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Development of Core Competencies for a new Master of Pharmacy Degree

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Abstract

Background: A new MSc Pharmacy degree is being developed at Lund University, Sweden.

Aims: To identify the core competencies that a newly qualified pharmacist needs for future employment.

Method: In a modified three-round Delphi technique, 40 experts were asked to list the necessary competencies. After content analysis, the experts classified the list by importance on two successive occasions using a 4-level scale (4: necessary; 1: not necessary). Competencies with a consensual mean score of > 3.5 were retained.

Results: Thirty three experts (82%) completed all three rounds. The open questions resulted in 600 suggestions, subsequently reduced to 120 competencies. Another five competencies were added after the second round. After round three, 48 competencies had been retained. The experts agreed on both necessary and not absolutely necessary competencies.

Conclusion: Our study allowed consensus to be reached and identified core competencies that could be transferred to learning outcomes for the planned degree.

Keywords: *Core curriculum, core competencies, pharmacist, pharmacy student, delphi, expert group, pharmacy degree, Sweden*

Introduction

What is a pharmacist? What do pharmacists do? What are their general and specific competencies? What are the needs of related stakeholders and society now and in the future? What is the current focus of pharmacy education and what needs to be improved? These were some of the questions that needed answers when the planning started for a new MSc degree in Pharmacy at Lund University, Sweden. Clinical pharmacy healthcare services are currently expanding in Sweden. In the south of Sweden, where Lund University is the biggest university, this expansion is based on development of the Lund Integrated Medicines Management model (Hellström *et al.* 2011). However, those developing the new pharmacy curriculum, while recognising the increasing need for trained clinical pharmacists, also need to consider such aspects as changes in the development and use of medications.

All curriculum developers face the challenge of identifying the appropriate competencies for a constantly changing labour market. New information that changes current practice is constantly being added, thus increasing the risk of curriculum overload. The underlying concept of the core curriculum movement, which emerged partly as a response to this (Bandaranayake 2000) was subsequently utilised by Harden and Davis in their description of "The seven Cs", i.e. certification, capability, comprehensiveness, consistency, constructivism, choice, and compacted curriculum (Harden and Davis 1995). During training, students should be able to relate what is being studied to the competencies that will be needed in the workplace. Planning of curricula therefore involves identifying abilities that are relevant to good professional practice ("learning outcomes"), to be used as the basis for course objectives, teaching and assessment (Prideaux 2003; Frank *et al.* 2010; Biggs 1996). The core curriculum should not take up all of the study time, leaving time for other options such as elective courses, undergraduate research experience and international exchange (Harden and Davis 1995). The basic principle of education in pharmacy schools must be that the students' study should be focused on the work tasks of a professional pharmacist and that the pharmaceutical perspective should be highlighted early in the course (Brown *et al.* 2009).

Several different methods can be used for development of curricula (Dunn *et al.* 1985). The Delphi technique has been widely used for such a purpose in education, particularly for short programmes or courses, including some related to pharmacy (Strang *et al.* 2001; Kilner 2004; Puumalainen *et al.* 2005; Mackellar *et al.* 2007; Kilroy and Mooney 2007; Pfleger *et al.* 2008; Byrne *et al.* 2010; Ross and Loke 2010). It has also been used for entire education programmes (Edgren 2006; Calhoun *et al.* 2008) but, to our knowledge, for none directly related to pharmacy. The Delphi technique is a consensus method based on technological forecasting that was developed initially by the RAND Corporation in the 1950s (Mullen 2003; Hsu and Sandford 2007). The method, which can be adapted to various situations, is based on suggestions from a panel of experts within the area to be explored. The experts never meet and are anonymous to each other, which means that differences in status should not bias the results.

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Pharmacy education differs between countries and also between regions/states within countries. In many countries, pharmacists must obtain a university degree, and/or satisfy other national or local requirements for credentials. In 1991, European ministers of education signed the Bologna Declaration in order to harmonise the structure of European university degrees, improve the transparency of the degrees, and promote mobility and cooperation throughout Europe (EHEA 2010). The Pharmine project was subsequently started and funded with support from the European Commission's Lifelong Learning Programme of the European Union (Pharmine 2011). The project aims to examine opportunities for the introduction of the principles of the Bologna declaration into pharmacy education and training in order to tune the latter to future needs in the three areas of pharmaceutical expertise: community, hospital and industrial pharmacy. In the USA, the American Association of Colleges of Pharmacy has also made specific recommendations for educational outcomes (AACP 2004).

