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How do European pharmacy students rank competences for practice?

Jeffrey Atkinson [1,*], Kristien De Paepe [2], Antonio Sánchez Pozo [3], Dimitrios Rekkas [4], Daisy Volmer [5], Jouni Hirvonen [6], Borut Bozic [7], Agnieska Skowron [8], Constantin Mircioiu [9], Annie Marcincal [10], Andries Koster [11], Keith Wilson [12], Chris van Schravendijk [13], Sandra Hočevar[14].

[1] Pharmacology Department Lorraine University, Pharmacolor Consultants Nancy, 12 rue de Versigny, Villers 54600, France

[2] Pharmacy Faculty, Vrije Universiteit Brussel, Laarbeeklaan 103, Brussels 1090, Belgium; E-mail: kdepaepe@vub.ac.be

[3] Faculty of Pharmacy, University of Granada (UGR), Campus Universitario de la Cartuja s/n, Granada 18701, Spain; E-Mail: sanchezpster@gmail.com

[4] School of Pharmacy, National and Kapodistrian University Athens, Panepistimiou 30, Athens 10679, Greece; E-Mail: rekkas@pharm.uoa.gr

[5] Pharmacy Faculty, University of Tartu, Nooruse 1, Tartu 50411, Estonia; E-Mail: daisy.volmer@ut.ee

[6] Pharmacy Faculty, University of Helsinki, Yliopistonkatu 4, P.O. Box 33-4, Helsinki 00014, Finland; E-Mail: jouni.hirvonen@helsinki.fi

[7] Faculty of Pharmacy, University of Ljubljana, Askerceva cesta 7, Ljubljana 1000, Slovenia; E-Mail: Borut.Bozic@ffa.uni-lj.si

[8] Pharmacy Faculty, Jagiellonian University, UL, Golebia 24, Krakow 31-007, Poland; E-Mail: askowron@cm-uj.krakow.pl

[9] Pharmacy Faculty, University of Medicine and Pharmacy “Carol Davila” Bucharest, Dionisie Lupu 37, Bucharest 020021, Romania; E-Mail: constantin.mircioiu@yahoo.com

[10] European Association of Faculties of Pharmacy, Faculty of Pharmacy, Université de Lille 2 , Lille 59000, France; E-Mail: annie.marcincal@pharma.univ-lille2.fr

[11] European Association of Faculties of Pharmacy, Dept. Pharmaceutical Sciences, Utrecht University, PO Box 80082, 3508 TB Utrecht, The Netherlands; E-mail: A.S.Koster@uu.nl

[12] School of Life and Health Sciences, Aston University, Birmingham, B4 7ET, UK; E-Mail: k.a.wilson@aston.ac.uk (advisory board)

[13] Medical Faculty, Vrije Universiteit Brussel, Laarbeeklaan 103, 1090 Brussels, Belgium; E-mail: chrisvs@vub.ac.be (advisory board)

[14] European Pharmacy Students' Association, EPSA, Rue de Luxembourg 19/6, 1000 Brussels, Belgium; E-mail: sandra.hoce@gmail.com

* Author to whom correspondence should be addressed; E-Mail: jeffrey.atkinson@univ-lorraine.fr; Tel./Fax: +33-383-27-37-03.

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Abstract: European students (n=370), academics (n=241) and community pharmacists (n=258) ranked 13 clusters of 68 personal and patient care competences for pharmacy practice. The results show that ranking profiles for all 3 groups were similar. This was especially true of the comparison between students and community pharmacists concerning patient care competences suggesting that students have a good idea of their future profession. A comparison of 1st and 5th (final) year students shows more awareness of patient care competences in the final year students. Differences do exist, however, between students and community pharmacists. Students – like academics – ranked competences concerned with industrial pharmacy and the quality aspects of preparing drugs, as well as scientific fundamentals of pharmacy practice, well above the rankings of community pharmacists.

Keywords: pharmacy; education; competences; framework; student; practice

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1. Introduction

The PHARMINE[i] study aimed at promoting the use of competence frameworks in European pharmacy education in Europe. Competence frameworks have already been used in the workplace to monitor and improve practice of Singaporean hospital pharmacists[ii], and of hospital pharmacists in Queensland[iii]. Studies have also been conducted in Canada[iv] in community pharmacy. All conclude that competence frameworks are useful tools to monitor and improve performance in the workplace. PHARMINE through its follow-up PHAR-QA aims to extend this approach to pre-graduate education.

The PHAR-QA ("*Quality Assurance in European PHARmacy Education and Training*") project[v], funded by the European Commission, asked pharmacy students, academics and community pharmacists to rank competences for pharmacy practice.

This paper asks the question of whether the ranking of competences by students is similar to that of academics and/or to that of community pharmacists. It also looks at whether their ideas on ranking evolve during their studies by comparing the scores of 1st year students with that of 5th (final) year students.

2. Experimental Section

Ranking data on competences for practice were obtained via the PHAR-QA *surveymonkey*[vi] questionnaire that was available online from 14/2/2014 through 1/11/2014 *i.e.* 8.5 months[vii]. Respondents came from 39/49 countries of the European Higher Education Area[viii].

The first 6 questions of the survey were on the profile of the respondent asking, amongst others, country of residence, current occupation (student, academic, community pharmacist…), and, for students, year of study.

Questions 7 through 19 asked about 13 clusters of competences with a total of 68 competences. Questions in clusters 7 through 11 were concerned with personal competences and in clusters 12 through 19 with patient care competences (appendix, table 1A).

Respondents were asked to rank the proposals for competences with a 4-point Likert scale:

Rank	Significance	Explanation
1	Not important	Can be ignored
2	Quite important	Valuable but not obligatory
3	Very important	Obligatory, with exceptions depending upon field of pharmacy practice
4	Essential	Obligatory

There was also a "cannot rank" possibility as well as that of leaving the answer blank; these numbers were pooled.

Results are presented in the form of "scores"[ix]: score = (frequency rank 3 + frequency rank 4) as % of total frequency. This calculation is based on that used by the MEDINE consortium[v] that studied the ranking of competences for medical practice by academics and medical students. Scores were used for descriptive purposes only.

