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Educational Article

A guide to developing a competency based curriculum for a residency training program – Orthopaedic prospective



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المخلص

أصبحت برامج تدريب الأطباء المقيمين من الأساسيات الضرورية في حياة الطبيب التعليمية الطويلة. وقد بدأت في المملكة العربية السعودية مثل هذه البرامج منذ أكثر من ٢٥ سنة في التخصصات المختلفة، ومنذ بدأت طرأ على هذه البرامج الكثير من التغيرات، التي كانت في معظمها تعتمد على الخبرة الشخصية للقائمين على هذه البرامج، التي تعتمد على خبراتهم الشخصية في التدريب الذي حصلوا عليه. ترتب على ذلك أنه في أحيان كثيرة لم يتم تلبية الاحتياجات المهمة والرئيسية للأطباء المقيمين، ولم تكن طرق التدريب والتدريس تساعد على تحقيق أهداف هذه البرامج.

في السنوات الأخيرة قام عدد من الجهات المختلفة في العالم، بتطوير نماذج تدريب جديدة اعتمد كثير منها على تحقيق أهداف محددة ومعينة، يتم تحديدها بناء على دراسة الاحتياجات الفعلية. في هذه المقالة نقوم بشرح إحدى هذه الطرق والأساسيات المتبعة في تطوير برامج تطوير كفاءة الأطباء المقيمين، ونعطي مثالاً لكيفية تطبيق بعض هذه النظريات على برنامج للمقيمين في جراحة العظام، وسوف يتم شرح طريقة إعداد البرنامج والمنهج بالاعتماد على طريقة التطوير العكسي لتحديد الكفاءات المطلوبة وتحديد نتائج التعلم.

الكلمات المفتاحية: كفاءة؛ المنهج؛ جراحة العظام؛ برنامج تدريب المقيمين؛ التخطيط العكسي

Abstract

Residency training programs have emerged as an essential and important element in the lifelong learning path for any physician. In the Kingdom of Saudi Arabia (KSA),

residency programs in different specialties have been implemented for more than 25 years. Although a number of changes have taken place regarding the format and conduct of these different training programs, the majority of residency programs have been developed based on the expertise of the prominent academics in the field and on feedback from physicians that underwent previous training programs in the region. However, in many centres, the true needs of physicians are not met and the teaching strategies used do not result in the intended outcome.

In recent years, many new models for the development of residency program curricula have been developed worldwide. Many of these models are based on specific needs or are goal-driven. This article describes several of the essential and fundamental concepts for developing a competency-based curriculum for a residency training program in the field of orthopaedics. The concept of backward planning is explained, and the possible teaching methods based on the identified competencies and desired learning outcomes of physicians are illustrated.

Keywords: Backward planning; Competency; Curriculum; Orthopaedic residency program; Residency training

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Introduction

Today's physicians continue to witness significant changes in the nature of health care delivery. Clinical practice

is changing daily, with literally thousands of medical journals documenting our evolving understanding of the clinical sciences. Patients are treated in more diversified settings.¹ Patients spend less time in hospitals, and those who stay longer are usually older patients with many co-morbidities. We live in an era with a rising emphasis on accountability, and information has been made easier to access than ever before. Furthermore, patients are more aware of treatment options.

Medical education has evolved in the last two decades, and new theories and methods have been introduced in this field. The aim of medical education is to educate care givers to provide a high standard of medical practice for a healthier community. An important step in the lifelong learning experience for any physician is residency training. New curricula have been developed in many parts of the world with the aim of providing physicians with a quality education to aid in the ultimate goal of developing a healthy community.

A new method of educational planning has been advocated with the end result in mind. In other words, the goal of a training program curriculum should be determined, and the planning of that program should be designed to reach that goal. The ultimate goal is to address issues that pertain to the overall health of the community and to identify competencies through which trainees can perform the skills needed to address these clinical issues.² However, there is very little information on using this method of educational planning in postgraduate education, specifically for residency training programs.³⁻⁷ The CanMeds is a famous example of a similar approach to educational planning.¹ There have been some efforts to establish SaudiMeds; however, these efforts are still in the earliest stages. The aim of this paper is to outline the important steps and processes in developing a curriculum for a residency program in orthopaedics using this new method.

