

# Determining and prioritizing competencies in the undergraduate internal medicine curriculum in Saudi Arabia

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## تحديد الكفاءات وتقييم أولوياتها في المنهج التعليمي الجامعي للطب الباطني في المملكة العربية السعودية هاني المعلم

الخلاصة: هدف الباحث إلى تحديد كفاءات المعارف والمهارات في الطب الباطني في المنهج التعليمي الجامعي للطب الباطني في المملكة العربية السعودية، وذلك استناداً إلى عمل جماعي وباستخدام الكتب المرجعية الشائعة. واستخدمت طريقة دلفي Delphi باعتبارها طريقة متفقاً عليها لتحديد الكفاءات في الطب الباطني وتحديد أولوياتها. وقد قامت مجموعة من عشرين طبيباً بتبويب الكفاءات التي جرى تحديدها بدرجات تتراوح بين الصفر وبين ثلاث درجات (0: تعني أن لا حاجة لمعرفتها، 1: تعني أن من المثير للانتباه التعرف عليها، 2: تعني أنه ينبغي معرفتها، 3: تعني لا بد من معرفتها). وبعد صياغة النتائج، أجريت جولة أخرى بطريقة دلفي شارك فيها خمسة خبراء في الطب الباطني. وقد جرى تحديد ما مجموعه 1513 كفاءة معارف و189 كفاءة مهارات كما حُدِّدَت أولوياتها. وتقابل هذه الكفاءات اثنتي عشرة منظومة في الطب الباطني. ثم تم فرز جميع الكفاءات التي بلغت درجتها 2.2-3.0 واعتُبرت كفاءات محورية للمنهج التعليمي الجامعي للطب الباطني. ولا يخفى أن مثل هذا التحديد للكفاءات وتعيين أولوياتها ينبغي أن يكون له أثره على عملية إصلاح المنهج التعليمي.

ABSTRACT To determine knowledge and skills competencies in internal medicine for the undergraduate curriculum in Saudi Arabia, competencies were identified based on group work utilizing common textbooks. The Delphi Technique was used as a consensus method to determine and prioritize competencies in internal medicine. A group of 20 clinicians rated the identified competencies from 0-3 (0: no need to know, 1: interesting to know, 2: should know and 3: must know). After formulating the results, a second Delphi round was conducted with 5 experts in internal medicine. A total of 1513 knowledge competencies and 189 skills competencies were determined and prioritized. The competencies corresponded to the 12 systems in internal medicine. All competencies rated 2.2-3.0 were produced separately and considered core competencies for the undergraduate internal medicine curriculum. Determining and prioritizing competencies should influence the curriculum reform process.

## Détermination et classement par ordre de priorité des compétences dans le programme de médecine interne de premier cycle en Arabie Saoudite

RÉSUMÉ Pour déterminer les compétences théoriques et pratiques en médecine interne dans le programme de premier cycle en Arabie saoudite, un travail de groupe a été réalisé sur des manuels communs. La méthode Delphi a été utilisée en tant que méthode d'obtention d'un consensus pour déterminer les compétences utiles en médecine interne et les classer par ordre de priorité. Un groupe de 20 cliniciens a attribué une note allant de 0 à 3 aux compétences identifiées (0 : connaissance inutile, 1 : connaissance intéressante, 2 : connaissance utile, 3 : connaissance indispensable). Après la formulation des résultats, une deuxième vague de consultation selon la méthode Delphi a été menée auprès de cinq experts en médecine interne. Au total, 1513 compétences théoriques et 189 compétences pratiques ont été identifiées puis classées par ordre de priorité. Les compétences correspondaient aux douze systèmes de médecine interne. Toutes les compétences notées de 2,2 à 3,0 ont été présentées séparément et considérées comme des compétences clés pour le programme de médecine interne de premier cycle. La détermination des compétences et leur classement par ordre de priorité devraient influencer sur le processus de réforme du programme.

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## Introduction

One of the current trends in curriculum planning is to base it on outcomes [1]. These outcomes should be clearly defined in the form of competencies. Curriculum designers should know precisely what they want from medical students in terms of knowledge, attitudes and skills competencies. Otherwise, teaching may miss certain competencies important for the practising physician; on the other hand, it may focus on unnecessary or less important competencies. The epidemiology of diseases differs between countries and common diseases locally in Saudi Arabia such as dengue fever and tuberculosis may not be well addressed in standard textbooks. Therefore, curriculum designers are required to consider such differences.