Although information is available on outcome-based curricula or related competencies in pharmacy (Ho *et al.* 2009; Broedel -Zaugg *et al.* 2008; AACP 2004; Boyce and Lawson 2009; Jungnickel *et al.* 2009; Carrington et al, 2010), on the necessary professional skills for pre-registration training in the UK (Langley and Aheer 2010), and on clinical competencies for pharmacist (McRobbie *et al.* 2001; Mills *et al.* 2005; Antinou *et al.* 2005; Mestrovica *et al.* 2011) there is no information on the expectations of future employers and colleagues on the required competencies of the newly graduated pharmacists. The assessment and use of these as learning outcomes for the planned MSc Pharmacy programme at Lund University is both challenging and important and could, if correctly implemented, affect motivation and improve student learning.

In many countries, students are required to complete pre-professional (undergraduate) studies followed by about four years of professional academic studies in order to obtain a degree in pharmacy. In Sweden, Norway and Finland, where students can start their university education after 12 years of primary and secondary school, there are two separate pharmacy degrees: a 5-year (MSc Pharm) degree and a 3-year (BSc Pharm) degree. The latter was designed mainly for employment in a pharmacy, where the principal occupation is filling prescriptions. In Sweden, the MSc in Pharmacy is currently offered at three universities. These programmes are mainly based on traditional topics and the resulting pharmacists are usually employed in pharmacies or the pharmaceutical industry. While there is an increased focus on pharmacotherapy education, there is as yet no mandatory clinical pharmacy training.

The aim of this study was to identify the core competencies that a newly qualified pharmacist requires for employment. These will then form the basis for planning the new MSc Pharmacy programme at Lund University. Specifically, we wanted to study what competencies an employer might expect from a recently graduated pharmacist in their first job, from a five-year perspective.

Methods

A modified version of the Delphi technique was used in the study (see Mullen 2003; Kennedy *et al.* 2004; Keeney *et al.* 2006; Hsu and Sandford 2007). In its original form, carefully selected experts are asked to express their opinion on the matter at hand (qualitative round). The results of this round are then made into a quantitative questionnaire and returned to the expert panel for grading. The resultant lists are then compiled and again sent to the experts for comparison with their own answers and reconsideration of their own opinion. These rounds continue until consensus is achieved. However, because the response rate tends to drop for each round, usually resulting in only two or three rounds, consensus has to be defined in some other way. The experts are not known to each other, and should thus not be influenced by differences in power or position. The identity of the experts is, of course, known to the researchers, but full confidentiality is maintained.

In this study, we asked the experts to identify the necessary competencies for a recently graduated pharmacist. The first round was followed by two successive questionnaires. The procedures and definition of consensus in this modified process are described in more detail below.

Expert panel

Based on personal experience, that of our networks and reviews of the literature, the main operational branches for future employment of a pharmacist were identified as health care; drug discovery and development, marketing and regulatory control; academia; and traditional community and hospital pharmacy. The first two operational branches were considered to be the most important, since the MSc Pharmacy degree at Lund University will focus on medicines in health care (clinical pharmacy) and medicines as products (drug discovery and development). To compose the expert panel, we required representatives from each area with differing experience, such as managers and employees with long or short work experience. We based our decision to have at least 36 experts in the panel, 12 in each of the first two areas and six in each of the two latter, on literature reports (Mullen 2003; Kennedy *et al.* 2004; Keeney *et al.* 2006; Hsu and Sandford 2007). Forty-five experts were identified by our research group and were invited to participate by phone or in personal meetings. Forty-three accepted and received an information letter requesting their formal consent to participate, and 40 accepted. Some had experience in more than one operational branch (Table I). They represented all geographic areas of Sweden and their work experience was equally divided between short-term (0-2 years), long-term (>5 years) and head of operations. Among the experts, 35 had a Pharmacy degree, 17 had a PhD, and six were Associate Professors (Table I).

Delphi rounds and questionnaires

Before the first round, a pilot run to test understanding of the instructions was undertaken by two of the experts. Subsequently, in the first round, all the experts were asked to identify and list the competencies they considered necessary for a recently graduated pharmacist, taking a long-term perspective of at least five years. The experts were informed that the MSc Pharmacy degree at Lund University would focus on medicines in health care and medicines as products. Two researchers (TE, GE) independently performed content analysis of the listed competencies (Graneheim and Lundman 2004)

Table I: Description of the expert panel based on educational level and main operational branch. The number in brackets indicates the number of experts with earlier main experience in this operational branch.