Leik ordinal consensus[x] was calculated as an indication of the dispersion of the data using an excel in-house spreadsheet. Responses for consensus were graded as:

- <0.2 poor,
- 0.21-0.4 fair,
- 0.41-0.6 moderate,
- 0.61-0.8 substantial,
- >0.81 good[v].

Data for the 3 groups were analysed at 3 levels: overall, cluster and competence. Data comparing 1st and 5th year students were analysed at the competence level.

The significance of differences between the results for ranking by groups was calculated using the chi-squared test on the distribution of frequencies for the 4 ranks. A significance level of $P < 0.05$ was used (chi-square for 3 degrees of freedom (4 ranks -1) = 7.81; ns = not significant).

All statistical tests were performed using GraphPad software[xi].

3. Results and Discussion

The first level of analysis was the overall analysis of the pooled results. In table 1 is given the distribution of rankings. For all 3 groups the response rate was high with only 6.9 to 11.7% unable to reply. This suggests that all groups of respondents considered they were sufficiently informed to reply to the questions asked.

Scores for the 3 groups were similar and within the range of 77.4 to 78.3% showing that almost 80% of the competences proposed were considered "obligatory" by all.

Values for Leik's ordinal consensus were similar (0.55 – 0.59) and at the top end of the "moderate" category (0.41-0.6). It should be noted, however, that this Leik analysis confounds groups and competences.

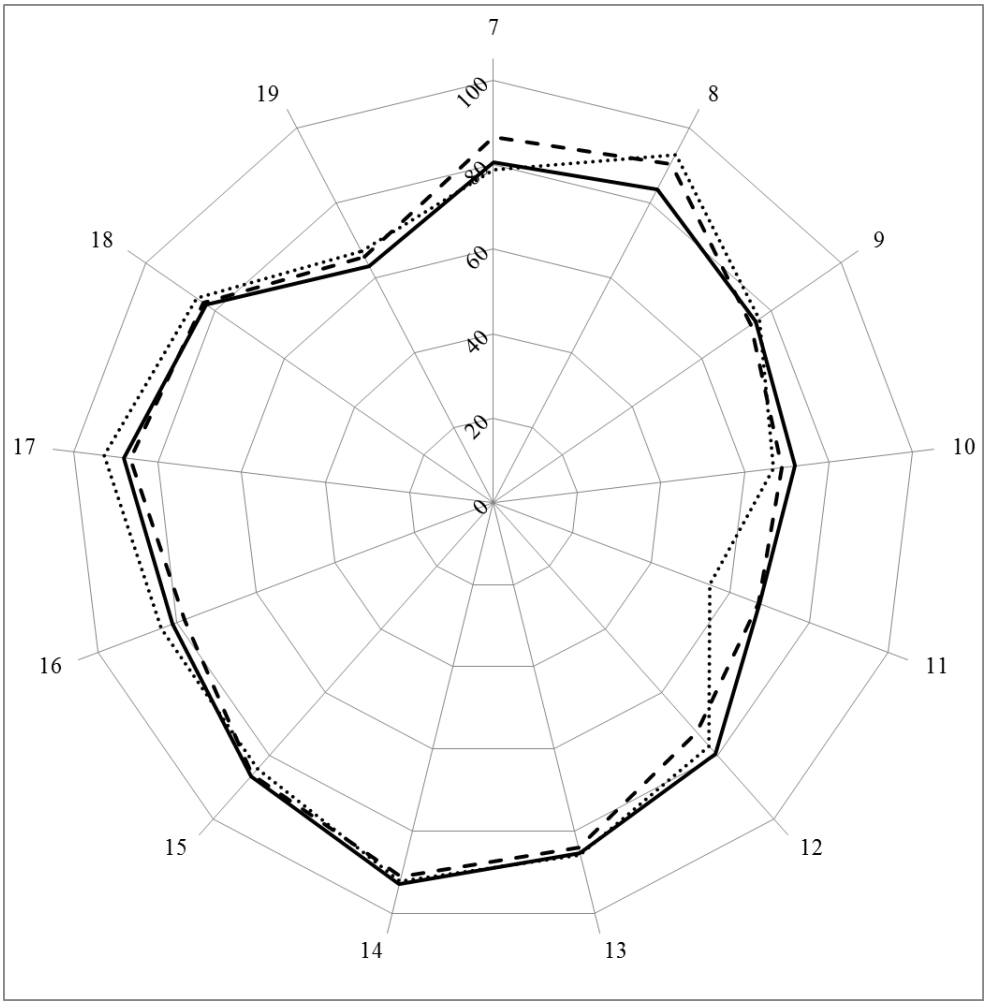
Thus ordinal consensus may be moderate because there are differences amongst the groups and/or amongst the competences. Albeit as judged from the Leik ordinal consensus values, dispersion was relatively low. This suggests that groups were homogeneous and there were no subgroups with responses significantly different from the others. Similar values for ordinal consensus were reported by the MEDINE consortium when they evaluated the ranking of competences for medical doctors. Their respondent population consisted of 2/3 academics delivering undergraduate medical education, and 28% medical students[v].

Table 1. Overall distribution (over 68 competences) of rankings by students, community pharmacists and academics.

	Students		Community pharmacists		Academics	
Number of respondents	370		258		241	
Theoretical total number of replies	25,160 (= 370 x 68)		17,544 (= 258 x 68)		16,388 (= 241 x 68)	
Replies by rank	Frequency	%	Frequency	%	Frequency	%
4	8,428	33.5	6,643	37.9	5,821	35.5
3	8,967	35.6	6,002	34.2	6,005	36.6
2	4,278	17.0	3,076	17.5	2,982	18.2
1	531	2.1	608	3.5	366	2.2
Cannot rank + blanks	619	11.7	1,215	6.9	1,214	7.4
Score (%)	77.4		78.3		77.9	
Leik ordinal consensus	0.59		0.55		0.58	

The second level of analysis was based on the grouping of competences into clusters. In figure 1 are given the scores for the 13 clusters of competences (numbered 7 through 19).