The Delphi Technique a research approach is employed to develop consensus amongst a heterogeneous population. It is “a method for systematic collection and aggregation of informal judgment from a group of experts on specific questions and issues” [2]. The Delphi Technique utilizes iterative multistage processes; 2 or more rounds are conducted using a questionnaire survey. Each round uses information gathered during previous rounds to converge toward a consensus of the group’s opinions. It is valued for its probability

in avoiding drawbacks often associated with group dynamics in structured and unstructured direct interactions. The technique has many advantages over other group decision-making methods because it allows participants’ anonymity while preventing the possible bias of dominating the consensus development by a powerful individual in face-to-face meetings. It facilitates ownership and increases acceptance of the generated consensus. In addition, the study’s statistical group response allows qualitative data to be transformed into quantitative data; and it overcomes the geographical limitation of the participation of a wide range of experts and stakeholders [3].

The primary objective of this study was to determine and prioritize knowledge and skills competencies in undergraduate internal medicine curriculum in Saudi Arabia.

## Methods

### Delphi

The Delphi Technique is considered one of the most useful techniques in identifying competencies in medical education [3,4] A rigorous stepwise approach for use of the technique was followed in this research in conjunction with several guidelines and recommendations (Figure 1) [5].

Prior to application of the Delphi Technique, a list of all internal medicine competencies was developed. This was done using a team of 29 volunteers, final-year medical students and interns from Umm Alqura University Medical College, Mecca. Team members were divided into 12 groups corresponding to the 12 systems in internal medicine. Each group was asked to write up all internal medicine competencies corresponding to their assigned system. Knowledge and skills competencies were identified based on standard medical textbooks [6,7]. All groups received detailed instructions on “how to write competencies” and “how to choose the observable verbs that describe precisely the cognitive function to be achieved by each objective” (Figure 1). To unify the work and style, the author reviewed all the competencies for each system and modifications were introduced where needed, e.g. any knowledge competency felt to be a skill was moved to the skills competencies section of that system and vice versa. Written competencies were then reviewed by a panel of 12 experts and any missing competencies added. The second stage was the application of iteration 2 of the Delphi Technique. This was aimed at developing a consensus on the core competencies essential for undergraduate medical students.

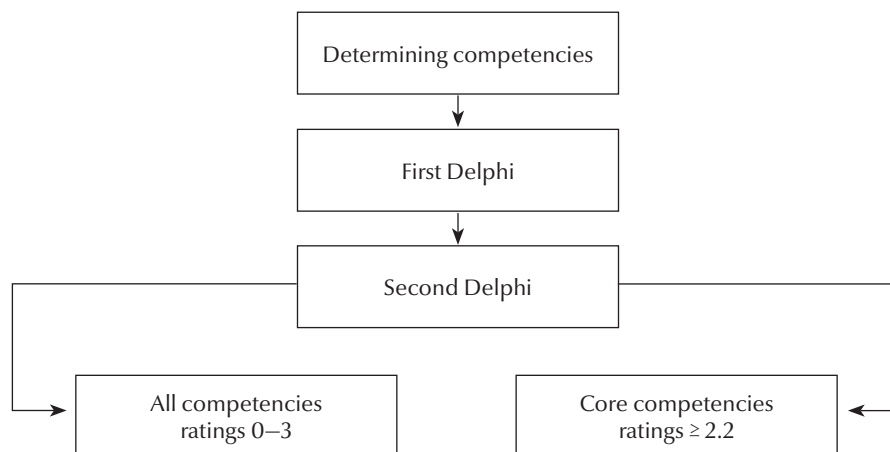


Figure 1 Steps followed in identifying and rating the competencies based on the Delphi Technique

In the first Delphi round, a booklet containing all competencies of all systems was sent with an instruction letter to a total of 30 participants. Participants were asked to rate each competency as 0, 1, 2, and 3 corresponding to: no need to know the subject, good and interesting to know, should know and must know the subject respectively. If the judgment of the rater was between 2 levels, the following numbers were assigned 0.5, 1.5 and 2.5 respectively. A period of 2 months was allowed to return the booklet. After collecting all data, the weighted response for each competency was calculated following a standard method [8].

The second round of Delphi was conducted with a list of all competencies with the weighted responses. This was sent to 6 experts in internal medicine. The same instructions and system of rating was followed, and the booklets were returned after 2 months. The final weighted responses were then calculated.