	Number of experts
Educational level	
BSc Pharmacy	5
MSc Pharmacy	30
Medical Doctor	3
MSc other	2
Main (and additional) operational branch	
Drug development, control, and marketing	13 (5)
Health care including clinical pharmacy	12 (6)
Academia	7 (6)
Traditional community and hospital pharmacy	8 (13)

Before the second round, a pilot run to test understanding of the instructions was undertaken by two of the experts. The second round constituted a quantitative questionnaire comprising the competencies identified in round one, numbered and roughly arranged according to the Centre for the Advancement of Pharmaceutical Education (CAPE) outcomes (AACP 2004). The experts were asked to classify the competencies on a four-point scale (1 = not necessary, 2 = useful, 3 = desirable, 4 = necessary).

The third round was identical to the second but included the new competencies and the results of the previous round as the percentage of the experts choosing each scale point for each question. An example is given in Table II.

Table II: The first two listed competencies in the third Delphi round. The experts were instructed: "For each of the listed competencies, reflect on the grading given by the other experts in the second round. Then indicate the importance of each given competency"

How important is the following competency for a newly graduated pharmacist?	*Place a cross in the empty column for one of the following options. The percentages indicate how the options were graded in the previous round.*							
	Not necessary		*Useful*		*Desirable*		*Necessary*	
Assess patients' drug effects and adverse reactions	0%		12%		35%		53%	
Select appropriate formulations of medicines for patients	0%		9%		32%		59%	

Consensus definition and presentation

Since we did not expect to reach full consensus with two quantitative questionnaires, we considered consensus to be achieved when a competency received a mean score of > 3.5. To achieve this level, at least half of the experts would have to consider the competency "necessary". The answers were analysed using mean values and standard deviations.

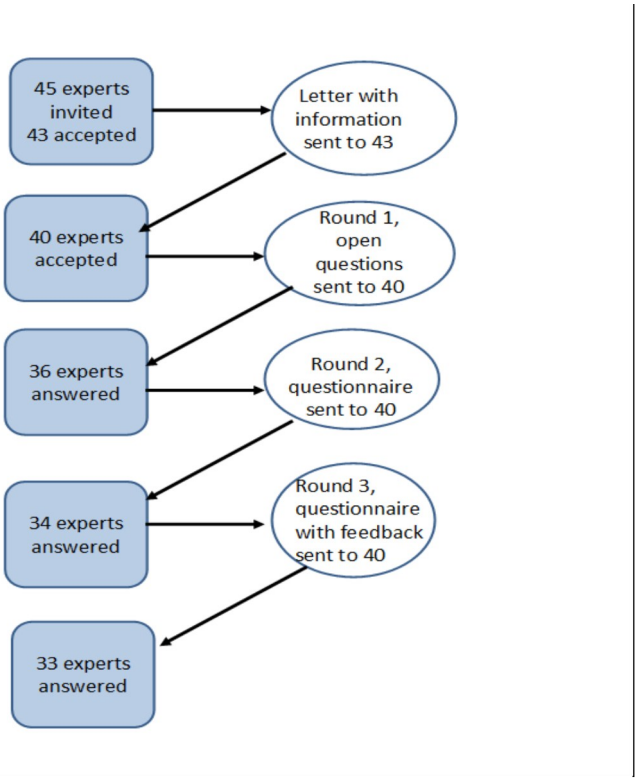
The Core Curriculum

The final list of necessary competencies was arranged according to categories and rephrased, when needed, to provide a list of learning outcomes for individual students (Graneheim and Lundman 2004).

Results

The study was performed during March to September 2011. Results of the communications between the researchers and experts are outlined in figure 1. Thirty-six of 40 (90%) experts made suggestions in the first round. All 40 received the questionnaires in the second and third rounds; 34 (85%) answered the second and 33 (82%) the third. The drop-outs included 1-2 experts from each of the main operational areas presented in Table 1.

Figure 1: Results of the communications between researchers and experts in the three Delphi rounds.



The experts suggested 600 competencies in the first round. After content analysis, a list of 120 different competencies was identified from these (appendix 1). In addition to the suggested competencies, we also received advice from the experts on the content of the pharmacy programme and on how to train the students for various competencies. Although these were not part of the study, they were analysed for potential use when planning the programme.

The results of assessment by the experts in the following two rounds are presented in Appendix 1. Using our definition of consensus (mean > 3.5), 22 competencies were considered necessary in the second round, and 5 new competencies were added. All 125 competencies were re-sent to the experts in the third round, and 48 of these were considered necessary (Table III). For all except two competencies, the standard deviation

decreased from round 2 to 3; further, the mean values increased for the high scoring competencies and decreased for the low scoring competencies. The experts thus came to a high degree of agreement on which competencies were necessary and increased their agreement on which were not absolutely necessary.

The final list of competencies was used to form a core curriculum for the 5-year MSc Pharmacy degree at Lund University (Table IV). We considered eleven of the competencies as generic to all degrees, and the others as more or less unique to the pharmacy profession.