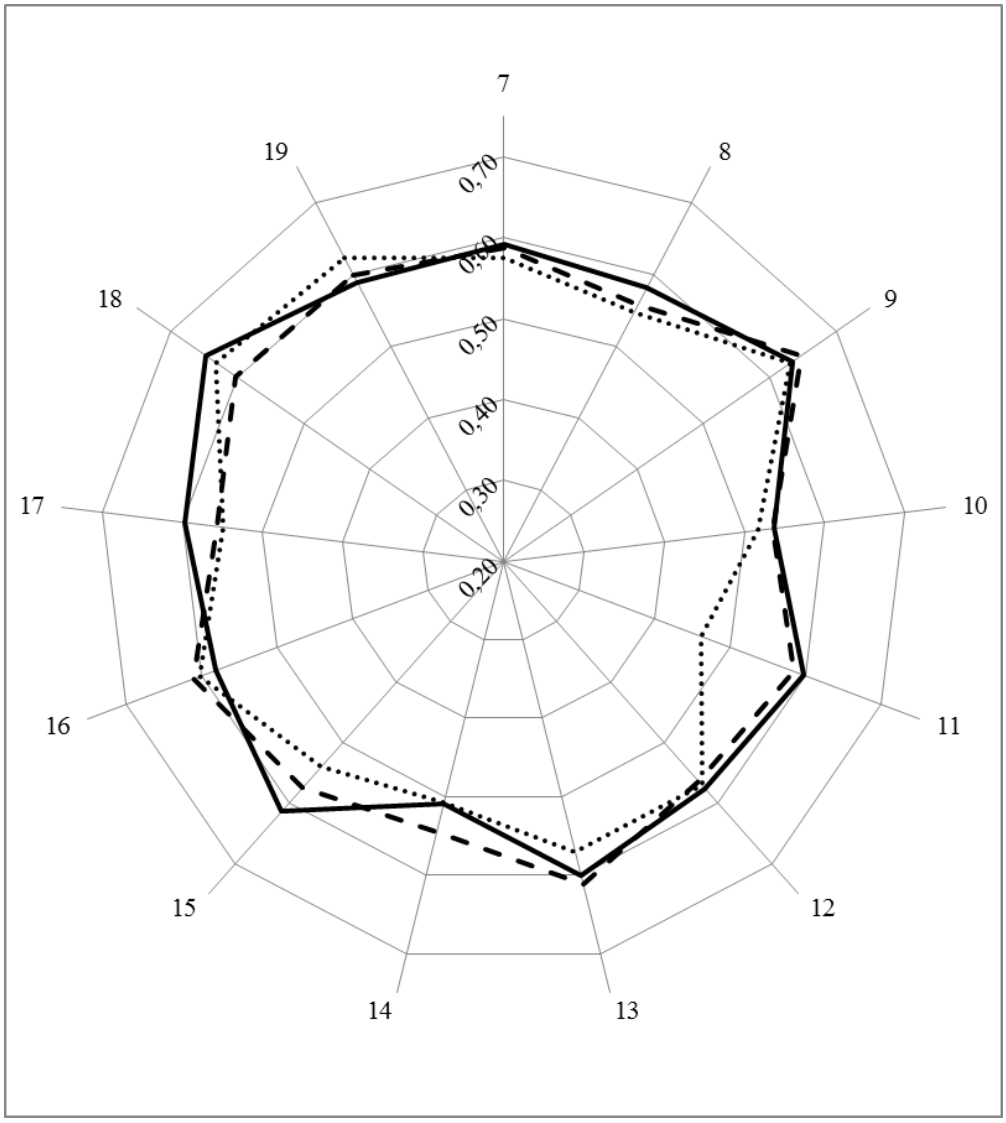
Figure 1. Scores (central vertical axe, 0-100%) for the 13 clusters of competences of students (full line), academics (dashed line) and community pharmacists (dotted line).



Scores for most clusters were around 80% or above. Scores were lower for clusters of personal competences especially those for cluster 11 that dealt with industrial pharmacy. In this case students had similar scores to academics (chi-square: 2.85, ns) but scored well above community pharmacists (chi-square: 89.04, $P < 0.05$). Students scored lower than academics for clusters 7 and 8, and lower than community pharmacists for cluster 8. Scores were also lower for cluster 19 (evaluation of outcomes) with no difference between students and academics (chi-square: 1.79, ns) or community pharmacists (chi-square: 3.19, ns).

In figure 2 are given the values for Leik's ordinal consensus for the 13 clusters of competences (numbered 7 through 19).