### Rating and analysis of data

The following technique was used to analyse the ratings of each competency and the combined responses of all participants. First, the 4 levels of ratings were assigned; to obtain a weighted response for each competency, the number of responses in each level was multiplied by the assigned number, and then the products were added together and divided by the total number of responses, which gives a mean score for each competency (0.0–3.0). This technique has been described previously [8]. Using this method, all knowledge and skills competencies in internal medicine were ranked and the relative importance for each competency in the curriculum was determined.

### Participants

In the first stage of developing the list of all competencies, 29 medical students and interns who graduated from the medical college of Umm Alqura University volunteered to help with this project.

**Table 1 Composition of groups in the two Delphi rounds**

Category	Clinicians (No.)	Experts (No.)
Expert	4	5
Internist	6	0
Resident	3	0
Intern	3	0
Non-internist	4	0
Total	20	5

*20 out of 30 completed the first round and 5 out of 6 completed the second round.*

Written competencies were reviewed by a group of 12 consultants in internal medicine. All were trained in North America and have been involved in teaching undergraduate medical student and residents in Umm Alqura University.

In the first Delphi round, a group of 30 clinicians who had different levels of experience and different specializations were invited to participate; they included faculty staff, internship directors, practising general internists, senior medical residents and interns (Table 1). Participants were selected to represent all medical colleges in Saudi Arabia. The practising general internists were from 5 major educational hospitals in 5 different cities. All of the non-internists selected (an obstetrician, a surgeon, a family physician and a paediatrician) were full professors in their

institutions, with an academic qualification in medical education.

In the second Delphi round, a total of 6 experts in internal medicine were involved (Table 1). These experts represent 5 different medical colleges in Saudi Arabia and all had wide clinical and educational experience in undergraduate medical education.

## Results

For the first Delphi survey, 20 out of the 30 participants completed the survey booklet, a response rate of 66.6%. Only 1 expert general practitioner out of 3 in our region responded to this round. For the second survey, 5 out of 6 participants completed the booklet, a response rate of 83.3%.

**Table 2 Number of knowledge and skills competencies for all systems.**

Internal medicine systems	Competency	
	Knowledge	Skills
Allergic and immunologic disorders	48	0
Cardiovascular diseases	135	27
Dermatologic disorders	49	7
Endocrine and metabolic diseases	236	33
Gastrointestinal diseases	224	20
Hematologic diseases	75	11
Infectious diseases	85	13
Neurologic disorders	150	11
Oncologic diseases	140	0
Pulmonary diseases	117	31
Renal, fluid and electrolyte disorders	136	16
Rheumatologic diseases	119	20
Total	1514	189

**Table 3 Core skills competencies (rated  $\geq 2.2-3.0$ ) for cardiovascular disorders**

Cardiovascular disease (skills competencies)	Expert rating
To formulate a comprehensive history from patients with cardiovascular diseases	3.00
To apply knowledge about presenting symptoms of cardiovascular system (chest pain, dyspnoea, orthopnoea, paroxysmal nocturnal dyspnoea, palpitations, nocturia, oedema, anorexia, syncope, pre-syncope, dizziness, intermittent claudication, fatigue) in obtaining history from patient	3.00
To demonstrate competency in performing a comprehensive cardiovascular examination starting with proper positioning of the patient to the general appearance then by examining the hands, the face, the trachea, the chest and the pericardium	2.80
To demonstrate competency in eliciting physical signs of CHF	2.80
To demonstrate on CXR most of the findings associated with CHF	2.60
To identify based on ECG interpretations ischaemic changes consistent with acute coronary syndrome	2.50
To demonstrate competency skills in examining patient with mi and be familiar with Killip classification	2.40
To identify based on ECG interpretations ischemic changes consistent with mi	2.70
To demonstrate competency in eliciting signs of aortic stenosis	2.30
To demonstrate competency in eliciting signs of mitral stenosis	2.70
To demonstrate competency in eliciting signs of aortic regurgitation	2.70
To demonstrate competency in eliciting signs of mitral regurgitation	2.60
To identify the ECG changes seen in pericarditis and pericardial effusion	2.20
To demonstrate competency in eliciting signs of pericardial diseases	2.40
To demonstrate on CXR changes consistent with pericardial effusion	2.20
To demonstrate competency in eliciting signs of deep venous thrombosis	2.70
To demonstrate competency in measuring the blood pressure	3.00
To demonstrate competency in examining patients with hypertension	2.40

Separate tables for all skills competencies, including core skills, for all systems are available from the author upon request.

