) Accreditation Standards for the Doctor of Pharmacy degree, the American Association of Colleges of Pharmacy (AACP), the Center for the Advancement of Pharmaceutical Education (CAPE) Education Outcomes, the National Association of Pharmacy Regulatory Authorities (NAPRA), the American Society of Health-System Pharmacists (ASHP), the Board of Pharmaceutical Specialties content outline for the Pharmacotherapy Specialty Certification examination, and the American College of Clinical Pharmacy (ACCP).<sup>2,9,13,16-20</sup> Many schools/faculties of pharmacy worldwide have adhered to suggested competencies frameworks through accreditation standards, embedding them into the curriculum.<sup>21</sup>

Moreover, the International Pharmacy Federation (FIP) developed an evidenced-based Global Competency Framework.<sup>22,23</sup> It entails a core set of behavioral competencies generally applicable to the pharmacy workforce worldwide, whereby countries can adapt it to their needs.<sup>23</sup> Published literature showed that such a framework, when used with standards of practice, facilitates performance improvement, helps to identify learning needs and gaps, and nurtures continuing professional development.<sup>24-28</sup> These findings have been used in 64 countries after adapting to the FIP framework.<sup>29</sup>

In Lebanon, pharmacy education is set to a minimum of five years; yet, no official national framework for pharmacy education exists.<sup>30</sup> Five schools/faculties of pharmacy (1 public and 4 private) are licensed by the Lebanese Ministry of Education and Higher Education (MEHE), with considerable variations across pharmacy curricula.<sup>4-8</sup> The number of pharmacists in Lebanon is 10,500 approximately, mainly practicing in community settings, pharmaceutical companies, including marketing and sales opportunities, with minorities working in other sectors, e.g., hospitals, pharmaceutical industry, or academia; however, no professional competencies are available for universities to engineer their curricula accordingly.<sup>31</sup>

The only common element is that graduates from private schools/faculties and abroad should pass a national licensing examination termed "Colloquium".<sup>30</sup> Except for one of the French-speaking universities, where it is mandatory, all schools/faculties offer an elective Doctor of Pharmacy degree beyond the 5-year program. Since Lebanon is a multi-cultural country, the languages of pharmacy education are either English or French. English-speaking schools/faculties of pharmacy have adopted external professional accreditation for their programs, such as ACPE and NAPRA.<sup>6-9</sup> Whereas, the French-speaking schools follow the CIDPHARMEF and HCERES standards of quality, with both having no compelling list of competencies; thus, French schools/faculties have developed their internal competency framework.<sup>10-12</sup>

Given these discrepancies between pharmacy schools/faculties, the Official Pharmacists' Association in Lebanon [OPL - Order of Pharmacists of Lebanon] took the initiative in 2017 to develop a pharmacy core competency framework.<sup>30</sup> The ultimate goal would be to standardize pharmacy education across all pharmacy schools/faculties

so that graduates have the minimum required to practice pharmacy in Lebanon. It also aimed to assess the needs and fill the gaps of practicing pharmacists.<sup>30</sup> The Lebanese framework was mainly adapted from the FIP/World Health Organization (WHO) initial version, in addition to other standards for pharmacy education used in Lebanon, particularly ACPE, NAPRA, and CAPE; the contextual adaptation was performed before suggesting the framework, taking into account cultural competency in a multi-cultural country.<sup>32</sup> This framework has been suggested by the OPL but still needs to be officially adopted by the MEHE, the Ministry of Public Health, and, consequently, universities. It consists of seven domains, each with several competencies. The behavioral statements given for each competency indicate how working individuals will be behaving in practice.<sup>30</sup> After it was developed, the suggested framework was validated among a representative sample of pharmacists and showed an excellent internal structure with appropriate construct validity (loadings of behaviors over domains and competencies were higher than 0.5) and reliability (internal consistency was higher than 0.8 for competencies and domains). Also, applying the varimax rotation enabled us to validate the distribution of competencies over the seven domains (results outside the scope of this manuscript).

