

### Developing educational competencies required for the infectious diseases specialty residency program in Iran: A competency-based curriculum

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**Background:** Curriculum design and development are among the key components of medical education. Today, the dominant approach to curriculum planning is the competency-based approach. However, despite the emphasis posed by the medical education scientific community on this approach, medical education in both undergraduate and graduate levels in Iran continues to be delivered traditionally. As it is highly important for infectious diseases specialists to acquire the necessary competencies for the treatment of patients with infectious diseases, this study aimed to identify and present such competencies through localizing the competencies laid down by the Accreditation Council for Graduate Medical Education (ACGME) of the United States.

**Methods:** This study built on ACGME competencies as its point of departure. The Delphi method was used to extract the required items (i.e., competencies) into a questionnaire. When the content and face validity as well as the reliability of the questionnaire was confirmed, copies of the questionnaire were distributed among faculty members, specialists and residents. The items were prioritized according to the scores given by the participants.

**Results:** According to the results of this study, one general rotation and ten specialized rotations were defined for infectious diseases residents. In each rotation, the expected competencies are enlisted. These competencies are categorized differently in competency-based curricula for the infectious diseases specialty residency programs.

**Conclusion:** According to characteristics of a competency-based curriculum, accountable physicians can be assuredly expected to be trained according to the requirements of the community in case they are trained within such a program.

**Keywords:** Competency-based curriculum, Infectious diseases, Outcome-based curriculum

### تدوین توانمندی های آموزشی مورد نیاز دوره تخصصی بیماریهای عفونی در ایران؛ برنامه درسی مبتنی بر توانمندی

**زمینه و هدف:** طراحی و توسعه برنامه درسی، یکی از مهم ترین بخش های آموزش پزشکی است. امروزه رویکرد غالب در برنامه ریزی درسی، برنامه درسی مبتنی بر توانمندی است. اما علی رغم تاکید مجامع علمی آموزش پزشکی به این رویکرد، آموزش پزشکی در مقطع عمومی و دستیاری در ایران همچنان به صورت سنتی ارائه می شود. به دلیل اهمیت موضوع دستیاری پزشکان متخصص عفونی به توانمندی های لازم برای درمان بیماران با بیماری های عفونی، این مطالعه با هدف تعیین و پیشنهاد توانمندی های لازم برای کار به عنوان متخصص عفونی بر اساس بومی سازی توانمندی های انجمن اعتباربخشی آموزش پزشکی تخصصی آمریکا انجام گرفته است. **روش:** در این پژوهش توانمندی های ACGME به عنوان مبنای کار قرار گرفت. سپس به روش دلفی، آیتها (توانمندی های) ضروری مورد نیاز استخراج گردید. پس از کسب روالی محتوایی و صوری و پایایی پرسشنامه ها، در اختیار اساتید، متخصصین و دستیاران گذاشته شد و میزان اهمیت هر کدام از توانمندی ها بر اساس میانگین کسب شده، به دست آمد.

**یافته ها:** بر اساس نتایج این مطالعه، یک روتیشن جنرال و ده روتیشن تخصصی برای دستیاران عفونی تعریف شد که در آن بر حسب هر کدام توانمندی های ACGME و میانگین نمره کسب شده در هر کدام از توانمندی ها مشخص شد. در هر کدام از کوریکولوم های مبتنی بر توانمندی در رشته تخصص عفونی، این توانمندی ها به طرق مختلف طبقه بندی شده اند.

**نتیجه گیری:** با توجه به ویژگی های برنامه درسی مبتنی بر توانمندی، با طراحی و اجرای چنین برنامه های، می توان اطمینان داشت که پزشکانی پاسخگو در قبال نیازهای جامعه تربیت شوند.