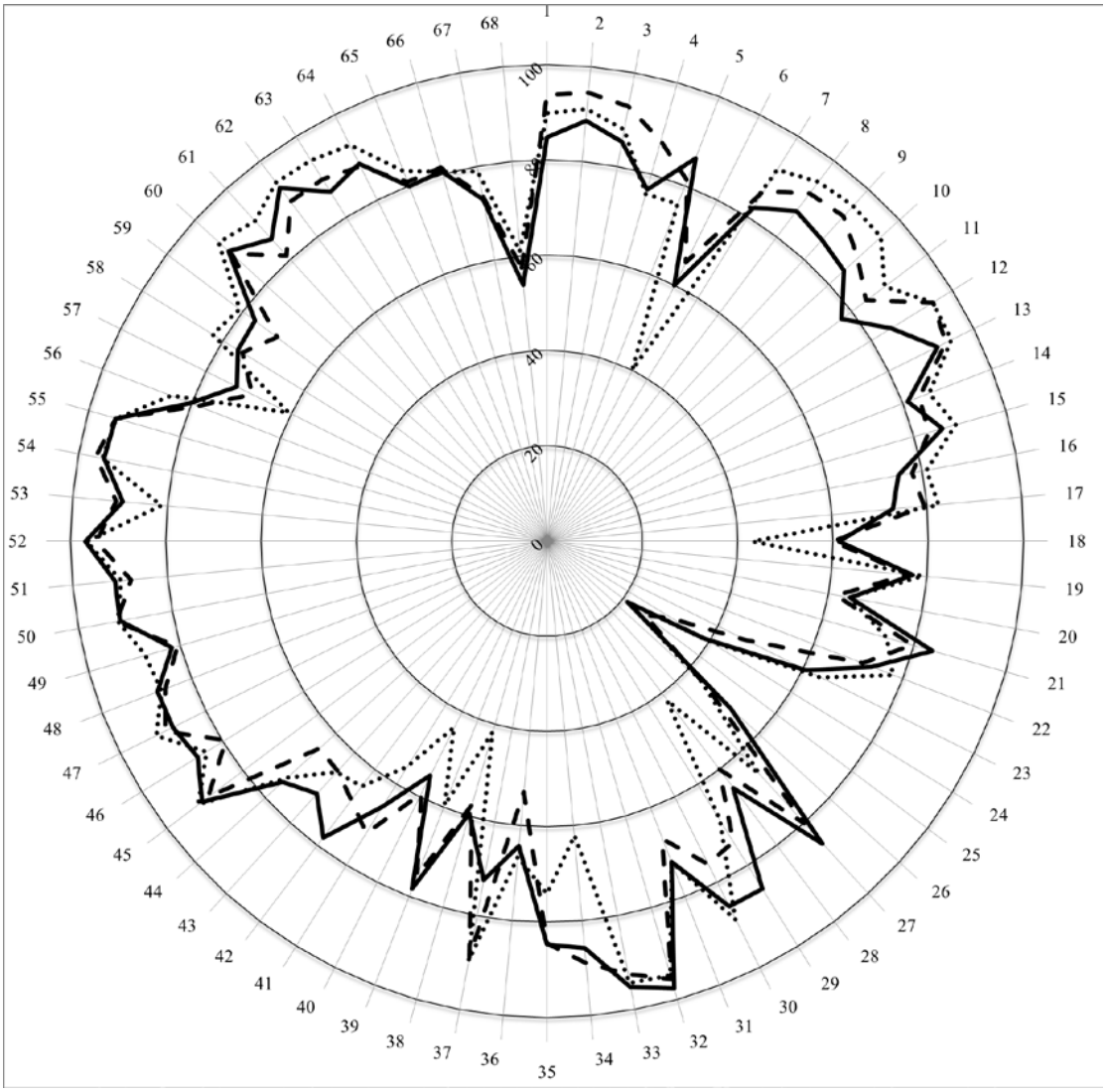
Figure 2. Leik's ordinal consensus (central vertical axe, 0.2 – 0.7) for the 13 clusters of competences of students (full line), academics (dashed line) and community pharmacists (dotted line).



For most clusters ordinal consensus was at the top end of the 0.14 – 0.60 “moderate” category. Students (and academics) generally showed higher values than community pharmacists and this was especially true for cluster 11 which community pharmacists scored low (figure 1) and showed a low ordinal consensus. This is explained by the fact that the low score for cluster 11 was not shared by all community pharmacists.

The third level of analysis was at the level of competences. In figure 3 are given the scores for the 68 competences (numbered 1 through 68 on the circumference). This figure shows that more detail amongst the groups is revealed by analysis at the third, competence level.

Figure 3. Scores (central vertical axe, 0-100%) for the 68 competences of students (full line), academics (dashed line) and community pharmacists (dotted line).



Significant differences between students and community pharmacists (appendix, table A1) were seen in cluster 8 “personal competences: values” covering aspects such as contact, confidentiality, responsibility and ethics for which student scores were lower than those of community pharmacists. This was also seen but to lesser extent in the comparison between students and academics. Student scores for quality aspects of drug production and testing were higher than those of community pharmacists - cluster 11 (industrial pharmacy) and competence 57 in cluster 15 “ability to manufacture medicinal products that are not commercially available”. Differences with academics were seen in cluster 7 “personal competences: learning and knowledge” with competences 1, 3 and 4 dealing with ability to learn independently and critical appraisal of relevant knowledge being scored lower by students.