Backward planning

This proposed curriculum for the orthopaedic residency program was designed using a “backward planning” strategy. The ultimate goal of medical education, the development of a healthy community, was outlined in the above paragraph. Thus, we first needed to identify the community health issues for which patients seek medical attention.

Once these clinical problems were identified, the next step was to identify the clinical performances that are required by the physician to address these clinical problems. For example, if we identify pain and disability following treatment of femoral neck fractures in the elderly as a common community health problem, then the performances affecting this problem would include a correct diagnosis, performing an anatomic reduction and performing the correct fixation. These are called the “performances”. Based on the identified performances, competencies need to be developed. Competency is holistic and requires the documentation of learning abilities, which include the cognitive knowledge, psychomotor skills and affect, or attitude, that will help physicians in performing at the level of clinical practice.⁸

A competency based curriculum aims at developing different aspects of the learner to allow him to have the

abilities necessary to perform at the level of clinical practice in the community. Competencies can be developed in many areas, including clinical, research, communication and other domains. However, here we concentrated on developing clinical competencies.

Competencies are broken down into the domains of learning, i.e., knowledge, skills and attitudes, and for each domain, the intended learning outcomes must be developed. The level of the resident must be considered because learning outcomes are different for junior residents and senior residents (Figure 1).

Documenting the learning objectives under a specific learning domain helps in choosing the correct teaching method. Specific teaching methods that are suitable for a specific learning domain are necessary to assure that the learning processes are effective (Figure 2).

Needs assessment

Performing a needs assessment is an important part of designing any educational curriculum. Needs assessments generate information regarding what health issues need to be addressed and how residents prefer to be taught. They also can help identify issues related to faculty development and help optimise training. Needs assessments can be conducted using a questionnaire and direct interviews with different stakeholders.⁹

Key principles and organisation of curriculum

Although this is a competency-based curriculum, other concepts from other curricula can be used.

Core curriculum with options

The “core curriculum with options” concept identifies certain topics as essential, and they become an integral part of the curriculum; the learner must complete those areas of the curriculum and learn those topics. In addition to the integral topics of the curriculum, there are topics that are considered optional, and the learner can choose to complete those areas of the curriculum based on a specific need.¹⁰

Spiral curriculum

With spiral curricula, basic science principles are covered in the first stages of learning. However, these principles are revisited as the learner progresses through the curriculum to help reinforce these principles.

Adaptive curriculum

Although adaptive curricula have received much criticism, this type of curriculum has the advantage of being adaptable. No resident is able to progress from one stage of learning to the next without comprehending the core principles of that stage. This ensures that at the end of the training the resident will have successfully acquired the core knowledge intended by the curriculum.

Taking into consideration these different concepts of residency training curricula, we present an example of the

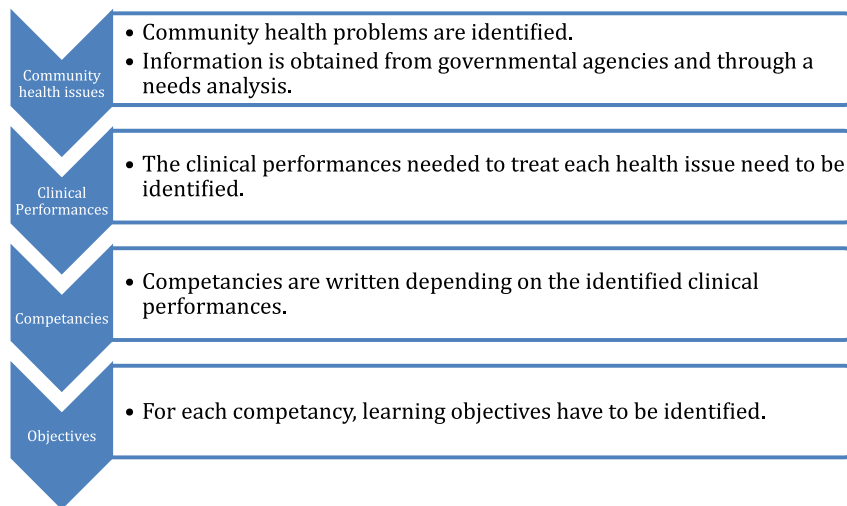


Figure 1: Backward planning for competency-based curriculum.

design of a curriculum for an orthopaedic residency program. The proposed curriculum is organised as follows:

1st Stage

After a resident is accepted into the program, he begins start his training in the basic principles of surgery and orthopaedics. This can be achieved by clinical rotations in aspects that will help the resident acquire the basic knowledge and skills necessary to progress through his training. Thus, the first year of training will consist of clinical rotations in areas to be defined based on the necessary competencies. The rotations with cover methods that mainly help the resident

acquire knowledge and skills. This will be supplemented with feedback sessions at regular intervals to help adjust for any noticeable deficiencies. At the end of this stage, the resident will have to pass an assessment to progress to the next stage of his training. This assessment will assess knowledge and basic skills. This stage is suggested to be 12 months in duration.