CHF = congestive heart failure; CXR = chest X-ray; ECG = electrocardiogram.

Internal medicine systems were organized alphabetically: allergic and immunologic disorders, cardiovascular disorders, dermatologic disorders, endocrine diseases, gastrointestinal diseases, haematologic diseases, infectious diseases, neurologic disorders, oncologic disorders, pulmonary diseases, renal diseases and rheumatologic diseases. The competencies for each system were organized under 2 major categories knowledge competencies and skills competencies, with disease subheadings as outlined in the textbook (Table 2). A total of 1703 competencies were identified for the 12 systems, of which 1514 were knowledge competencies and 189 skills competencies (All of these competencies were produced in a booklet format at the end of the study; this is available by direct request from the author).

All competencies in knowledge and skills with weighted response of  $\geq 2.2$  were considered core competencies.

Table 3 shows an example of the core skills competencies for cardiovascular disorders.

Table 4 shows the weighted responses of the 12 knowledge competencies determined for congestive heart failure (CHF) based on experts' ratings in the second Delphi survey. Prioritization is apparent in this example as the results clearly reflect the level of importance of this disease, 11 out of 12 knowledge competencies were rated  $> 2$  (should know the subject) and 7 out of these 12 were actually rated  $> 2.5$ , close to 3 (must know the subject).

The mean weighted responses for all disease subheadings for all systems were calculated. This is to give further prioritization and relative importance of diseases within each system. The mean weighted responses for knowledge competencies for all cardiovascular disorders are shown in Table 5. The number of determined competencies

for each disease has also been counted (full package for all mean weighted responses of all disease subheadings for all systems is available through direct request from the author).

The correlation coefficient for all results comparing clinicians' group ratings in the first Delphi to experts' ratings in the second Delphi was 0.90 for knowledge competencies and 0.70 for skills competencies.

## Discussion

Determining competencies is an essential component to the success of any educational programme. A strict methodology was followed in this comprehensive study to determine and prioritize knowledge and skills competencies for the undergraduate curriculum in internal medicine in Saudi Arabia. It is hoped that this effort will



**Table 4 Knowledge competencies (rated 0.0–3.0) for congestive heart failure (CHF)**

Cardiovascular disease (knowledge competencies)	Expert rating
To define congestive heart failure	2.90
To classify congestive heart failure based on etiological abnormalities, systolic dysfunction and diastolic dysfunction	2.80
To describe pathophysiological mechanisms for CHF	2.40
To describe some terminology for CHF (high-output failure, left-sided heart failure, right-sided heart failure)	2.80
To describe clinical features of congestive heart failure	3.00
To construct approach to diagnosis of CHF based on etiology, symptoms and investigation (ECG, echo, cardiac catheterization)	2.50
To construct approach to therapy for CHF	2.60
To outline therapy of systolic dysfunction	2.20
To outline therapy of diastolic dysfunction	2.30
To prescribe therapy of pulmonary oedema	2.80
To discuss mechanism of action, indications and side effects of different drugs used in CHF	2.10
To discuss the neurohumoral hypothesis of heart failure and its application in management	1.63

All knowledge competencies for all diseases are available from the author upon request.  
ECG = electrocardiogram.

direct medical educators in developing competency-based curricula with more focus on essential and must-know competencies. There is an extensive effort in medical education literature addressing reforming and constructing new curricula, not only for internal medicine core clerkship [9,10], but also other specialties [11]. The type of methodology followed in this study is unique in medical education literature [12].

One of the advantages of developing a core list of should know and must know competencies is to help in designing a national guide for internal medicine teaching in medical colleges in Saudi Arabia. It would also help in designing a clerkship curriculum in internal medicine based on the specified competencies that augment and serve as a continuum of what had been taught in the undergraduate curriculum. It was reported in a different health system than Saudi

Arabia that the use of a national guide is associated with improved ability to meet clerkship accreditation criteria, improved performance of students on the clerkship exam and increased clerkship time devoted to ambulatory care [12]. There is no published national guideline for minimal acceptable competencies of a medical graduate in Saudi Arabia [13]. This effort of developing a comprehensive guide and follow its implementation on the national level should result in the rapid adoption by medical colleges, with subsequent improvement in the quality of medical education [11].