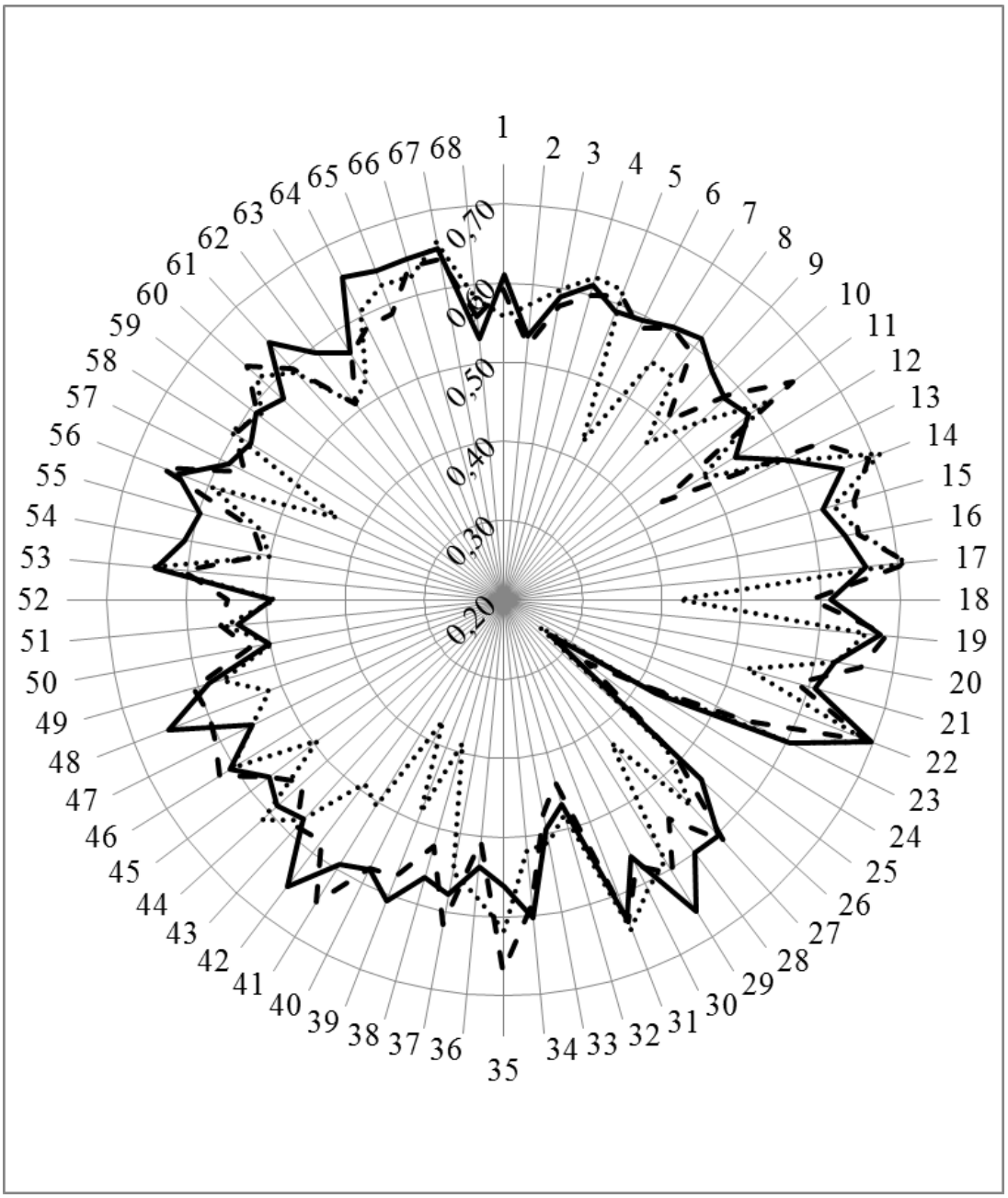
Although competence 6 dealing with research issues was scored low by students (and by academics) the score was significantly higher than that of community pharmacists. This lack of recognition that pharmacy is a research-based discipline is paralleled by the lack of a substantial link between biomedical research and medical education and practice as described in the MEDINE study[xii]. In the latter paper Van Schravendijk and his MEDINE colleagues suggested ways of strengthening this link by bibliographic research and thesis work during pre-graduate study. Such tools do exist in many pharmacy departments. In some cases this “science” aspect is taken even further with traineeships based on participation in clinical research topics in community and hospital pharmacy, and in pharmaceutical research and development in industrial settings. Further efforts are needed to promote such activities.

Globally, the ranking by students, academics and community pharmacists were similar. Patient care competences were ranked similarly by students and community pharmacists suggesting – importantly – that

students have a good conception of their future job responsibilities and practice. Because there were no differences with academics, it is also important to notice that academics have a good conception of the activity in community pharmacy. The critical nature of the "type of patient care provided by pharmacists" has been emphasised following evaluation of competences for pharmacists throughout the world[xiii].

In figure 4 are given the values for Leik's ordinal consensus for the 13 clusters of competences (numbered 7 through 19).

Figure 4. Leik's ordinal consensus (central vertical axe, 0.2 – 0.7) for the 68 competences of students (full line), academics (dashed line) and community pharmacists (dotted line).



For many competences ordinal consensus was lower in community pharmacists than in both students and academics. Ordinal consensus was low for all groups for competences 24 "biology" and 25 "physics".

The scatter diagram in figure 5 shows that competences with low scores tend to have low ordinal consensus suggesting that the low scoring is not shared by all members of a given group.

Figure 5. Scatter diagram of scores and ordinal consensus for the 68 competences of students (full circles), academics (full squares) and community pharmacists (open circles).