After validation, it was necessary to start implementing this framework by assessing self-declared competencies upon graduation. This evaluation would clarify how close the curriculum of each pharmacy school/faculty meets the aspired curriculum that would give graduates the necessary skills for the labor market. Therefore, the primary objective of this survey was to evaluate graduates' perceptions of pharmacy-related competencies "taught" across Lebanese pharmacy schools/faculties, based on the suggested Lebanese Pharmacy Competencies Framework. This study also explored the association between graduates' demographics, university attributes, and self-assessed competency performance.

## METHODS

### Design, population, and procedure

This cross-sectional study, conducted during June 2020, involved pharmacists who graduated from any of the five licensed universities in Lebanon. Participants had to answer a 40-minute electronic questionnaire developed on Google Form and shared on social media platforms and public and private groups of pharmacists. A convenience sample was recruited using the snowball technique to minimize COVID-19 risks and exposure: 2-3 pharmacists from every university were identified and asked to share the project with their colleagues and/or previous students, using social media platforms and alumni groups to reach out to graduates. The procedure was repeated until the target sample size was reached.

Although the authors are aware that the time required to fill the survey is long, yet this was deemed essential for the study to assess the whole competencies framework. Before enrolling in the survey, participants were required to read and consent to the study objectives and the average expected time to complete the questionnaire. At the beginning of the questionnaire, a specific statement oriented the pharmacists to self-report their perceived



competency about their readiness to practice “upon graduation”. Participation was voluntary, and pharmacists received no incentive in return for their participation. No follow-up was possible as data were collected anonymously.

#### Sample size calculation

The G-Power software calculated a minimum sample of 199 participants, using an alpha error of 5%, a beta error of 20%, a mean difference of 5 points, and a mean standard deviation of 25 to be demonstrated. Data collection was stopped on the day this number was reached at midnight; the final sample included a total of 202 participants. The sample was then weighted according to the current percentages of pharmacists, as per the figures of the OPL.<sup>33</sup>

#### Ethical aspect

The Psychiatric Hospital of the Cross Ethics and Research Committee, in compliance with the Hospital's Regulatory Research Protocol, approved this study protocol (HPC-022–2020). The study was observational, voluntary, and respected participants' anonymity and confidentiality. Data were collected anonymously with no identifying or sensitive information.

#### Questionnaire and variables

The questionnaire was built in English, based upon the core competencies framework developed for pharmacists.<sup>30</sup> It was divided into two parts: the first one included sociodemographic, educational, and professional characteristics, i.e., age, gender, university of graduation, degree earned (BS, PharmD, or both), year of graduation, and field of work. The latter information would allow comparing self-declared competencies among pharmacists related to the cited variables. It is noteworthy that since we had no specific reason to classify the graduation period, the time since graduation was divided into four quartiles through an automatic procedure to allow for comparisons between equitable groups.

The second part included all behaviors related to the previously established competencies framework.<sup>30</sup> The competencies framework consisted of seven domains, distributed over 35 competencies and 297 behaviors. Behaviors were grouped into competencies, and competencies grouped into domains, as follows: fundamental knowledge (4 competencies, 30 behaviors), professional practice (6 competencies, 33 behaviors), personal skills (7 competencies, 56 behaviors), medicines supply (3 competencies, 42 behaviors), safe and rational use of medicines (5 competencies, 47 behaviors), pharmaceutical public health (4 competencies, 44 behaviors), and organization and management (6 competencies, 45 behaviors) (Online appendix). For every behavior, answers were graded on a 6-point Likert scale: 0 (not competent at all), 1 (a little competent), 2 (moderately competent), 3 (good competency), 4 (very good competency), and 5 (excellent competency). The mean was calculated and standardized over 100 for every competency. All competencies related to a domain were also summed and standardized over 100.