**واژه های کلیدی:** بیماری های عفونی، کوریکولوم مبتنی بر پیامد، کوریکولوم مبتنی بر توانمندی

### کتابه القدرات التعليمية المطلوبة للدورات التخصصية في الأمراض الخبيثة في إيران . البرنامج الدراسي المبني على القدرة

**الأرضية والهدف:** يعد تصميم وتوسيع البرامج التعليمية واحداً من أهم أجزاء التعليم الطبي. و يعتبر التخطيط التعليمي المبني على القدرات هو النهج الغالب في البرامج التدريسية في أيامنا هذه. ولكن على الرغم من تأكيد المجتمعات الطبية على هذا النهج، فإن التعليم الطبي في المرحلة العمومية والتخصصية للبرازيل يدرس بالطريقة التقليدية. بدليل أهمية حصول متخصصي الأمراض الخبيثة على القدرات اللازمة من أجل علاج المرضى لذلك فإن هدف هذه الدراسة هو تعيين وتقديم الإقتراحات اللازمة من أجل عمل متخصص الأمراض الخبيثة حسب مجلس تعريف القدرات الإعتبارية اللازمة للتعليم الطبي التخصصي في أمريكا.

**الطريقة:** في هذا التحقيق تم إعتبار قدرات ACGME مبدأ العمل. تم استخراج القدرات بطريقة دلفي. وبعد التحقق من صحة محتوى الدقة تم وضع ورقة الأسئلة الإستفسارية في متناول يد أعضاء الهيئة التدريسية والمتخصصين وتم بعدلها تحديد أهمية كل واحد من هذه الشروط حسب العلامة الحاصل عليها.

**الواصل:** حسب نتائج هذه المطالعة تم تعريف دورات تدريبية دورة عمومية وعشر دورات إختصاصية لتخصصي الأمراض الخبيثة كان حسب أي واحد من القدرات في ACGME تم تحديد معدل العلامة المكتسبة.

**النتيجة:** بالنظر إلى خصوصيات البرنامج الدراسي المبني على القدرات يمكن من خلال تقديم هكذا برنامج الإطمئنان من تخرج أطباء قادرين على التجاوب مع متطلبات المجتمع.

**الكلمات الدليلية:** الأمراض الخبيثة، المنهج المبني على النتيجة، المنهج المبني على القدرة

### ایران میں متعدی بیماریوں کے علاج کے لئے ماہرین کے تعلیمی تقاضوں کے مطابق نصاب کی تدوین، صلاحیتوں کو تقویت پہنچانے کے لئے تعلیمی نصاب

**بیک گراؤنڈ:** میڈیکل فیئلڈ میں نصاب کو اپ ڈیٹ کرنا نہایت اہمیت کا حامل ہے۔ آج کی دنیا میں میڈیکل تعلیم کا نصاب طلبہ کی توانائیوں اور صلاحیتوں کو مزید اجاگر کرتا ہے۔ دنیا میں سائنسی حلقوں کی تاکید کے باوجود ایران میں عام ڈاکٹری کا کورس اور اسٹنٹ کا کورس بدستور روایتی طریقے سے پڑھایا جاتا ہے۔ متعدی بیماریوں کا علاج کرنے کے سلسلے میں ماہر ڈاکٹروں کی صلاحیتوں کو اجاگر کرنے پروگرام کی اہمیت کے پیش نظر یہ تحقیق انجام دی گئی ہے۔

**روش:** اس تحقیق میں اے سی جی ایم ائی کو تحقیق کی بنیاد بنایا گیا ہے، اس کے بعد ڈلفی روش سے متعدی بیماریوں کا علاج کرنے والے ماہر ڈاکٹروں کی تعلیمی ضرورتوں کا جائزہ لیا گیا ہے۔ عام ڈاکٹروں، ماہر ڈاکٹروں اور میڈیکل اساتذہ کو سوالنامہ دیا گیا، ڈیٹا کا جائزہ لینے سے اوسط طور پر صلاحیتوں کا انداز ہوا۔

**نتیجے:** اس تحقیق کے نتیجوں کے مطابق ایک جنرل روٹیشن اور متعدی بیماریوں کا علاج کرنے والے اسٹنٹ ڈاکٹروں کے لئے دس روٹیشن رکھے گئے، ان کی توانائیاں اے سی جی ایم ائی کے مطابق حاصل ہوئیں۔