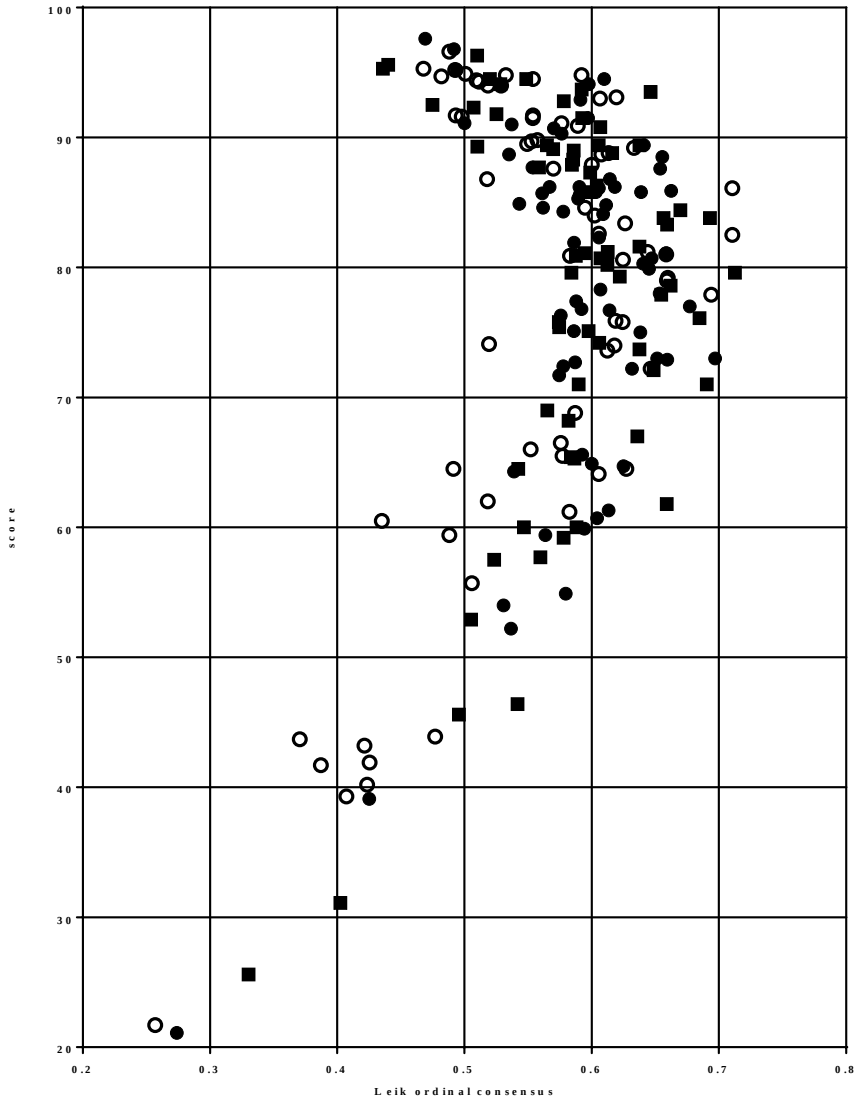
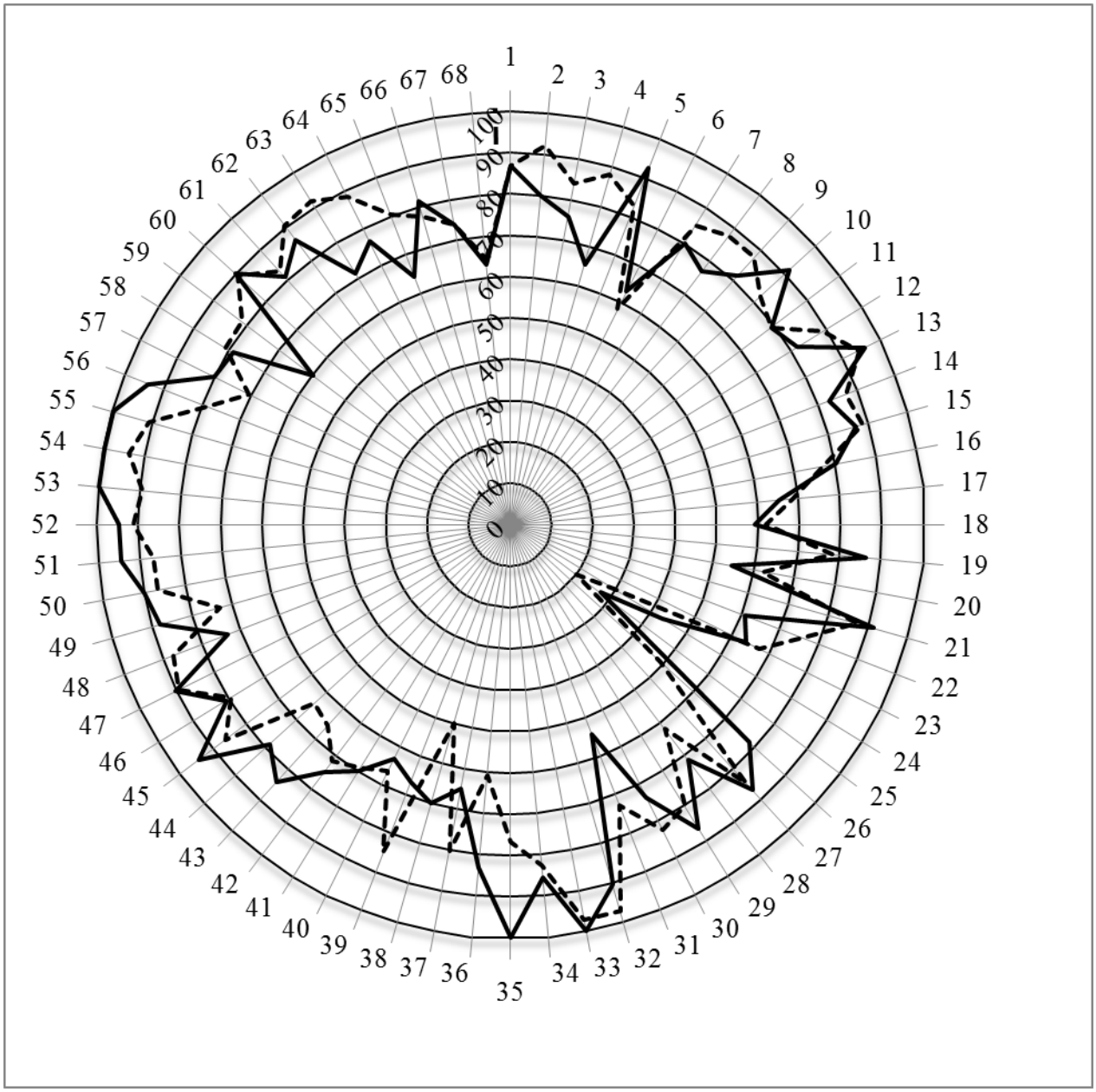


Figure 6 shows the ranking scores for 1st (n=30) and 5th (n=77) students. Competences 24, 25, 26, 35, 36, 38 and 43 decreased in ranking from the 1st to the 5th year, whereas 4, 22, 31, 37, 39, 59, 63 and 65 increased.

Figure 6. Ranking scores (central vertical axe, 0-100%) for the 68 competences (on the circumference) by1st (full line) and 5th (dotted line) year students.



The evolution of ranking throughout the pharmacy degree course, reflected by the changes in ranking between 1st and 5th year students, involved again mainly personal values and subject areas. Ranks were 5th year > 1st year for competences 4, 22, 31, 37 and 39, and 1st year > 5th year for competences 24, 25, 26, 35, 36, 38 and 43. Three patient care competences increased in ranking throughout studies and these were 59 “provision of appropriate lifestyle advice on smoking, obesity, *etc*.”, 63 “provision of informed support for patients in selection and use of non-prescription medicines for minor ailments (*e.g.* cough remedies...)”, and 65 “ability to monitor and report to all concerned in a timely manner, and in accordance with current regulatory guidelines on Good Pharmacovigilance Practices (GVPs), Adverse Drug Events and Reactions (ADEs and ADRs)”. This may be linked to the increased awareness of advanced students of their role as an advisor on health matters, especially so once they have undergone their traineeship in their final year.