Table III: Competencies considered necessary to achieve an MSc Pharmacy degree at Lund University. Results are presented as means (SD) in descending order from round 3 and compared with round 2.

The graduate should be able to	Round 3	Round 2
Find information on drugs and evaluate sources	4.00 (0.0)	4.00 (0.0)
Act with a sound basic ethical attitude	4.00 (0.0)	3.88 (0.4)
Respond to patients and relatives with respect	4.00 (0.0)	3.88 (0.3)
Identify his/her limitations and be able to refer and hand over to others	4.00 (0.0)	3.82 (0.4)
Name the most common drug substances and their uses	4.00 (0.0)	3.79 (0.5)
Collaborate with other professionals	3.97 (0.2)	3.79 (0.4)
Assess and develop his/her own skills within the profession	3.97 (0.2)	3.62 (0.6)
Apply the principles of evidence-based medicine (EBM)	3.97 (0.2)	3.45 (0.8)
Provide written information on various aspects of drugs, adapted for different groups of users	3.97 (0.2)	3.67 (0.5)
Assess drug-drug interactions	3.94 (0.2)	3.76 (0.4)
Explain the pros and cons of different types of formulation	3.94 (0.2)	3.68 (0.5)
Provide oral information on various aspects of drugs, adapted for different groups of users	3.94 (0.2)	3.67 (0.5)
Work in teams	3.94 (0.2)	3.65 (0.5)
Be clear about their own role and that of their profession in different situations	3.94 (0.3)	3.59 (0.7)
Provide advice and information to the patient and follow up	3.91 (0.3)	3.62 (0.7)
Communicate in groups	3.91 (0.3)	3.61 (0.6)
Analyse and argue for their position in a discussion	3.91 (0.3)	3.59 (0.6)
Assess the benefits and risks of different drug treatments	3.91 (0.3)	3.56 (0.6)
Apply pharmacokinetic principles	3.88 (0.4)	3.69 (0.6)
Identify problems and plan how to solve them	3.88 (0.3)	3.53 (0.6)
Apply pharmacodynamic principles	3.85 (0.4)	3.66 (0.7)
Determine drug dosages for patients with impaired organ function (kidney, liver)	3.85 (0.4)	3.50 (0.7)
Dispense the prescription in a safe manner using the current support systems	3.85 (0.4)	3.50 (0.9)
Adjust his/her discussion to the individual patient	3.82 (0.5)	3.56 (0.7)
Provide the most common trade names for each generic drug	3.82 (0.4)	3.44 (0.7)
Motivate patients to take essential medicines	3.79 (0.5)	3.47 (0.7)
Communicate the risks and benefits of drug therapy to patients	3.79 (0.5)	3.44 (0.8)
Handle medications in accordance with regulations in healthcare situations	3.79 (0.6)	3.26 (1.0)
Identify deviations in the management of prescriptions	3.79 (0.5)	3.26 (0.8)
Select appropriate formulations for patients' medications	3.73 (0.5)	3.50 (0.6)
Assess the bioequivalence and interchangeability of drugs	3.73 (0.6)	3.32 (0.9)
Apply the principles of Good Pharmacy Practice (GPP)	3.70 (0.5)	3.44 (0.7)
Motivate customers to take essential medications	3.70 (0.5)	3.29 (0.8)
List the risks associated with, and most common causes of, incorrect medication	3.69 (0.6)	Not included
Assess the effects and adverse reactions of drugs	3.67 (0.5)	3.41 (0.7)
Select the appropriate dosage form for a patient; i.e. one that is tailored to the individual and to other treatments	3.66 (0.5)	3.26 (0.8)
Use technological support for oral presentations	3.64 (0.5)	3.35 (0.7)
Critically examine the results of clinical trials	3.61 (0.5)	3.47 (0.6)
Critically examine pharmaceutical advertising and promotions	3.61 (0.5)	3.38 (0.7)
Develop a current drug list for an individual patient	3.61 (0.8)	3.29 (1.0)
Apply basic principles of how to develop new drugs for commercial use	3.61 (0.7)	3.29 (0.8)
Give advice to physicians at a level appropriate to their profession	3.61 (0.6)	3.26 (0.8)
Assess the concentration-effect relationships of drugs	3.58 (0.6)	3.26 (0.8)
Suggest how to start and complete a drug treatment regimen	3.58 (0.6)	3.24 (0.8)
Write in English	3.56 (0.6)	3.35 (0.6)
Apply the basic principles for formulating drugs	3.55 (0.6)	3.36 (0.7)
Carry out a medication interview with a patient	3.55 (0.8)	3.29 (1.0)
Apply the principles of Good Manufacturing Practice (GMP)	3.55 (0.6)	3.24 (0.8)