The widely adopted Bloom's cutoff points were used to assess the adequacy of the self-declared knowledge: 80-

100% (good), 60-79% (moderate), and less than 60% (poor).<sup>34</sup>

#### Statistical analysis

Data were converted from Excel to SPSS version 23.0. After checking the normality, skewness, and kurtosis of the continuous variables, means were compared using the Student T-test for two groups (or corrected Student when variances were non-homogeneous) and ANOVA for three groups or more (or Kruskal-Wallis in case of non-homogeneous variances). Afterward, a General Linear Model was used to assess correlates of domains through a multivariate analysis; estimated marginal means and standard errors were reported, after adjusting for gender, age, year of graduation, type of university [French (Lebanese University and Saint-Joseph University) versus North-American system universities (Beirut Arab University, Lebanese American University, and Lebanese International University)], and degree (BS, PharmD or both). Post hoc tests using Bonferroni correction (to adjust for multiple testing) were applied to compare between modalities of 3 groups or more.

## RESULTS

Among 202 participants, 31.4% were males. Educational variables showed that 39.7% had a BS in pharmacy, 18% had a PharmD, and 42.3% had both a BS and PharmD degrees. The highest percentage graduated from the Beirut Arab University (23.9%), 20.6% from the Lebanese American University, 18.1% from the Saint-Joseph University, 19.8% from the Lebanese International University, and 17.6% graduated from the Lebanese University (the only public university in Lebanon).

As for the graduation period, 27.9% graduated before 2009, 24.2% between 2009 and 2015, 34.7% between 2015 and 2019, and 13.3% are graduating in 2020. As for the professional field, 43.4% work in community pharmacy, 18.2% in marketing and regulatory departments of pharmaceutical companies, 13.7% work in academia, 9% work as hospital/clinical pharmacists, 4.2% in industries, and 3.2% do not work (mostly freshly graduates). The mean age of respondents was 31.13 years (SD=7.53).

Pharmacists perceived their scores over the seven domains as follows: fundamental knowledge (M=67.11; SD=19.94), professional practice (M=79.29; SD=21.85), personal skills (M=76.99; SD=22.99), medicines supply (67.30; SD=25.38), safe and rational use of medicines (M=75.98; SD=23.29), pharmaceutical public health (M=71.92; SD=25.05), and organizational management (74.47; SD=22.63). Overall, the grand mean was 73.30 (SD=20.27) (Table 1). Mean scores on self-declared competencies are also presented in the Online appendix.

Females, graduates from universities adopting the American system, pharmacists from academia, and hospital/clinical pharmacists had the highest scores in all domains. Oppositely, pharmacists who graduated before 2009, those currently working in the public sector, or medical laboratories reported the lowest scores in all domains. Furthermore, pharmacists with a BS degree reported the lowest scores in all domains except for pharmaceutical public health (Table 1).

Table 1. Descriptive results: bivariate analysis.