**سفارش:** چونکہ اس پروگرام سے ڈاکٹروں کی صلاحیتیں نکھر کر سامنے آتی ہیں لہذا یہ امید کی جاسکتی ہے کہ اس کے تحت معاشرے کو اچھے ڈاکٹر پیش کئے جائیں گے۔

**کلیدی الفاظ:** متعدی بیماریاں، نصاب، تعلیم، صلاحیتوں کے مطابق

## INTRODUCTION

The curriculum is all that happens during an educational course, that is, what an aim is trained via what strategies and methods, in what kind of an environment, under what circumstances, and how students' learning is assured (1). Curriculum design and development are among the key components of medical education. Clearly, careful planning is essential for success in teaching and learning (2).

Medical education is no longer aimed to allocate similar attention to all the medical contents but is today expected to be responsive to the needs of the community (3). Accordingly, the highlighted approach today is the competency-based curriculum, which is the platform for delivering medical education in many centers worldwide (2).

In this approach, the curriculum focuses on the services needed by the people of the community (demand-driven), which ultimately leads to desirable changes in health care issues (3). Competency is a dynamic and developing concept and is a basis for practice and learning. Each competency comprises of the elements of knowledge, attitude and skills, where a set of these competencies forms the basis of larger competencies (4). There are four characteristics that distinguish these types of programs from the traditional educational programs, including emphasis on program outcomes, emphasis on competencies as the guiding principles of other components of the program, lack of emphasis on time in these programs, and increased emphasis on student-centeredness in these programs (3, 5).

Despite the emphasis of medical education communities on this approach and the movement of most universities of medical sciences across the world towards it, medical education in undergraduate and graduate levels in Iran is still delivered traditionally (6). On the other hand, infectious diseases remain the most important cause of mortality and morbidity (7). Increased threats of infectious diseases, such as the AIDS, SARS, and the influenza, as well as increased drug resistance and emerging diseases in every part of the world have led medicine and public health to continue to be globalized. Therefore, physicians need to learn about determinants of health and disease, including socioeconomic and geopolitical contributors and bilateral cultural interactions as well as numerous other issues. This, along with increasing population growth and transaction of products, services and information between countries and continents have had a significant impact on health and health care across the world (6). This role is especially important for infectious diseases specialists in Iran.

As it is highly important for infectious diseases specialists to acquire the necessary competencies for the treatment of patients with different diseases in this changing world, and as it is vital to develop a curriculum based on competencies required for globalization, this study aimed to identify and present the competencies required by an infectious diseases specialist through localizing the competencies laid down by the Accreditation Council for Graduate Medical Education (ACGME) of the United States.

## METHODS

This research is a quantitative study of survey type using the Delphi Needs Assessment Technique. In this study, the ACGME competencies were built on as the basis, and a list of essential competencies for training in the infectious diseases course was defined.

According to ACGME, the required competencies are in six areas: (a) Patient Care and Procedural Skills, (b) medical knowledge, (c) Practice-Based Learning and Improvement, (d) Interpersonal and Communication Skills, (e) professionalism, and (f) Systems-Based Practice. Through a library review of the infectious diseases residency specialty curricula of the University of Emory, University of California, McMaster University of Canada, Santo Thomas in the Philippines, and the Royal College of London, England, the expected competencies from an infectious diseases specialist were extracted. The requirements were formulated in a preliminary questionnaire, which was subsequently given to 15 specialists of infectious diseases and pediatric infectious diseases, microbiologists, and supervisors of the Infectious Disease Control Committees in Mashhad-based hospitals in order to assess the expected competencies as a field study. In addition to the items laid in the questionnaire, their supplementary comments were also acquired via open-ended questions.