Table IV: Core curriculum for the prospective pharmacy programme at Lund University

	The recently graduated pharmacist should be able to
Clinical pharmacy/ health care	Assess the effects and adverse reactions of drugs
	Select appropriate formulations for patients' medications
	Select the appropriate dosage form, i e one that is tailored to the individual and to other treatments
	Develop a current drug list for an individual patient
	Carry out a medication interview with a patient
	Assess the benefits and risks of different drug treatments
	Suggest how to start and complete a drug treatment regimen
	Determine drug dosages for patients with impaired organ function (kidney, liver)
	Handle medications in accordance with regulations in healthcare situations
	Assess drug-drug interactions
	Explain the pros and cons of different types of formulation
	Provide advice and information to the patient and follow up
	Communicate the risks and benefits of drug therapy to patients
	List the risks associated with and the most common causes of incorrect medication
Pharmacy	Dispense the prescription in a safe manner using the current support systems
	Identify deviations in the management of prescriptions
	Apply the principles of Good Manufacturing Practice (GMP)
	Apply the principles of Good Pharmacy Practice (GPP)
	Apply the basic principles for formulating drugs
	Provide the most common product names given for each generic drug
Pharmacology	Apply pharmacodynamic principles
	Apply pharmacokinetic principles
	Assess the concentration-effect relationships of drugs
	Name the most common drug substances and their uses
	Assess the bioequivalence and interchangeability of drugs
Scientific method	Apply the principles of evidence-based medicine (EBM)
	Find information on drugs and evaluate sources
	Critically examine the results of clinical trials
	Critically examine pharmaceutical advertising and promotions
	Apply basic principles of how to develop new drugs for commercial use
	* Identify problems and plan how to solve them
Communication skills	Provide oral information on various aspects of drugs, adapted for different groups of users
	Provide written information on various aspects of drugs, adapted for different groups of users
	Adjust his/her discussion to the individual patient
	Motivate customers to take essential medications
	Motivate patients to take essential medicines
	Give advice to physicians in a level appropriate to their profession
	Respond to patients and relatives with respect
	* Use technological support for oral presentations
	* Analyse and argue for his/her position in a discussion
	* Write in English
	* Collaborate with other professionals (members of other professions)
	* Communicate in groups
	* Work in teams
Professionalism	* Assess and develop his/her own skills within the profession
	* Identify his/her limitations and be able to refer and hand over to others
	* Be clear about his/her own role and that of his/her profession in different situations
	* Act with a sound basic ethical attitude

* Generic competencies

Discussion

In this study we have identified the necessary competencies for a recently graduated pharmacist as perceived by future employers. These competencies are to be included in the core curriculum for a future pharmacy degree.

The main objective of a pharmacy school is to educate pharmacists to an extent that makes them attractive to the future employment market. This can be achieved by developing and assessing learning outcomes that are based on relevant core competencies. The Swedish Higher Education Ordinance (HEO) sets the graduation outcomes for the 5-year pharmacy degree in Sweden (HEO 2011). We found a high degree of agreement between our results and the HEO outcomes, which indicates that, despite the diverse branches of pharmacy as a profession, there is essential agreement on the core competencies of the profession. We were interested that the HEO listed 15 learning outcomes while our core competencies contained 48 learning outcomes. On analysing the differences we found that our experts had listed specific competencies where the HEO had been more generic; especially for competencies that were profession-specific. For example, the 25 competencies in the categories Clinical pharmacy/Health care, Pharmacy and Pharmacology are summarised as only four competencies in the HEO document. We feel that the more specific items associated with our method are an advantage. However, the HEO list also contains two learning outcomes that are missing from our

results: "…taking particular account of human rights" and "…the capacity for empathy"; these will be added to the core curriculum.

The CAPE framework lists three main groups of educational outcomes for pharmacists (AACP 2004). These groups are pharmaceutical care, systems management, and public health. Not only do the listed competencies in these groups overlap to a large extent, but they are also expressed in rather broad and generic terms. The results of our study are more specific, but retain broad agreement.

The outcomes used by Ho *et al.* in their questionnaire to graduates are in partial agreement with our results (Ho *et al.* 2009). However, it is interesting to see that only 12 statements on their list are specific to pharmacy, and the remaining 28 could apply to any higher university degree. We noted some generic competencies in our results also, but much fewer (11 of 48 were entirely generic).

Clinical governance has been introduced as a UK government initiative to assure and improve the quality of clinical services and a set of competency grids for the assessment of junior pharmacists. This has been used to identify areas of satisfactory and inadequate performance (McRobbie *et al.* 2001). Although this focuses only on clinical skills two other areas, problem solving and personal skills, were identified as needed competency clusters. The competencies in these clusters are very similar to ours grouped as scientific method, communication skills and professionalism.