	Total competency	Domain 6 Organization and Management	Domain 5 Pharmaceutical Public Health	Domain 4 Safe & Rational use of Medicines	Domain 3 Medicines' Supply	Domain 2 Personal Skills	Domain 1 Professional Practice	Domain 0 Fundamental Knowledge
	<b>73.30(20.27)</b>	<b>74.47(22.63)</b>	<b>71.92(25.05)</b>	<b>75.98(23.29)</b>	<b>67.30(25.38)</b>	<b>76.99(22.99)</b>	<b>79.29(21.85)</b>	<b>67.11(19.94)</b>
Gender	<0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001	0.031
	63.77(22.95)	65.40(25.10)	63.47(26.19)	64.92(25.74)	57.64(27.18)	65.10(27.03)	67.16(24.29)	62.67(22.94)
Male n=64								
	77.65(17.33)	78.61(20.18)	75.78(23.61)	81.03(20.24)	71.71(23.30)	82.42(18.60)	84.83(18.20)	69.14(18.12)
Female n=140								
Graduation Year	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	58.72(21.30)	58.86(25.20)	50.01(26.09)	61.19(25.63)	55.12(23.44)	62.96(24.52)	65.85(23.81)	57.08(19.54)
≤2008 n=57								
	82.74(14.06)	84.92(15.26)	84.41(15.33)	86.69(13.03)	73.09(29.37)	88.24(16.78)	88.91(16.43)	72.89(18.92)
2009-2015 n=49								
	75.46(19.21)	76.69(20.90)	76.66(20.82)	77.21(22.92)	69.17(22.82)	77.31(22.29)	81.35(20.60)	69.82(19.15)
2016-2019 n=71								
	81.08(12.81)	82.46(14.44)	82.84(17.39)	84.34(18.02)	77.47(18.46)	85.16(15.40)	84.68(15.97)	70.58(17.76)
2020 n=27								
Degree	0.003	0.008	0.144	0.003	0.002	0.002	0.008	0.014
	69.41(22.66)	69.42(25.37)	69.99(25.12)	72.15(25.00)	62.21(29.38)	73.89(25.55)	75.04(24.69)	63.20(23.27)
BS degree n=81								
	68.64(14.94)	72.43(19.10)	67.13(22.23)	69.62(18.48)	61.71(20.79)	69.30(23.07)	75.66(18.56)	64.65(13.23)
PharmD degree n=37								
	78.91(18.63)	80.07(20.12)	75.78(25.80)	82.28(22.14)	74.45(21.27)	83.17(18.71)	84.82(19.14)	71.82(18.04)
BS&PharmD n=86								
System type	<0.001	0.005	0.001	<0.001	0.003	<0.001	0.005	0.001
	66.41(16.63)	68.60(21.14)	64.04(21.79)	67.72(20.80)	60.80(20.42)	69.27(21.55)	73.56(18.95)	60.91(16.44)
French system n=73								
	77.11(21.13)	77.73(22.85)	76.30(25.73)	80.56(23.41)	70.91(27.15)	81.27(22.72)	82.48(22.75)	70.55(20.91)
American system n=131								
Field of work	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	66.09(17.75)	58.27(26.06)	64.18(17.54)	71.44(15.31)	66.16(20.71)	64.20(21.78)	74.68(18.66)	63.71(15.72)
Not working (yet) n=6								
	81.27(12.48)	83.12(16.71)	76.71(20.34)	85.49(13.76)	73.02(19.20)	89.06(10.89)	88.52(13.25)	72.96(11.65)
Academia n=28								
	76.43(20.92)	77.70(21.70)	76.47(24.19)	76.92(25.37)	72.56(24.45)	80.44(22.18)	82.26(21.55)	68.65(22.45)
Community n=89								
	82.05(17.13)	83.46(18.67)	81.82(21.10)	86.26(18.25)	80.83(16.72)	81.65(21.68)	81.85(21.33)	78.48(16.69)
Hospital/clinical n=18								
	74.51(23.63)	79.70(25.32)	77.97(24.57)	75.79(23.41)	64.08(29.01)	77.65(28.32)	80.22(25.99)	66.15(19.64)
Industry n=9								
	68.29(11.46)	69.93(13.95)	64.24(22.87)	75.49(14.31)	58.07(26.54)	72.91(18.87)	74.85(19.17)	62.55(13.17)
Marketing/sales n=37								
	47.48(22.92)	47.18(28.85)	46.39(29.42)	47.25(26.61)	38.08(17.64)	47.59(24.35)	47.59(24.35)	48.97(21.70)
Other (public, medical laboratory) n=17								