4. Conclusions

To our knowledge this is the first study in which students in a sectoral profession are asked to rank the relative importance of competences for practice in their future professional lives. Globally their

perception of the relative importance of competences is similar to that of practicing community pharmacists especially in the area of patient care competences.

Given the growing interest in competence-based educational reforms in several areas of the world, it would be useful to do studies similar to this one in various areas worldwide in order to see whether student perceptions are equally advanced in all areas. This could be done through European-funded programmes such as Erasmus+[xiv] and would be one way of increasing awareness of and developing competence-based education in other regions.

A proviso to this study is that it concentrates on community pharmacy practice. Whilst 70-80% of pharmacists do work in a community pharmacy in Europe (data from PHARMINE), many work in other areas such as hospital and industrial pharmacy. As education for jobs in the latter areas differs substantially amongst European countries and the options for hospital and industrial pharmacy courses and training occur late in the cursus it proved impossible to do a study similar to this in the specific areas of hospital or industrial pharmacy.

The data is to be used ultimately to produce a consensual, harmonized framework of competence for pharmacy practice. According with these results it is no longer justified to maintain the current study plans (subject-based) without a shift to the competence-based ones. Furthermore, when asked for subject areas many of the ones listed in the European Directive were ranked as not important/can be ignored. Arguably these are not competences[xv] as such but more components of competences. They were included in the questionnaire because they are cited in the European directive on the sectoral profession of pharmacy[xvi].

There were more differences amongst the groups as far as personal competences were concerned. These differences could be due to the education programs in which contents are prevalent over abilities to learn. In other words education continues centred in the content more than in the student. Pharmacy is considered at a master level in some countries and probably this trend will increase in the future. The low score in the competence for research could be a problem for the recognition by the accreditation agencies at the master level has to include the research competence.

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Author Contributions

JA constructed, ran and analysed the survey and wrote the paper. KDP ran the PHAR-QA consortium. CM played a major role in the statistical analyses of the data. ASP and DR developed the questionnaire. ASP, DR, JH, BB, AM and AS helped with distribution of the survey. ASP, DV and KDP provided useful criticism and suggestions during revision of the manuscript. CVS assured the contacts with MEDINE. SH played a major role in distributing the survey to students.

Conflicts of Interest

The authors declare no conflicts of interest.

Appendix

Table A1. Ranking scores for competences by groups (students, academics, community pharmacists).
Note that the numbering of the clusters of competences starts at 7, *i.e*. after the 6 questions on profile of respondent).
N: number of competence. Stud.: students. Acad.: academics. Comm.: community pharmacists. Chi.: chi-square. vs: versus.

	N	Competence	Stud.	Acad.	Chi Stud. vs. Acad.	Comm.	Chi Stud. vs Comm.
Cluster 7. Personal competences: learning and knowledge.	1	Ability to identify learning needs and to learn independently (including continuous professional development (CPD)).	84.5	93.7	15.7	89.8	13.1
	2	Analysis: ability to apply logic to problem solving, evaluating pros and cons and following up on the solution found.	88.8	94.5	7.5	91.1	3.6
	3	Synthesis: capacity to gather and critically appraise relevant knowledge and to summarise the key points.	85.1	92.8	10.8	87.9	4.0
	4	Capacity to evaluate scientific data in line with current scientific and technological knowledge.	76.5	87.3	18.5	75.8	0.4
	5	Ability to interpret preclinical and clinical evidence-based medical science and apply the knowledge to pharmaceutical practice.	86.0	81.2	5.2	75.9	17.3
	6	Ability to design and conduct research using appropriate methodology.	60.6	65.4	4.9	40.2	34.3
	7	Ability to maintain current knowledge of relevant legislation and codes of pharmacy practice.	81.7	86.3	3.3	91.7	25.7
Cluster 8. Personal competences: values.	8	Demonstrate a professional approach to tasks and human relations.	86.6	91.5	7.7	94.5	23.3
	9	Demonstrate the ability to maintain confidentiality.	85.4	92.3	22.8	95.3	50.6
	10	Take full personal responsibility for patient care and other aspects of one's practice.	84.4	88.3	3.2	94.8	24.9
	11	Inspire the confidence of others in one's actions and advice.	77.8	83.8	8.9	88.8	13.0
	12	Demonstrate high ethical standards.	85.3	95.3	43.4	95.2	24.6
Cluster 9. Personal competences: communication and organisational skills.	13	Effective communication skills (both orally and written).	91.2	93.5	3.9	94.8	4.0
	14	Effective use of information technology.	81.1	83.8	1.4	86.1	3.8
	15	Ability to work effectively as part of a team.	86.4	83.3	6.1	89.2	1.1
	16	Ability to identify and implement legal and professional requirements relating to employment (e.g. for pharmacy technicians) and to safety in the workplace.	74.8	77.9	1.9	81.0	4.5