Langley and Aheer interviewed recruiters of pre-registration graduates about their perceptions of the necessary professional skills among pharmacy graduates in the UK (Langley and Aheer 2010). Knowledge in the field of pharmacy was, of course, important, but applying knowledge was even more important, as were generic competencies and personal attributes such as "fairness, honesty, rationality, responsibility, trustworthiness". While it is understandable that these attributes are interesting to recruiters, they did not appear in our results. This is interesting, since a previous study by one of the authors in the current study also resulted in such personal attributes being highlighted (Edgren 2006). The question, perhaps, is should such attributes be a result of higher education or should they remain personal attributes that recruiters can wish for in any professional to be employed. The experts in our study may have been focused on competencies occurring as a result of education. Nonetheless, the ability to show empathy (see above) has been identified as essential but was missing from our results (Langley and Aheer 2010).

When Jungnickel and co-workers reviewed the literature, they found that future pharmacy curricula will probably centre around three functional roles: "patient-centred care, population-based care and systems management" (Jungnickel et.al., 2009). Our results suggested a tendency to emphasise patient-centred care, but there were also competencies within the other functional roles. Jungnickel *et al.* also suggest that future curricula should "foster the development of 5 cross-cutting abilities in student pharmacists: professionalism, self-directed learning, leadership and advocacy, inter-professional collaboration and cultural competence" (Jungnickel *et al.* 2009). Some of these were also identified in our study, with leadership skills and cultural competence, however, missing. The lack of agreed leadership skills may have been the result of our request for the competencies of a recently graduated pharmacist, since leading roles will usually come later in a career. Perhaps leadership skills should be developed after graduation to support the individual career path. More interesting is the lack of a cultural competence requirement. This can be compared to the lack of mention of human rights, which was included in the HEO graduation outcomes (see above). Sweden, over a couple of decades, has now become a multicultural society, and one would expect such a competency to be identified by the experts.

One of the Pharmine project focus is to develop recommendations on a competency curriculum for pharmacy I Europe, named WP3 (Pharmine 2011). Some examples from pilot framework competencies evaluated by students across Europe are available. So is the result of a survey on pharmacy and pharmacy education (Atkinson and Rombaut 2011a), on the content (Atkinson and Rombaut 2011b) and quality (Guimaraes Morais *et al.* 2011).

A potential future use of a competency framework such as the one reported in the current article, is development and testing in professional practice (cf Antoniou *et al.* 2005; Mestrovica *et al.* 2011).

Conclusions

In our study, which used a modified three-round Delphi technique process, 36 experts reached consensus in identifying core competencies that could be transferred to learning outcomes for our planned 5-year MSc Pharmacy degree. This is an important step in the development of a degree that is attractive to both students and future employers. International literature sources and national legislation are necessary and useful in curriculum planning, but a study such as ours improves local and national acceptance. We also suggest that these results offer important information for further planning of the European Pharmine project.

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Appendix 1. Total list of competences, their mean and standard deviation (SD) in Round 3 and 2