Table 2. Estimated marginal means & standard errors: multivariate analysis									
	Total competency	Domain 6 Organization and Management	Domain 5 Pharmaceutical Public Health	Domain 4 Safe & Rational use of Medicines	Domain 3 Medicines' Supply	Domain 2 Personal Skills	Domain 1 Professional Practice	Domain 0 Fundamental Knowledge	
Gender	<b>71.41(1.70)</b>	<b>73.09(2.01)</b>	<b>71.00(2.18)</b>	<b>75.55(2.13)</b>	<b>64.71(2.35)</b>	<b>73.60(2.02)</b>	<b>77.34(2.05)</b>	<b>67.59(1.92)</b>	
	0.012	0.065	0.243	0.001	0.078	0.006	0.006	0.574	
Male n=64	68.16(2.40)	70.29(2.83)	69.08(3.07)	66.96(3.00)	61.58(3.31)	69.42(2.84)	73.04(2.88)	66.78(2.70)	
Female n=140	74.66(1.82)	75.90(2.15)	72.92(2.33)	78.14(2.28)	67.84(2.52)	77.79(2.16)	81.64(2.19)	68.40(2.05)	
Graduation year	0.001	0.001	<0.001	0.015	0.014	0.002	0.008	0.133	
≤2008 n=57	63.27(4.97)**	64.15(5.87)*	57.81(6.36)*	64.83(6.21)	51.04(6.87)*	66.25(5.88)	73.69(5.97)	65.13(5.61)	
2009-2015 n=49	77.97(2.66)*	80.21(3.15)**	80.57(3.41)**	78.94(3.33)	68.71(3.68)**	80.84(3.15)	84.35(3.20)	72.15(3.00)	
2016-2019 n=71	69.28(2.47)	69.72(2.92)	71.34(3.16)	70.55(3.08)	64.82(3.41)	70.50(2.92)	73.06(2.92)	64.97(2.78)	
2020 n=27	75.13(3.55)	78.28(4.19)	74.28(4.54)	75.89(4.43)	74.26(4.90)	76.82(4.19)	78.26(4.26)	68.12(4.00)	
Degree	0.001	0.001	0.02	0.03	0.009	0.026	0.004	0.002	
BS degree n=81	63.92(2.34)*	64.05(2.99)*	64.06(2.99)*	66.08(2.92)*	56.35(3.23)*	67.49(2.77)*	69.57(2.81)*	59.83(2.64)*	
PharmD degree n=37	77.67(3.05)	80.51(3.61)	77.77(3.90)**	78.22(3.81)**	71.35(4.22)	77.50(3.61)	83.32(3.66)	75.00(3.44)	
BS & PharmD n=86	72.65(2.55)	74.72(3.01)	71.17(3.26)	73.35(3.18)	66.42(3.52)	75.82(3.01)**	79.13(3.06)	79.13(3.06)	
System type	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	
French system n=73	64.61(2.40)	66.94(2.84)	63.16(3.08)	65.43(3.00)	57.76(3.32)	67.44(2.84)	72.04(2.89)	59.49(2.71)	
American system n=131	78.21(2.06)	79.25(2.43)	78.84(2.63)	79.68(2.57)	71.65(2.84)	79.76(2.43)	82.63(2.47)	75.69(2.32)	
Field of work	<0.001	0.001	0.035	0.002	<0.001	0.001	0.15	0.031	
Not working (yet) n=6	68.17(5.27)	65.39(6.23)	70.74(6.74)	65.84(6.58)	64.29(7.28)	67.66(6.23)	77.41(6.33)	65.85(5.94)	
Academia n=28	77.02(3.07)**	78.84(3.63)**	73.37(3.93)	78.91(3.83)**	69.90(4.24)**	82.53(3.63)**	82.33(3.68)	73.29(3.46)	
Community n=89	73.79(2.02)**	75.83(2.39)**	72.67(2.58)	72.65(2.52)	69.87(2.79)**	76.62(2.39)**	80.11(2.42)	68.78(2.28)	
Hospital/clinical n=18	81.96(3.70)**	84.05(4.37)**	81.80(4.73)**	85.32(4.62)**	80.14(5.11)**	83.28(4.37)**	81.48(4.44)	77.65(4.17)**	
Industry n=9	70.79(5.75)	76.79(6.79)	73.47(7.35)	70.23(7.18)	60.26(7.94)	73.95(6.80)	77.13(6.90)	63.69(6.48)	
Marketing/sales n=37	71.54(3.24)	74.02(3.83)	67.66(4.15)	77.44(4.05)*	63.94(4.48)	73.77(3.84)	77.35(3.90)	66.63(3.66)	
Other (public, medical laboratory) n=17	56.61(4.03)*	56.72(4.77)*	57.29(5.16)*	57.48(5.04)*	44.55(5.57)*	57.43(4.77)*	65.56(4.84)	57.26(4.55)*	

\*Significantly lower than other groups means; \*\*Significantly higher from other groups means

In the multivariate analysis, females had similar scores to males in fundamental knowledge, medicines supply, pharmaceutical public health, and organization and management. However, they scored significantly higher than males for professional practice, personal skills, and safe and rational use of medicines. Fundamental knowledge was reported similarly for all graduation periods; other domains showed significantly lower scores for pharmacists who graduated before 2009, particularly when compared to those who graduated between 2009 and 2015.