2nd Stage

In this stage, the resident will rotate in different specialties (modules) for a period of 24 months. These modules should have specific learning objectives related to the specialty and

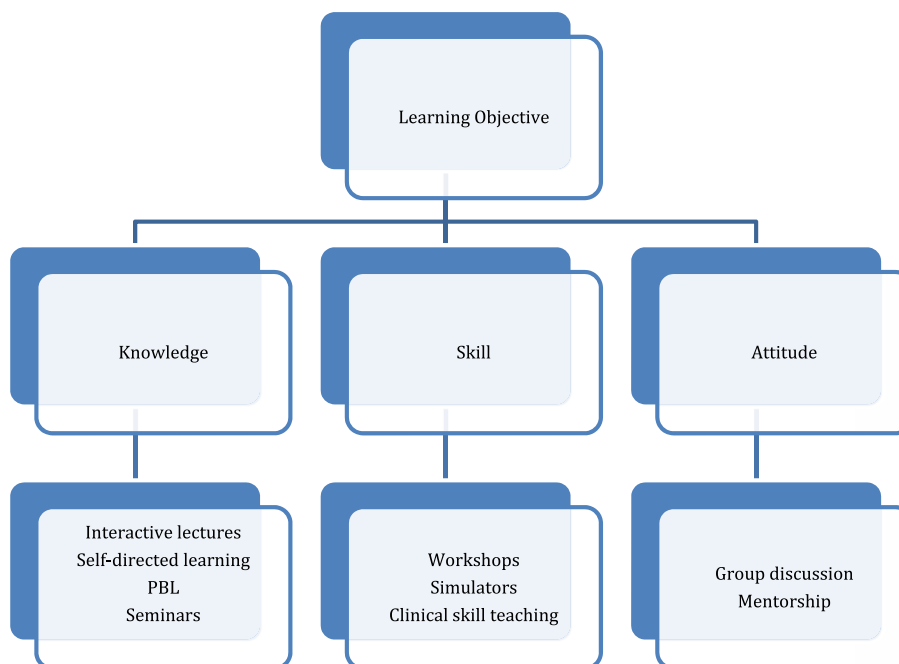


Figure 2: Learning method.

the level of the resident, who will be a junior resident at this stage. The goal of these modules will be for the resident to acquire basic principles of knowledge and skills in different specialties. During and at the end of each module, a feedback session will be conducted to evaluate the performances of both the residents and tutors and to make any necessary adjustments to the curriculum. At the end of the first year of this stage, an assessment of knowledge will be performed, and at the end of the 2nd year, an assessment of knowledge and skills will be performed.

All of the modules in this stage are core modules, and the resident will not be able to pass to the next stage without successfully completing all of these modules.

3rd Stage

In this stage, the resident will repeat most of the modules he went through in the first two stages; however, this stage will build on his basic knowledge and have more emphasis on building more skills and attitudes (spiral curriculum concept). The learning objectives for each module will be written according to the resident's level, which at this stage is a senior resident level. The resident will go through a similar process of feedback and assessment; however, at this stage, tools for assessing skills and attitudes will be used more than in the previous stages (Figure 3).

Competencies for the orthopaedic training program

Developing and writing competencies for a curriculum is a major challenge for the development of any curriculum. Competencies are abilities that residents must master to perform a task in a real-life situation. Based on the necessary competencies, learning outcomes are defined, and the proper teaching method is chosen based on the domain being addressed, knowledge, skills, or attitudes. Care must be taken when writing the competency to ensure that it meets the required needs and that the learning process is successful.

Here, we provide an example of competencies suggested for an orthopaedic residency program; however, it is important to note that these competencies are based on previous experience and not on a needs assessment.