	Round 3		Round 2	
	Mean	SD	Mean	SD
Find information on drugs and evaluate sources	4.00	0.000	4.00	0.000
Act with a sound basic ethical attitude	4.00	0.000	3.88	0.409
Respond to patients and relatives with respect	4.00	0.000	3.88	0.331
Identify their limitations and be able to refer and hand over to others	4.00	0.000	3.82	0.387
Name the most common drug substances and their uses	4.00	0.000	3.79	0.479
Collaborate with other professionals	3.97	0.174	3.79	0.410
Assess and develop their own skills within the profession	3.97	0.174	3.62	0.604
Apply the principles of evidence-based medicine (EBM)	3.97	0.174	3.45	0.833
Provide written information on various aspects of drugs, adapted for different groups of users	3.97	0.177	3.67	0.540
Assess drug-drug interactions	3.94	0.242	3.76	0.431
Explain the pros and cons of different types of formulation	3.94	0.242	3.68	0.535
Provide oral information on various aspects of drugs, adapted for different groups of users	3.94	0.242	3.67	0.540
Work in teams	3.94	0.242	3.65	0.485
Be clear about their own role and that of their profession in different situations	3.94	0.348	3.59	0.657
Provide advice and information to the patient and follow up	3.91	0.384	3.62	0.652
Communicate in groups	3.91	0.292	3.61	0.556
Analyse and argue for their position in a discussion	3.91	0.292	3.59	0.609
Assess the benefits and risks of different drug treatments	3.91	0.292	3.56	0.561
Apply pharmacokinetic principles	3.88	0.415	3.69	0.592
Identify problems and plan how to solve them	3.88	0.331	3.53	0.615
Apply pharmacodynamic principles	3.85	0.442	3.66	0.653
Determine drug dosage for patients with impaired organ function (kidney, liver)	3.85	0.442	3.50	0.663
Dispense the prescription in a safe manner using the current support systems	3.85	0.442	3.50	0.896
Adjust their discussion to the individual patient	3.82	0.528	3.56	0.705
Provide the most common trade names for each generic drug	3.82	0.392	3.44	0.705
Motivate patients to take essential medicines	3.79	0.485	3.47	0.748
Communicate the risks and benefits of drug therapy to patients	3.79	0.485	3.44	0.786
Handle medications in accordance with regulations in healthcare situations	3.79	0.600	3.26	0.994
Identify deviations in the management of prescriptions	3.79	0.485	3.26	0.828
Select appropriate formulations for patients' medications	3.73	0.517	3.50	0.663
Assess the bioequivalence and interchangeability of drugs	3.73	0.574	3.32	0.878
Apply the principles of Good Pharmacy Practice (GPP)	3.70	0.529	3.44	0.705
Motivate customers to take essential medications	3.70	0.529	3.29	0.836
List the risks associated with, and most common causes of, incorrect medication	3.69	0.592	Not included	
Assess the effects and adverse reactions of drugs	3.67	0.540	3.41	0.701
Select the appropriate dosage form for a patient; i.e. one that is tailored to the individual and to other treatments	3.66	0.545	3.26	0.751
Use technological support for oral presentations	3.64	0.549	3.35	0.691
Critically examine the results of clinical trials	3.61	0.496	3.47	0.615
Critically examine pharmaceutical advertising and promotions	3.61	0.496	3.38	0.739
Develop a current drug list for an individual patient	3.61	0.827	3.29	1.031
Apply basic principles of how to develop new drugs for commercial use	3.61	0.704	3.29	0.836
Give advice to physicians at a level appropriate to their profession	3.61	0.556	3.26	0.828
Assess the concentration-effect relationships of drugs	3.58	0.561	3.26	0.751
Suggest how to start and complete a drug treatment regimen	3.58	0.663	3.24	0.819
Write in English	3.56	0.564	3.35	0.646
Apply the basic principles for formulating drugs	3.55	0.617	3.36	0.742
Carry out a medication interview with a patient	3.55	0.833	3.29	1.001
Apply the principles of Good Manufacturing Practice (GMP)	3.55	0.617	3.24	0.792
Present orally in both Swedish and English	3.48	0.566	3.41	0.609
Apply the principles of Good Clinical Practice (GCP)	3.48	0.619	3.21	0.808
Give advice, mainly practical, to nurses, at a level appropriate to their profession	3.45	0.617	3.24	0.741
Explain the benefit scheme for reimbursement of drug costs for patients and customers	3.42	0.936	2.91	1.138
Analyse and evaluate drug-related statistics	3.39	0.609	3.32	0.768
Suggest alternative administration routes and drugs for patients with special needs (e.g. difficulty swallowing, feeding tubes, etc.)	3.39	0.659	3.15	0.784
Document their healthcare work	3.30	0.883	3.03	1.087
Describe practical drug management practices both within and outside a hospital and how they are linked	3.27	0.761	3.00	1.015
Work under sterile conditions	3.24	0.969	3.03	1.058
Implement business intelligence in the pharmaceutical field	3.22	0.751	3.09	0.900
Assess the miscibility and stability of drug substances	3.18	0.584	3.18	0.758
Analyse texts or phenomena such as drug-related incidents, drug-related risks, record reviews, standard operating procedures (SOPs)	3.15	0.508	3.18	0.727