Pharmacists holding a BS degree reported significantly lower scores than PharmD holders (whether a sole degree or dual degree) in all domains. In all cases, reported significantly lower competency than their American system counterparts in all domains, regardless of the degree earned.

Except for the professional practice, pharmacists from the public sector and those working in medical laboratories scored lower than those in academia and hospital/clinical positions in all domains; they also scored lower than community pharmacists for personal skills, medicines supply, and organization and management (Table 2).

## DISCUSSION

This study assessed graduates' perceptions of pharmacy-related competencies and pharmacy practice readiness across Lebanese Pharmacy schools/faculties, using the Lebanese Pharmacy Core Competency framework. Literature in the East Mediterranean region (EMR) on competence for pharmacists is scarce, and results of a meta-analysis pointed toward the need to implement a competency framework specific to the EMR, thus the importance of our findings.<sup>35</sup>

Overall results showed that pharmacists have a perception of various levels of competence upon their graduation, the lowest scores being in the fundamental knowledge (67.11/100) and medicine supply (67.3/100) domains, while professional practice (79.29/100), personal skills (76.99/100), and safe and rational use of medicines (75.98/100) had the highest reported scores. The results showed a self-declared competency rating varying between 67 and 79, corresponding widely to a moderate knowledge 34. This finding is somehow surprising, particularly for fundamental knowledge given that the pharmacy curricula are known to stress this aspect in Lebanon and that it is the only aspect assessed by the National exam (colloquium) organized by the MEHE, raising questions about the adequacy of the given courses and the mentioned exam.

It is noteworthy that very few studies have assessed the domains or competencies of pharmacists in Lebanon. One study conducted in 2016 in a school of pharmacy in Lebanon showed that students' readiness to critically evaluate literature improved while advancing in the study years, somehow contrary to our results that showed low scores for fundamental knowledge that includes among its competencies, the literature evaluation.<sup>36</sup> Furthermore, researchers had always urged educational institutions to elaborate on personal skills and encouraged them to include them in curricula and extra-curricular activities; this

domain seems to be better covered than others, as reported by graduates, although not perfectly (mean below 80%).<sup>37</sup>

As for the medicines supply domain, the compounding, manufacturing, and supply of medicines are aspects of industrial pharmacy that seem to be under-taught in Lebanese universities. This lack might be related to financial difficulties in equipping advanced laboratories in the pharmaceutical industry; also, training placement in local plants and pharmaceutical companies is difficult due to the low number of positions available in such a small market.<sup>38</sup>

Furthermore, pharmaceutical public health competencies were not assessed favorably, although this domain has long been presented as the pathway forward for pharmacy.<sup>39</sup> Additionally, the pharmacist's role in global health is continuing to grow; pharmacists have the opportunity to make a significant contribution to national and international health agendas, such as the United States Healthy People 2020 plan and the United Nations Sustainable Development Goals.<sup>40,41</sup> Educational institutions in Lebanon are not giving this aspect of pharmacy enough consideration; pharmacists working in the public sector thought that their pre-graduation curriculum was not good enough. More emphasis on public health and management competencies is required. Given the challenges that the profession is facing, pharmacists in Lebanon would gain from emphasizing the public health aspect, particularly in the community and primary care institution.<sup>42</sup> In the same line, a cross-sectional survey of pharmacists practicing in 14 countries in Africa revealed that the competencies within the pharmaceutical care and pharmaceutical public health clusters received higher weighting on relevance.<sup>43</sup>

Competencies related to cultural aspects remain of importance in pharmacy education and practice. Lebanon being a multicultural country, it is essential to adapt pharmacy graduates to different cultural backgrounds and measure pharmacy students' perceived level of cultural competence at baseline and upon completion of the pharmacy program.<sup>44</sup> In the framework used in this study, the cultural aspects were especially approached in the personal skills domain that scored high among respondents. As a low-to middle-income country, Lebanon shows good adaptation to cultural differences and backgrounds of the patients among the pharmacy graduates. Our results are consistent with those of a study comparing students from low- to middle-income countries to those from high-income countries. Pharmacists who did their internships in low- to middle-income countries demonstrated increased cultural sensitivity, more patient-centered care, and skill development, while those who went to high-income countries displayed increased knowledge regarding differences in healthcare system components, pharmacy practice, pharmacy education, and an appreciation for alternative patient care approaches. Thus, graduates from low- to middle-income countries showed enhanced cultural awareness, making them more empathetic and better practitioners.<sup>45</sup>