After the training program the resident should be able to do the following:

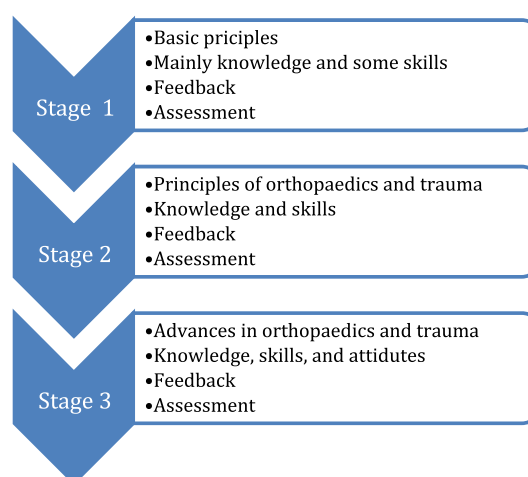


Figure 3: Stages of curriculum for orthopaedic training.

Once the competencies have been planned, and the stages of the educational process have been defined, now the educational plan must be developed in more detail based on the defined competencies; this involves defining the aim of the educational plan, the learning objectives for each competency according to the level of the resident and the learning method.^{9,11}

Here, we provide an example of the development of an educational plan for the 1st stage of a training program. The following stages can be developed in a similar manner.

Educational plan

AIM

To train medical graduates who have chosen orthopaedic surgery as their specialty so that they obtain the knowledge, skills and attitudes that will support them in becoming safe and effective surgeons who can assess, manage and solve problems of patients with MSK disease in the community.

The four main characteristics of this curriculum (outcome-based) are as follows¹²:

C01	Understand the concepts of fracture stability, their influence on bone healing, and how to apply implants to achieve the appropriate stability for different fractures.
C02	Plan treatments based on assessment, imaging, classification, and decision-making.
C03	Assess and treat disorders of paediatric patients.
C04	Recognise risks of different treatment methods in paediatric patients and ways to prevent such risks.
C05	Assess and treat sports-related fractures.
C06	Assess and treat disorders of the foot and ankle.
C07	Demonstrate strategies for assessing and treating tumours of the MSK system.
C08	Manage polytrauma patients.
C09	Evaluate, classify, and formulate a treatment plan for joint disorders.
C10	Recognise risk factors and complications and manage osteoporosis.
C11	Recognise and treat bone union disorders.
C12	Recognise and manage disorders in the elderly related to the MSK system.

Each competency can be broken down into many subjects and elements, ranging from clinical assessment and reasoning to skill performance.

- Outcomes are clearly identified.
- Achievement determines progress.
- Multiple instructional strategies and authentic assessment tools are used.
- Students are given time and assistance to reach their maximal potential.

Stage 1

The aim at this stage is to prepare the resident with the basic knowledge and principles of orthopaedics in particular and surgery in general. This will involve mastering the basic surgical skills and gaining the basic science knowledge that are essential for the resident to proceed through his training.

Of the overall competencies for the program identified earlier, the competencies that must be addressed at this stage are as follows:

C01	Understand the concepts of fracture stability, their influence on bone healing, and how to apply implants to achieve the appropriate stabilities for different fractures.
C02	Plan treatment based on assessment, imaging, classification, and decision-making.
C08	Manage polytrauma patients.
C09	Evaluate, classify, and formulate a treatment plan for joint disorders.
These are the only competencies needed at this stage.	

The learning objectives are as follows:

By the end of this stage, the resident should be able to do the following:

1. List the stages of bone development.
2. List the stages of bone healing.
3. List the different stages of inflammation.
4. Master fluid management for different patients, including paediatric, adult, geriatric, and trauma patients, etc.
5. Perform different suturing techniques.
6. Perform assisting tasks in the operating room.
7. List the different principles for taking medical histories for different aspects and pathologies of MSK disorders.
8. Perform different clinical examinations of joints and limbs.
9. Perform the necessary investigations and radiological studies of different joints and limbs.
10. List different findings on x-rays of limbs and joints.
11. Perform an initial assessment of trauma patients.
12. Perform basic resuscitation of cardiac arrested patients.
13. Know the principles of fracture management.
14. Interpret different laboratory results.
15. Perform basic splinting and casting techniques for different parts of the body.