At this stage, the inclusion criteria were all infectious diseases specialists and pediatric infectious diseases specialists (faculty and non-faculty staff), microbiologists, and supervisors of infectious disease control committees in hospitals affiliated with Mashhad University of Medical Sciences. Exclusion criteria involved unwillingness to participate in this study. In total, at this stage, 15 people responded to the questionnaire. After reviewing and completing the competencies obtained at this stage, the final questionnaire was devised. Its content validity was assessed using the Waltz & Bausell's approach, whereby the views of 15 infectious diseases specialists (12 faculty and 3 non-faculty specialists) and 3 infectious diseases residents were enquired about the clarity, simplicity and relevance of the items on a 4-point Likert scale. Content Validity Index was obtained for every item, and the item was eliminated if the coefficient was below 0.79. Also, to assess the face validity of the questionnaire, the participants were asked to determine the importance of each item on a 5-point Likert scale. Items with impact coefficients below 1.5 were excluded from the questionnaire. The reliability of the questionnaire using Cronbach's alpha coefficient was 0.90.

In the final stage, a questionnaire containing 234 items was extracted in order to assess the importance of the competencies needed for instruction in the infectious diseases specialty course. The scoring criterion for this questionnaire was based on a 10-point Likert scale where a high priority competency was scored 10, while a low priority competency was scored 1. The questionnaire was sent to the faculty members of different universities and cities across the country. The inclusion criteria for those who completed the checklist at this stage comprised of all infectious specialists, including faculty and non-faculty members, as well as

infectious diseases Exclusion criterion at this stage was disagreement to participate in the study.

At the end, the questionnaire was completed by 28 faculty members from medical sciences universities of Tehran, Mashhad, Birjand, Kermanshah, Kashan, Hamadan, Arak, Kurdistan, Sistan and Baluchestan, Khuzestan, Kerman, Babol, and Bandar Abbas; 15 infectious diseases specialists in Tehran, Mashhad, Shiraz, Gorgan, Chalus, Bandar Genaveh, Ilam, Boukan, Torbat Jam, Torbat Heydarieh, Bardesakan, and Neyshabur; and 12 infectious diseases residents in Mashhad, Kermanshah, and Kashan.

The collected data was analyzed in Excel 2013 software. As the scientific rank of the participants differed, coefficients were considered for their opinions. In this way, an opinion by a professor was multiplied by 4, whereas those of an associate professor, and an assistant professor or a specialist with over 10 years of tenure were multiplied by 3 or 2.5 respectively. The coefficients for an assistant professor or a specialist with less than 10 years of tenure was 2, and that of residents was 1. In this way, the average score given by 55 individuals was computed for each item whereupon the competencies were prioritized. In the next step, on the experts' panel, general and specialized competencies were categorized according to the competencies obtained.

**RESULTS**

Based on the results of this study, a total of 216 competencies were extracted as essential for training infectious diseases assistants. Of these competencies, 126 were categorized under one general rotation and 90 competencies under ten specialized rotations. These competencies are defined based on ACGME six-competency model in each rotation.

According to the results, a general rotation was defined for infectious diseases assistants for which the competencies were defined according to each competency contained in ACGME. The number of required competencies is determined based on the mean score assigned to them and based on the ACGME model in the general rotation (table 1). In the medical knowledge domain, from among the 22 competencies, specialized knowledge concerning patients with the sepsis syndrome and fever and rash with unknown cause gained the highest score (21.59 and 21.13) and medical knowledge in the field of infection of travelers and eye infections had the lowest scores, respectively (17.33 and 16.5).

Also, according to the results of this study, in the patient care

domain, 21 competencies in the hospitalization ward, 7 competencies in the outpatient department, and 14 competencies in the procedures ward were obtained with the mean scores of 19.63, 20.64 and 19.05, respectively. Among the competencies of the hospitalization ward, differential diagnoses according to the patient's problem and getting accurate, comprehensive, biography that is relevant to the patient's problem with the mean scores of 21.85 and 21.7, respectively, had the greatest importance, whilst chronological organization of signs, possible exposures, risk factors, and previous treatments and diagnosis of the psychological context of certain chronic infectious diseases, such as AIDS and viral hepatitis with the mean scores of 17.65 and 17.47, respectively, were the least important. In the outpatient department, obtaining a proper biography and completing a full examination at the clinic and monitoring the patient during the visit and follow-up on future visits, with averages of 21.02 and 20.02, respectively, were of the highest importance; in the procedures department, the competency of performing spinal cord puncture scoring 21.37 was of the highest significance, while CV-line fitting scoring 14.92 was of the least importance.