Additionally, our survey explored the association between demographics and the self-assessed competency



performance of graduates, showing that self-declared competencies differed by gender and age (graduation period). Many studies around the globe have shown that scores on competency evaluation in pharmacy schools differed by gender, age, race/ethnicity, and other factors. Women scored higher on the attitude subscale, and men had significantly higher scores related to comfort in clinical encounters in the US.<sup>46</sup> A study from the Royal Pharmaceutical Society in Great Britain also addressed the gender difference in perceived competence; it revealed that gender seemed to highly influence self-perceived competence, with females perceiving themselves to be more competent than males.<sup>47</sup> Our results were substantially similar: although there was no significant difference between men and women when it comes to fundamental knowledge, medicines supply, pharmaceutical public health, and organizational management, females scored higher in professional practice, personal skills, and safe and rational use of medicines.

The study of Great Britain also revealed that younger pharmacists perceive themselves to be more competent than older ones, which somehow matches our results, showing that pharmacists who graduated before 2009 had lower scores than those who graduated after 2009.<sup>47</sup> One of the competencies that could strikingly be perceived better among young pharmacists is information technology literacy, assessed in the personal skills domain, which scored high among others in our study. Likewise, the Canadian business school explains factors influencing student learning outcomes of information literacy; it lists the effects of demographics, learning environment factors, and information literacy components on behavioral, psychological, and benefit outcomes of information technology ease of use.<sup>48</sup> Another explanation could be the changes universities have made to their curricula over time since most respective accreditation projects have taken place in the decade. Newly adopted curricula seem closer to modern competencies: these efforts are to be commended, although further elaboration on some domains is recommended. Besides, the OPL needs to increase efforts in terms of continuing education, particularly for pharmacists who graduated more than ten years ago, to fill out the gap in knowledge and other competencies compared to their younger counterparts.

Expectedly, there was a difference between the scores of the French and North-American systems, given that the former usually use lower grades for subjective assessment of any concept, which led to using this variable in multivariate adjustments.<sup>49</sup> Our results also showed that PharmD degree holders score much higher than BS holders as total and individual domains scores of competence. This finding is consistent with that of a study showing that pharmacists with a doctor of pharmacy (PharmD) degree rated the competency statements higher in terms of criticality to entry-level practice than those with a bachelor of science (BS) degree did.<sup>50</sup> Similarly, a Thai study among hospital pharmacists showed that the hospital pharmacists holding a PharmD degree scored higher in competencies related to inpatient care, not in community and primary care settings due to the lack of skills in health promotion and humanistic aspects of pharmacy practice.<sup>51</sup> This point confirms the need to make the PharmD degree mandatory,

similar to developed countries since the Advanced Pharmacy Practice Experiences seem to be crucial for the maturation of competencies before pharmacists graduate and enter the labor market.<sup>52</sup> It is noteworthy that this matter has been discussed several times with the Lebanese authorities, namely the OPL, the MEHE, and the Ministry of Public Health, but still, no decision has been reached yet.

Regarding the perception of competencies among different pharmacy sectors, our results showed that hospital/clinical pharmacists in hospital settings scored the highest competencies scores, followed by academic pharmacists and community pharmacists. Most of the research around the world has been conducted among community and hospital pharmacists. In Croatia, community pharmacist preceptors have assessed themselves as the most competent in the Organization and Management domain and the least in Pharmaceutical Public Health competencies.<sup>53</sup> Our results showed good scores in the Organization and Management domain, contrary to those of a study in Kuwait, showing that graduates are ready to implement the various aspects of pharmaceutical care, with the least preparedness in the administrative/management aspects.<sup>54</sup> Similarly, a study in Canada found that the lower importance rankings were relatively equally distributed across the manager, advocate, and scholar domains.<sup>55</sup> In Malaysia, hospital pharmacy respondents showed higher perceptions of the importance of competence in most current pharmacy practice activities compared to their counterparts in community pharmacy settings.<sup>56</sup> Another study revealed that pharmacists working in inpatient settings gave slightly higher ratings to the competency statements than did pharmacists working in outpatient settings, pharmacists without direct patient care responsibilities, and those in academia.<sup>50</sup> Pharmacists working in medical laboratories had the lowest scores, showing that pharmacists are not well prepared for this field upon graduation; in Lebanon, 3-4 additional years are required before entering this field of work. Further research is necessary to confirm our results.