Educational method

The aim of this stage is to develop knowledge and skills based mainly on the learning outcomes defined above. However, many methods for clinical teaching have been described,¹³ including the use of simulation.¹⁴ In this example, the learning objectives can be achieved as follows:

Clinical attachment

To achieve the learning objectives for clinical attachment, residents will spend a minimum of 12 months rotating in four main areas and disciplines to learn the necessary skills. They will perform rotations in General Orthopaedics, General Surgery, Plastic Surgery and Intensive Care Medicine. During this time, the resident is given objectives and is expected to engage in self-directed learning and discussions throughout his different rotations; he/she is expected to observe and imitate skills learned during clinical rounds and in the operating room, emergency room and outpatient clinic.

Weekly academic half day

During a weekly 3 h session consisting of 2 parts, the new residents will be engaged in problem based learning (PBL).⁸ Throughout the year, they will be given a total of 16 clinical problems to discuss. Each problem is discussed over a period of two weeks. These problems are planned to cover all aspects of the defined objectives outlined above. This activity will be allocated 1.5 h weekly.

For the other 1.5 h of this weekly session, the residents will be asked to prepare a journal club activity or a mortality and morbidity round. This will be conducted as a tutorial activity with the basic aim of attaining knowledge through discussions.

Skills labs

In skills simulation labs, the resident is expected to learn basic surgical techniques. He will be taught basic knowledge and how to perform the skills, and he will be evaluated before he is considered to have completed the course.

Additionally, he will be expected to complete a course on basic life support (BLS) and advanced trauma life support (ATLS).

An example of how to organise a resident's weekly activities is shown in [Table 1](#).

Implementation

The implementation of this curriculum to the current orthopaedic residency program requires several actions,

Table 1: The table below is an example of the weekly plan for a resident in phase 2 of the training program.

Day	7:30–8:00	8:00–12:00	13:00–17:00
Day 1	Admission rounds (endorse cases)	Clinical rounds with team (clinical reasoning)	Self-learning
Day 2	Admission rounds (endorse cases)	Operating Room (skill learning)	Operating Room (skill learning)
Day 3	Admission rounds (endorse cases)	Academic half day	Clinical rounds with team (clinical reasoning)
Day 4	Admission rounds (endorse cases)	Outpatient clinic (clinical skill learning)	Clinical rounds with team (clinical reasoning)
Day 5	Admission rounds (endorse cases)	Self-Learning	Outpatient Clinic (clinical skill learning)

including identifying resources, support, and possible barriers.⁹ It is important to address these issues before implementing this curriculum. Some of these issues may generate an economic cost, which also must be addressed.

Political issues

The orthopaedic residency training program currently in place in Saudi Arabia is a joint program of different hospitals with one scientific committee that supervises the program and decides on the regulations and the general conduct of the training and assessment processes. This training program has been run in this manner for more than 20 years, over which time some changes to the program took place; however, in many instances this training program has not fully met the needs of residents and tutors. There is a general feeling among some people involved in managing this program that change to this program has been resisted. In 1999, Hamad mentioned that there is usually an urgency for implementing new plans in developing countries¹⁵; however, this is only the case when there is agreement regarding the desire to implement a change to a training program or to develop a new strategy for a training program, which is not always the case. Thus, building a strong case for the development of a new curriculum is a major step in the implementation process.

In this regards, it is essential to establish early partnership with the health system authority,¹⁵ in this case, the 'Saudi Commission for Health Specialties'. It is also necessary to be acquainted with the new curriculum and to be considered as one of the main stakeholders in the process of curriculum development. Persons promoting a new curriculum must be familiar with the benefits of that curriculum and the implementation process and must be aware of any changes to the new curriculum as it is being developed.

Resources

Many resources are necessary for residency training programs, including faculty, training residents, the health care system, learning resources, financial support for the program and training residents, etc.

An initial training committee should be formed and should include the director of the residency program, the curriculum developer, an educationalist, a resident representative, and a resident coordinator. Other members may be added as needed. This committee will be responsible for the implementation of the curriculum and the planning process for obtaining necessary resources and communicating with other stakeholders.

Faculty development

This may be one of the most important aspects that needs to be addressed in curriculum development and implementation. As mentioned in Part One, faculty development is a major part of this curriculum. The new curriculum is designed with the main teaching method of self-learning and interactive discussions with faculty. This is a major change from the current methods being used, which are traditional

lectures delivered from faculty to residents and the traditional method of bedside teaching. However, a great deal of training will be necessary to prepare the faculty for this new curriculum and the teaching processes it requires. Faculty have to be trained on how to function as moderators and facilitators rather than as passive teachers; thus, the principles and theories of clinical reasoning must be brought to their attention. Additionally, they need to be oriented to the new methods of assessment used in this curriculum.