Appendix

Select appropriate formulations of drugs for a patient, based on chemical, biological and medical data	3.15	0.508	3.12	0.808
Implement a systematic medication review for different types of care and different patient groups	3.15	0.712	3.09	0.830
Assess statistical methods	3.09	0.631	3.12	0.808
Assess basic scientific findings and methodologies that have been documented in the drug development process	3.09	0.384	3.03	0.647
Apply the principles of Good Laboratory Practice (GLP)	3.06	0.704	3.00	0.888
Take responsibility for quality in the relevant areas in a pharmacy	3.06	0.747	2.97	0.904
Help prevent the spread of antibiotic resistance	3.03	0.728	3.03	0.870
Provide advice on self-care	3.03	0.883	3.00	0.853
Comply with the regulations of drug distribution	3.03	0.918	2.97	0.904
Interpret common laboratory findings and relate these to current drug therapy	3.00	0.661	2.97	0.797
Utilise statistical methods	3.00	0.612	2.94	0.776
Manage ethical dilemmas that could occur in the drug development process	3.00	0.500	2.91	0.793
Write and review a Medication Report	3.00	0.661	2.85	0.989
Act as a liaison between healthcare and pharmacy market representatives	2.97	0.637	2.85	1.019
Write a report on texts or phenomena such as drug-related incidents, drug-related risk analyses, record reviews, standard operating procedures (SOPs)	2.97	0.474	2.97	0.728
Assess patient symptoms in relation to drug treatment	2.94	0.659	2.94	0.814
Manufacture common drug formulations	2.94	0.747	2.76	1.017
Select appropriate drug packaging in view of stability, patient ability, etc	2.94	0.609	2.71	0.906
Understand basic IT systems used in healthcare, pharmacy and the pharmaceutical industry	2.94	0.716	Not included	
Communicate with authorities and colleagues from other professions about the development of drugs	2.91	0.678	3.00	0.816
Suggest a drug treatment regimen in relation to diagnosis and symptoms	2.91	0.765	2.88	1.008
Take responsibility for assessing quality in relevant areas within the pharmaceutical industry	2.91	0.678	2.88	0.769
Be prepared to take part in research	2.85	0.712	2.97	0.847
Take responsibility for assessing quality in relevant areas of health care	2.85	0.667	2.74	0.864
Explain the importance of the work of drug and therapeutic committees and therapy groups	2.84	0.847	Not included	
Carry out pharmacokinetic calculations using computer support	2.82	0.465	2.85	0.821
Take responsibility for the management of projects	2.79	0.696	2.76	0.781
Meet the documentation requirements for the drug development process	2.73	0.761	2.85	1.004
Evaluate health economic studies	2.70	0.684	2.79	0.770
Write an adverse drug reaction report	2.70	0.467	2.62	0.954
Participate in work involving clinical trials in health care	2.67	0.692	2.65	0.849
Take responsibility for assessing quality in relevant areas within the professional authorities	2.64	0.783	2.74	0.828
Apply an economic interpretation of prescribing statistics	2.64	0.699	2.71	1.031
Participate in the care of patients in a hospital department	2.58	0.708	2.65	0.884
Apply national and international guidelines to and support for documentation before the approval of drugs	2.55	0.711	2.67	0.924
Participate in work involving clinical trials in the pharmaceutical industry	2.55	0.666	2.56	0.894
Label drugs accurately	2.48	0.870	2.55	1.003
Write Standard Operating Procedures (SOPs)	2.45	0.711	2.34	0.902
Explain the healthcare organisation: its structure, processes and practical realities	2.42	0.969	2.47	1.051
Design and compile questionnaires and surveys	2.42	0.765	Not included	
Provide advice to managers in health care departments	2.39	0.609	2.67	0.924
Provide leadership attributes	2.39	0.609	2.53	0.788
Analyse the environmental effects of medication management	2.30	0.585	2.53	0.662
Apply the principles for analysing simple molecules	2.30	0.585	2.50	0.862
Apply the principles for manufacturing simple molecules	2.30	0.637	2.47	0.825
Plan pharmacokinetic and pharmacodynamic studies	2.28	0.523	2.38	0.817
Apply the principles of pharmacoepidemiology	2.25	0.508	2.53	0.671
Provide information on the return and disposal of medicines	2.24	0.708	2.50	0.826
Work across borders worldwide	2.16	0.820	Not included	
Analyse the supply of medications	2.15	0.619	2.31	0.931
Explain the rules for marketing pharmaceuticals	2.12	0.415	2.38	0.817
Explain the importance of drug patents for society	2.12	0.650	2.29	0.836
Produce cytotoxic drugs	2.09	0.843	2.29	1.031
Apply the principles for producing biological medicines	2.06	0.704	2.50	0.961
Apply the principles for analysing biological medicines	2.06	0.659	2.38	0.817
Participate in the synthesis of new drugs	2.03	0.728	2.18	0.904
Conduct drug analyses in connection with the production of pharmaceuticals	2.00	0.559	2.35	0.849
Work as a contractor	1.94	0.659	2.18	0.904
Write applications to research ethics committee	1.94	0.496	2.09	0.830
Write applications for clinical trials to the competent authority	1.88	0.650	2.15	0.821
Explain the success factors for drug marketing	1.82	0.727	2.12	0.880
Determine the concentration of drugs in biological samples	1.79	0.696	2.09	0.933
Participate in the large scale production of pharmaceuticals	1.73	0.626	1.97	0.834
Prepare a budget for medicines for a hospital	1.70	0.585	2.00	0.888
Write applications for marketing authorisation to the relevant authority	1.48	0.667	1.91	0.933