One of the applications of the result of this study is to properly design assessment methods. Competency-based assessment measures what doctors can do in controlled representations of professional practice [14]. Competencies (knowledge or skills) drawn from this research can be used as the competencies that should be fulfilled and/or demonstrated by candidates during examinations, including objective-structured oral examination. Rethans et al. proposed that all assessments under examination-like settings should be referred to as competence-based assessments, whereas assessments in

**Table 5 Mean weighted response of all disease subheadings of cardiovascular diseases**

Knowledge competency	Expert rating (mean weighted response)	Total
Congestive heart failure	2.50	12
Cardiac arrhythmias	2.09	18
Ischemic heart disease	2.30	29
Valvular heart disease	2.15	25
Cardiomyopathy	1.81	12
Pericardial disease	2.35	11
Congenital heart disease in adult	1.75	6
Venous thrombosis	2.71	7
Cardiovascular syncope	1.78	5
Hypertension	2.53	10
Total	-	135

Tables like this for all systems are available from the author upon request.

actual practice should be referred to as performance-based assessments [14].

The mean weighted responses for cardiovascular diseases may help planners in organizing curriculum content based on this rating and in blue-printing cardiovascular-related assessments. The high ratings of competencies for CHF (knowledge: out of 12, 11 rated > 2 and 7 rated > 2.5) may direct curriculum planners to use these competencies as outcomes while designing and implementing courses and educational interventions. It also means that CHF must be considered while planning curriculum content and while designing assessment methods in internal medicine courses. The same rationale can be used when addressing the weighted responses for other competencies for all diseases in all systems outlined in this study.

There are significant sets of competencies in each system addressing issues taught in basic sciences in the classical curricular designs as in our college. The findings of this study should assist the redesigning of curriculum content for many basic sciences in our college. In outcome-based education, clear identification of competencies in all disciplines will prevent the flow of unnecessary information that has no relevance to the graduating doctors. This will also minimize the redundancy and overlap of information across disciplines. However, this should be conducted through a careful curriculum planning process.

Expert internists with subspecialty qualification from 4 different cities in Saudi Arabia with extensive academic experience were included in the first and second Delphi rounds. It has been suggested that a minimum figure of 20 or so would be appropriate for a medical discipline [4]. To provide representative information, some studies

have employed over 60 participants [15] while others have involved as few as 15 participants [16]. Obviously the larger the sample size, the greater the generation of data, which in turn influences the amount of data analysis to be undertaken [5].

The aim was to include around 30 participants in the first round of Delphi in this study, however, only 20 clinicians participated. They included clinicians from different specialties who all were experts in their fields with qualifications in medical education. Interns who finished their internal medicine rotations were included as well: they are newly encountering the professional life of a doctor where they can judge the applicability of what they have been taught and what they have experienced in the rotation. Internal medicine residents with different levels of training were also included as they are considering internal medicine as a career. Their views would likely be influenced by the relative relevancy of diseases, based on their experience. General internists with different subspecialties were included to enrich the outcome of this round with their generalist and subspecialist views.

There were some limitations to this study. The results cannot be generalized to different societies with different disease epidemiology. Any application of the findings should consider the local epidemiology of diseases. The findings are not time sensitive as they should go for revision after a specified period of time (determined by the curriculum planners). Issues that were not addressed in this research work were principles of curriculum planning, teaching methods that should be employed to achieve these competencies, time for inpatient versus outpatient training for medical students, communication skills, ethics and attitudes.

Competencies in knowledge and skills for internal medicine have been determined and prioritized. This study would greatly influence the curriculum reform process that has been adopted by many medical colleges in the region. It should direct curriculum planners to organize curriculum contents, to base teaching on important competencies and to design valid assessment methods. It should help designing a national guide for internal medicine teaching in medical colleges in Saudi Arabia.

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***Transformative scale up of health professional education: an effort to increase the numbers of health professionals and to strengthen their impact on population health***

At the request of its Member States and partners, the World Health Organization (WHO) is developing policy guidelines to assist countries, development partners and other stakeholders in efforts to expand the health workforce and improve the alignment between the education of health workers and population health needs. The first set of guidelines in this process will recommend the transformative scale up of health professional education and aims to increase the quantity, quality and relevance of health professionals to strengthen their impact on population health.

The information brochure *Transformative scale up of health professional education: an effort to increase the numbers of health professionals and to strengthen their impact on population health* provides a background and overview of WHO's efforts to provide guidance on the transformative scale up of health professional education.

Further information about this and other WHO publications is available at: <http://www.who.int/publications/en/>