Resident orientation

The residents need to be oriented to this new method of learning. They need to know the benefits of self-learning and learning through problem solving. They need to be trained in the use of libraries and in acquiring skills in information searching and management.¹⁵

The new curriculum design and stages and the assessment processes have to be clarified to the residents. The importance of feedback needs to be emphasised and how to provide effective feedback needs to be taught.

Learning resources

Learning resources include access to medical libraries and literature and skills labs and specialty training courses. Because a great deal of the learning process of this new curriculum depends on the acquisition of knowledge by the resident, these resources have to be made available from the first day of the program. Some of these learning resources may be not be needed until later in the training program; however, making them available in due time is essential.

Feedback

“Feedback is the fuel for improvement”

Feedback must be continuous to ensure continuing improvement to the curriculum. It was once said, “If you think that you have reached the end in your plan, that’s when you stop progressing.” Thus, success can only be achieved through further development and achievement of community goals, which was the basis of this curriculum.

Through the evaluation process, residency program accomplishments can be compared with objectives to determine what changes need to be made to fulfil those objectives. The evaluation process also serves as a tool for ensuring the quality of the training program and for improving the program and meeting any new expectations. In other words, the most important purpose of evaluations is to improve the program rather than to prove its value.

Thus, the evaluation process to be used is crucial in the preparation of this curriculum. The evaluation process will mainly involve the stakeholders, but it may also involve external evaluators that are stakeholders.

The educational concepts of this new curriculum are shifted greatly from those of the current program. There is a major change in the construct of the program based on competencies and learning objectives that have been previously documented. The learning methods have also been changed accordingly. The evaluation process should be designed to determine if these changes have been successfully

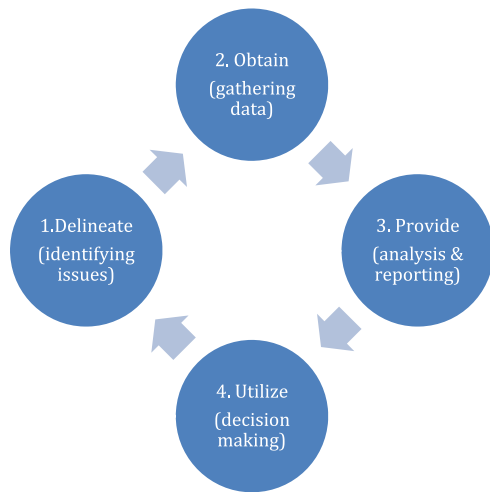


Figure 4: Stufflebeam Evaluation Sequence.

implemented. Changes can be intentional or unintentional, and the evaluation process should examine both possibilities.¹⁶

Evaluation

As this program involves complex interactions between participants, faculty and the environment, an evaluation tool that is well-suited for such a program is needed. The model that seems most suitable to achieve this goal is the CIPP model (context, input, process, product). This model is thought to evaluate all components of the program and to provide feedback to the program directors to make changes accordingly.¹⁷

The process of evaluation is performed in four steps. In the first step, the delineation step, the issue to be evaluated is identified. The next step is to gather information according to the methods identified for each component of the CIPP. The third step is to analyse data and form a report. The fourth step is to make decisions regarding any modifications to the curriculum that may be needed based on the data and reports. If any change is made, then the evaluation process is repeated to assess those changes (Figure 4).

Conclusions

Developing a curriculum for a residency program using the backward planning method will help to identify the health care concerns of a community related to the specialty that is being addressed. Combining this with a needs assessment should be the basis for designing a residency program curriculum. Clinical performances are identified based on community health concerns and the results of the needs assessment. From these performances, competencies are identified. Those competencies or abilities are then broken down to objectives based on the training stage, and the learning domains are sorted, i.e., knowledge, skills and attitudes. The proper instruction method is chosen for each learning domain, and the curriculum is designed accordingly.

It is important to take into consideration the level of the resident and the stage of training when deciding what teaching method to use.

This paper did not discuss the proper assessment tools for this new curriculum or how to apply them. Additionally, a sound method for continuous monitoring and evaluation needs to be included in the design of any curriculum.

Conflict of interest

The author has no conflict of interest to declare.

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