In the practice-based learning and improvement domain, nine competencies were extracted, including the "belief and skill of teaching the patient and his/her family", "identifying and designing one's own strengths and weaknesses at the end of each rotation", "updating knowledge and skills", "using modern information technologies for educational purposes", "belief in and skill of training students and other individuals in the care team", "identifying and applying proper learning activities", "applying evidence-based medicine approach", "belief in and skill of training faculties in other wards as well as other physicians about infection control", and "systematic analysis, application of quality and performance improvement methods" with mean scores of 19.9, 19.4, 19.19, 19.18, 19.13, 19.13, 19, 18.84, and 17.73, respectively.

Also, in the "interpersonal and communication skills" domain, the competencies of concise and useful introduction of the patient and examination skill according to the patient's mental and psychological status are respectively the most important (21.7 and 21.5), while the competencies of working effectively with other professionals to prevent, negotiate, and resolve inter-professional disputes and striving to increase public information through media are the least important with 18.26 and 17.85 mean scores,

**Table 1. Frequency distribution and mean ratings of the essential competencies for infectious diseases assistants in different areas in the general rotation**

Domain	Number of competencies	Mean rate score
Medical knowledge	22	19.77
Patient care	42	19.61
Practice-based learning and improvement	9	19.07
Interpersonal and communication skills	21	19.61
System-based practice	20	17.93
Professionalism	12	19.84

**Table 2. Distribution of the competencies necessary for infectious diseases assistants in different domains in different rotations**

Rotation/ Competency domain	Medical knowledge	Patient care	Practice-based learning and improvement	Interpersonal and communication skills	System-based practice	Professionalism
Infection control	12	22	9	21	20	12
Epidemiology of infections in society	12	22	9	21	20	12
Microbiology	14	22	9	21	20	12
Hospital infections	6	23	9	21	20	12
Infections in immunocompromised individuals	4	26	9	21	20	12
HIV	6	27	9	21	20	12
Tuberculosis	2	26	9	21	20	12
Pediatric infections	6	26	9	21	20	12
Radiology	3	22	9	21	20	12
Skin and burns	3	26	9	21	20	12

respectively.

There were 20 competencies as concerning the "system-based practice" domain in the infectious diseases ward, among which management of cost-effective diagnostic and therapeutic plans and management and implementation of issues related to the epidemiology of common infectious diseases in the region had the highest mean scores (21 and 20.8, respectively) and participation in the laboratory rounds and recognition of how the Ministry of Health affects the provision of infectious disease care, and educational and research activities at the national and regional levels obtained the lowest average scores (15.94 and 15.51, respectively).

Another domain among ACGME's competencies is professionalism. In this study, 12 competencies were defined within this domain, where timely attendance at the department, clinic, laboratory, etc. during each rotation and notification given to the faculty at his/her absence, and respect for autonomy and presentation of diagnostic-therapeutic therapies to the patient prior to one's own definitive decision with the mean scores of 20.68 and 18.93 had the highest and least importance, respectively.

In addition to the general rotation, ten specialized rotations were also defined for assistants the competencies of which are based on the ACGME parameters (table 2).

As indicated in table 2, the number of competencies associated with the "medical knowledge" domain in specialized rotations account to 88, which overrides their counterpart in the general rotation. Moreover, in the "patient care" domain, 22 specialized competencies were defined in addition to the competencies of this domain in the general rotation, of which one competency was related to hospital infections, 5 competencies to HIV infections, and 4 to each of the 4 rotations of infectious diseases in immunocompromised individuals, tuberculosis, pediatrics infections, and skin and burns.

In the "infection control" rotation, the competencies of the

highest importance within the "medical science" domain were "familiarity with the epidemiology of hospital infections and examining the prevalence of infectious diseases in the hospital" and "infection control management" with average scores of 24.58 and 19, respectively. Also, the least important competency in this domain was "infection control" with an average score of 14.72.