This study reported deficiencies between what is currently being taught in academia and the competency framework suggested by the OPL, showing a mismatch between the competencies of graduates and the market needs. This framework is expected to bridge the gap between academia and the labor market once officially adopted by the MEHE, the Ministry of Health, and, consequently, universities. Based on these findings, changes are recommended at the undergraduate and postgraduate education levels (mainly in academia). At the undergraduate level, improving knowledge and drug manufacturing are necessary without decreasing other aspects. It is to note that pharmacy practice simulation and interprofessional education are gaining more room in the curriculum, despite related challenges. In our study, simulated experiences are among the domains of personal skills where scores turned out to be above average on this competence domain. Simulation is also an effective method for assessing the abilities of pharmacy students, preparing them for real clinical encounters, making them more aware of medication errors and other patient safety issues, and improving interprofessional collaboration. Students feel more prepared regarding "technical" aspects after

completing simulation and interprofessional experience.<sup>57,58</sup>

At the graduate level, encouraging graduates to pursue specialized education is essential, particularly in Lebanon where there is an oversupply of non-specialized pharmacists and a concomitant lack of specialized pharmacists.<sup>59,60</sup> Moreover, continuing education adjustments need to be organized by the OPL.<sup>61</sup>

#### Strengths and limitations of the study

In our study, the majority of respondents were females, with a ratio of 68.6/31.4, representing the actual gender distribution of pharmacists in Lebanon, according to the OPL figures (70/30). The proportion obtained was not significantly different from the national one, indicating that the length of the questionnaire did not affect the answers differentially. The sample was also adjusted to university representation to decrease the risk of selection bias. However, as our sampling was done using a non-random snowball technique, a selection bias cannot be ruled out, given the particularly lengthy questionnaire that would preclude some busy pharmacists from filling it out. It is noteworthy that this method was common practice in developing countries during the pandemic, where face-to-face interviews are not recommended; thus, the results should be interpreted with caution.<sup>62</sup>

Moreover, pharmacists were explicitly asked to answer about their perception of competency upon graduation. However, respondents could have misunderstood this concept; thus, recall bias is also possible, particularly for pharmacists who graduated before 2009. Prospective studies are warranted to compare different generations and curriculum changes with time, but this will be only possible for future cohorts. Finally, although a multivariate analysis was conducted considering potential confounders, residual confounding is still possible. Consequently, further studies on a larger scale and taking into account the abovementioned weaknesses are recommended.

#### Educational and professional implications

Implementing modalities to measure and support the development of competencies is essential for program enhancement and, subsequently, better pharmacy practice in all areas. The value of the Lebanese competency framework is its ability to bridge international pharmacy accreditation requirements and professional organizations and adapt it to local needs to advance pharmacy practice in

Lebanon and bring forward the value of its evolving and dynamic role in all sectors. Adopting this framework would eventually guide curricular optimization based on identified gaps, improve professional performance, and develop expertise. It would also help other healthcare professionals learn about the contribution of pharmacists to primary healthcare, set standards and performance indicators, and prioritize supports and education to maximize effectiveness in this role.

#### CONCLUSIONS

This research explored the current gaps in pharmacy curricula when compared to the suggested framework and identified the competencies that require strengthening to optimize the perception, education, and practice of pharmacists. Although all domains need to be improved, it is essential to emphasize fundamental knowledge, medicines supply, and public health competencies. Consequently, areas for improvement in undergraduate curricula and additional continuing professional education are to be considered.

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#### CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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