	17	Ability to contribute to the learning and training of staff.	73.5	79.6	6.6	82.5	6.6
	18	Ability to design and manage the development processes in the production of medicines.	61.2	60.0	0.8	43.2	38.0
	19	Ability to identify and manage risk and quality of service issues.	77.5	76.1	4.0	79.2	2.3
	20	Ability to identify the need for new services.	65.0	61.8	7.7	64.5	1.2
	21	Ability to communicate in English and/or locally relevant languages.	84.5	79.6	2.3	74.1	16.3
	22	Ability to evaluate issues related to quality of service.	73.0	71.0	3.5	77.9	7.4
	23	Ability to negotiate, understand a business environment and develop entrepreneurship.	62.2	46.4	15.6	64.1	2.0
Cluster 10. Personal competences: knowledge of different areas of the science of medicines.	24	Plant and animal biology.	38.8	31.1	5.1	39.3	1.0
	25	Physics.	20.9	25.6	2.3	21.7	0.8
	26	General and inorganic chemistry.	53.0	45.6	3.3	43.9	5.3
	27	Organic and medicinal/pharmaceutical chemistry.	86.3	80.2	10.8	66.0	37.0
	28	Analytical chemistry.	65.8	60.0	3.0	41.9	46.9
	29	General and applied biochemistry (medicinal and clinical).	85.4	74.2	10.8	68.8	22.6
	30	Anatomy and physiology; medical terminology.	85.2	75.8	11.2	88.7	3.3
	31	Microbiology.	72.2	67.0	3.3	72.2	1.5
	32	Pharmacology including pharmacokinetics.	97.5	95.6	3.7	94.7	3.0
	33	Pharmacotherapy and pharmaco-epidemiology.	95.3	92.5	3.1	94.3	2.2
	34	Pharmaceutical technology including analyses of medicinal products.	86.9	89.0	1.4	62.0	50.8
	35	Toxicology.	85.0	84.4	17.3	74.0	27.7
	36	Pharmacognosy.	65.9	52.9	11.3	66.5	2.1
	37	Legislation and professional ethics.	71.7	88.8	26.8	89.5	44.2
Cluster 11. Personal competences: understanding of industrial pharmacy.	38	Current knowledge of design, synthesis, isolation, characterisation and biological evaluation of active substances.	59.9	57.5	1.9	41.7	34.2
	39	Current knowledge of good manufacturing practice (GMP) and of good laboratory practice (GLP).	79.2	75.4	1.6	59.4	29.8
	40	Current knowledge of European directives on qualified persons (QPs).	55.3	59.2	1.8	43.7	39.9
	41	Current knowledge of drug registration, licensing and marketing.	65.7	72.1	4.6	55.7	11.9

	42	Current knowledge of good clinical practice (GCP).	78.1	68.2	9.1	64.5	23.8
Cluster 12. Patient care competences: patient consultation and assessment.	43	Ability to perform and interpret medical laboratory tests.	72.0	65.3	5.9	65.5	6.0
	44	Ability to perform appropriate diagnostic or physiological tests to inform clinical decision making e.g. measurement of blood pressure.	76.1	64.5	17.3	73.6	7.8
	45	Ability to recognise when referral to another member of the healthcare team is needed because a potential clinical problem is identified (pharmaceutical, medical, psychological or social).	91.7	89.1	2.2	91.7	9.5
Cluster 13. Patient care competences: need for drug treatment.	46	Retrieval and interpretation of relevant information on the patient's clinical background.	85.6	79.3	8.4	84.0	0.7
	47	Retrieval and interpretation of an accurate and comprehensive drug history if and when required.	87.6	89.4	5.1	91.5	2.3
	48	Identification of non-adherence and implementation of appropriate patient intervention.	87.1	85.8	6.1	86.8	24.5
	49	Ability to advise to physicians and - in some cases – prescribe medication.	81.9	80.7	2.5	87.6	5.3
Cluster 14. Patient care competences: drug interactions.	50	Identification, understanding and prioritisation of drug-drug interactions at a molecular level (e.g. use of codeine with paracetamol).	91.4	91.8	1.1	91.6	0.6
	51	Identification, understanding, and prioritisation of drug-patient interactions, including those that preclude or require the use of a specific drug (e.g. trastuzumab for treatment of breast cancer in women with HER2 overexpression).	91.4	87.7	4.4	89.7	5.0
	52	Identification, understanding, and prioritisation of drug-disease interactions (e.g. NSAIDs in heart failure).	97.0	94.5	8.9	96.6	2.7
Cluster 15. Patient care competences: provision of drug product.	53	Familiarity with the bio-pharmaceutical, pharmacodynamic and pharmacokinetic activity of a substance in the body.	89.3	90.8	3.5	81.2	11.6
	54	Supply of appropriate medicines taking into account dose, correct formulation, concentration, administration route and timing.	94.3	96.3	16.3	94.9	18.0
	55	Critical evaluation of the prescription to ensure that it is clinically appropriate and legal.	93.9	94.1	6.6	94.0	11.1
	56	Familiarity with the supply chain of medicines and the ability to ensure timely flow of drug products to the patient.	81.6	78.6	4.5	84.6	11.3
	57	Ability to manufacture medicinal products that are not commercially available.	74.1	69.0	1.5	60.5	21.2

Cluster 16. Patient care competences: patient education.	58	Promotion of public health in collaboration with other actors in the healthcare system.	75.8	75.1	1.1	82.6	5.9
	59	Provision of appropriate lifestyle advice on smoking, obesity, etc.	76.9	71.0	3.8	80.9	4.7
	60	Provision of appropriate advice on resistance to antibiotics and similar public health issues.	90.3	89.4	5.2	93.1	3.6
Cluster 17. Patient care competences: provision of information and service.	61	Ability to use effective consultations to identify the patient's need for information.	85.6	81.1	3.1	90.9	11.1
	62	Provision of accurate and appropriate information on prescription medicines.	92.7	89.3	8.0	94.4	11.0
	63	Provision of informed support for patients in selection and use of non-prescription medicines for minor ailments (e.g. cough remedies...).	85.7	89.4	1.7	94.0	14.4
Cluster 18. Patient care competences: monitoring of drug therapy.	64	Identification and prioritisation of problems in the management of medicines in a timely manner and with sufficient efficacy to ensure patient safety.	88.5	87.9	8.2	93.0	8.7
	65	Ability to monitor and report to all concerned in a timely manner, and in accordance with current regulatory guidelines on Good Pharmacovigilance Practices (GVPs), Adverse Drug Events and Reactions (ADEs and ADRs).	79.8	80.9	5.0	83.4	3.3
	66	Undertaking of a critical evaluation of prescribed medicines to confirm that current clinical guidelines are appropriately applied.	80.7	81.6	0.3	80.6	4.5
Cluster 19. Patient care competences: evaluation of outcomes.	67	Assessment of outcomes on the monitoring of patient care and follow-up interventions.	73.3	73.7	0.5	79.0	4.4
	68	Evaluation of cost effectiveness of treatment.	53.3	57.7	2.1	61.2	4.8

Chi-square, d.f. 3, P = 0.05: 7.8. The chi-square test was performed on the frequencies of rankings.

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