From among the 12 competencies in the rotation "epidemiology of infections in the community" and in the domain of "medical knowledge", the highest score belonged to "recognition of the importance of the outbreak of communicable diseases in the region" with an average score of 24.58.

In the microbiology rotation, the most important competency in the domain of medical knowledge was "PPD performance and interpretation" with an average score of 20.3.

Also, in the "hospital infections" rotation, the competencies of "hospital blood and catheter infection" and "hospital pneumonia" had the highest scores, i.e., 21.59 and 21.31, respectively, and in the patient care domain, "appropriate strategies for the implementation of therapeutic interventions to prevent infection" had the average score of 18.77.

In addition, in the rotation "infectious diseases in immunocompromised individuals", the competency of "management of fever in patients with neutropenic malignant" had the highest mean score (i.e., 21.23) in the "medical knowledge" domain, while the competency of "provision of necessary recommendations to patients during post-engraftment to prevent infections" had the lowest mean score (i.e., 18.56) in the "patient care" domain.

In the HIV rotation, in the medical knowledge domain, the competencies of "HIV infection and its general manifestations", "HIV infection and its digestive tract manifestations", "HIV infection and respiratory symptoms",

"HIV infection and diagnosis and treatment", "HIV infection in women and children" and "HIV infection and opportunistic infections" obtained the same average score of 21.07, which indicates a similar importance in the view of the participants in this study. The competencies that were extracted in the patient care rotation were five, which included "recommendations for pregnant women with HIV", "recommendations for preventing the transmission of HIV to others", "determination of HIV staging in the HIV clinic and its appropriate management", "clear and accurate explanation of the course of HIV treatment, the importance of proper drug use, the risk of resistance, and drug side-effects", and "clinical and laboratory evaluations of HIV patients with and without treatment-differentiated indication".

In the tuberculosis rotation, two medical knowledge-associated competencies on "mycobacterial tuberculosis and associated clinical syndromes" and "anti-mycobacterial drugs" were obtained. Similarly, in the patient-care domain, the competencies of "proper management of the tuberculosis patient", "diagnosis and treatment of latent tuberculosis in high-risk patients", "correct treatment of individuals with positive PPDs or histories of contact with a tuberculosis patient" and "clear and precise explanation to the patient and his/her relatives about the course of tuberculosis (susceptible and resistant), the importance of correct drug use, disease complications and drug side-effects, transmission routes, transmission period, and the required precautions" were obtained.

The competencies in the medical knowledge domain in the pediatric infections rotation included "neonatal sepsis", "fever and rash in children", "neonatal meningitis", "congenital infections", "infection complications caused by vaccine", and "infection in patients with congenital immunodeficiency"; in the patient care domain, the competencies comprised of "performing LP in children", "brain shunt aspiration", "surface infection aspiration", and "performing BMA-BMB in children" with the mean scores of 20.37, 18.9, 18.85 and 17.94, respectively.

Also, the average scores obtained in the competencies required in the radiology rotation in the medical knowledge domain were "simple radiography interpretation", "CT scan", and "MRI interpretation" with mean scores of 20.56, 18.98, 17.69, respectively.

The competencies required in the "skin and burns" rotation in the domain of medical knowledge included "antibiotics", "dermatological diseases of viral and bacterial infections" and "burn infection" with average scores of 20.3, 19.19 and 18.48, respectively. In the patient care domain, the competencies comprised of "management of patients with severe skin reactions following infection or antibiotic use", "distinction between common rashes caused by infections and other causes, such as antibiotic allergies", "distinction between infectious and non-infectious rashes", and "prevention and treatment of infections in burn patients" with average scores of 21.11, 20.38, 19.97, and 18.69, respectively.

As the results of the study showed, the highest number of competencies defined in all general and specialized domains

was obtained in the "medical knowledge" domain, which seems obvious given the importance and key role of having basic knowledge in all affairs.

## DISCUSSION

The aim of this study was to develop the competencies needed to train in the infectious diseases specialty residency program in Iran. Based on the results of this study, a total of 216 competencies were extracted and subsequently categorized into one general rotation with 126 competencies and ten specialized rotations with 90 competencies. The competencies were defined according to the ACGME model in each rotation. The results showed that the most frequent competency in both general and specialized domains was medical knowledge, which seems evident given the importance and key role of having basic knowledge in all affairs.

The general and specialized categorization model of the competencies derived in this study is similar to the model defined in the General Medical Council (GMC) by the Joint Royal Colleges of Physicians Training Board (JRCPTB). In this council, standards have been stipulated for the training of physicians. The curriculum that was developed by the Council in 2010 for infectious diseases specialty residency, the competencies needed to train were categorized into general and specialized categories. However, in terms of the number of competencies in each category, there were 11 general and 19 specialized competencies in six domains (8). The difference in number between the GMC curriculum and the proposed one in this study is due to the fact that in the GMC model, these competencies are defined more broadly, while in the present study, competencies are defined more delicately. The GMC curriculum is also different as it defines indices separately for each of the knowledge, attitude, and skills domains to achieve competencies. Given that competency is a mixture of knowledge, attitude, and skills, this categorization seems to be in conflict with the definition of competency because when defining competency, the dimensions of knowledge, attitude, and skills cannot be defined separately.

In this study, inpatient and outpatient rotations were considered separately, which provided the basis for categorizing the required competencies, such that six domains were considered in each inpatient and outpatient rotation, according to the ACGME model. Moreover, for each of these domains, the relevant competencies were defined and categorized. The model obtained in this study is different from that of other curricula. For example, at the University of California, this category of competencies is based on ACGME domains, and the competencies are defined under each of the domains (7), while the inpatient and outpatient rotations are not mentioned. In this model of categorization, competencies are defined in general terms, ignoring specialized competencies. It is also not clear in the Californian curriculum at what stage each of these competencies will be attained. However, in the present study, a high number of competencies are defined in both general and specialized terms.

In the context of McMaster University of Canada, residents in

the inpatient and outpatient rotations are trained according to the CanMEDs competencies approved by the RCPSC, although the details are not provided in the curriculum. However, categorization of the competencies according to the inpatient and outpatient wards are expressed separately. At this university, there are two years of training for residency program, with each year being divided into 13 educational blocks that are similar to the specialized blocks defined in the present study. This means that the specialized blocks are also considered, similar to the present study. Clinical (outpatient) courses are provided both in sectional and longitudinal terms. In practice, this is managed in the Iran-based universities of medical sciences longitudinally via educational clinics. The training chart for McMaster University is presented below (9).

At UCSF, the curriculum only points to hospitalization and outpatient rotations as well as the research phase. The curriculum provides opportunities for residents to encounter nearly 1,000 AIDS patients. The university also provides educational opportunities in the fields of epidemiology, microbiology and preserving antimicrobial drugs for assistants, which is similar to the competencies expected in the present study (10). Of course, because of the fact that the expected competencies in epidemiology, microbiology and antimicrobial drugs, etc. are of great importance to infectious diseases specialists, most of the curricula in this regard address these areas. Although some universities do not explicitly refer to these areas in the curriculum, this may be included in the details of the program.

At Emory University, the inpatient and outpatient rotations are considered from the onset, whereupon resident education is planned. Only in the outpatient rotation the residents need to have sub-specialized rotations such as hepatitis C clinic, organ transplantation clinic, TB clinic, the travel clinic, and the outpatient antibiotics therapy clinic (11). Since clinical education is today focusing more on outpatient training, it is reasonable to plan sub-special only in the outpatient ward. In addition to the curricula thus far discussed, in the curriculum developed by the Infectious Diseases Society of America (IDSA), residents are also planned to have clinical experiences in outpatient and inpatient rotations. In this program, the two types of "medical knowledge" and "technical and other skills" are only mentioned. The medical knowledge domain points to the formal educational courses or clinical experience of 25 disorders for which the residents learn how to prevent, assess, and manage them. The technical and other skills

domain also includes multiple skills in six separate areas, which are similar to our study; however, they are more limited in terms of planning (12). At this university, the residents undergo clinical experiences only for 25 infection-associated dysfunctions, which reflects the need for native education in the respective country. This has also been considered in this study as concerns with the domestic needs of the infectious diseases discipline for education.

Comparison between different universities in terms of the number of competencies or expected rotations in the infectious diseases curriculum shows that few competencies have been considered in these countries. This can be attributed to two reasons: first, the subspecialization of the discipline in these countries and, secondly, inclusion of the general competencies in the undergraduate curriculum in these countries, whereby their number for specialized and sub-specialized courses is reduced.

Comparison between curricula of different countries and the currently proposed one showed that although the formulation of inpatient and outpatient rotations are considered, which is a significant issue due to its importance, this has been done differently. For instance, in McMaster and Emory curricula, from the very beginning, clinical experiences have been categorized into inpatient and outpatient rotations, and it is expected that the training of competencies will be achieved via these rotations. In the present study, outpatient and inpatient rotations are not addresses as comprehensively as discussed at other universities, and are defined only as the subset of the patient care domain. This difference may be due to the different formulation of various competencies in different rotations in this study, and it does not essentially make a difference in the acquisition of competencies. In fact, as the results of this study indicate, the outpatient or inpatient domains are discussed under each of the proposed rotations. This proposed curriculum formulation can be a hallmark of the emphasis on acquiring all six competencies in each rotation to achieve the objectives of the curriculum.

One of the findings of this study was focus on the pediatric rotation. In this regard, pediatrics infections is delivered on the Emory University's curriculum as a separate course in a three-year period (11). However, in the IDSA curriculum, this rotation is embedded into the infectious diseases fellowship curriculum, which is delivered as attendance in pediatric immunization clinics and electively as rotation in the pediatric inpatient ward (12). The difference in the delivery mode in each country can be due to the educational policies of the respective country. Attention to research in the

**Table 3. Arrangement of educational blocks at McMaster University for the two-year infectious diseases fellowship training**

1 <sup>st</sup> year	Inpatient ID (2 blocks).	Bacteriology (2 blocks).	Inpatient ID (2 blocks).	Infection Control	Inpatient ID (2 blocks).	Molecular	Virology	Research	Mycology
	Longitudinal Clinic								
2 <sup>nd</sup> year	Inpatient ID (2 blocks).	Pediatric ID (HSC). (2 blocks).	Elective	PH Lab	Research	Community (2 blocks).	Research (2 blocks).	Outpatient Clinics (2 blocks).	
	Longitudinal Clinic								

competency-based curriculum was another point that was addressed in the curricula of McMaster, Emory, and California universities, as in the proposed curriculum (7, 9, 11).

This paper enquired into the process of developing the competencies required in the competency-based curriculum for the specialized infectious diseases residency specialty program. This stage of curriculum design is the most important and basic stage of curriculum design, and is only part of the project undertaken in the specialized infectious diseases residency specialty dissertation at Mashhad University of Medical Sciences. Given the breadth of the topic, the needs assessment and development of the necessary competencies were the basis for writing this article. It is hoped that the authors of this article will also publish the other results of this thesis in the future. It is suggested that competency-based education be put on the agenda of the Ministry of Health and Medical Education, and subsequently, the universities training residents, and that the curricula of all specialized disciplines be revised according to competencies needed in each discipline and accountable physicians can be trained. On the other hand, as it has been pointed out in the UCSF University's curriculum, opportunities should be considered for education through post-residency programs in the curriculum. Therefore, it is necessary to pay more attention to what is called the continued medical education in Iran, so that after the completion of academic education, lifelong education will be guaranteed for physicians. Another point is that such a

program requires a close link between the centers for disease control and prevention and other schools, including the school of public health, in order to enable the cooperation and the strengthening of the system-based work competency proposed by this curriculum.

The limitations of this study were the lack of access to the lesson and course plans of universities on the global scale. In the programs available on the university websites, there was a program that included the entire course. However, access to the details of the lesson plan and the course plan could provide more information concerning education to the authors of the paper so that the information can be used to expand the results of the study. Also, lack of access to residency programs in many universities was another limitation of this study.

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