SHORT COMMUNICATION

Epidemiology Education in Libya: Classification of Courses and Teaching Methods

Naeima Houssein[1,*]
[1]Department of Epidemiology, Faculty of Public Health, University of Benghazi, Benghazi, Libya
*Faculty of Public Health, University of Benghazi, Benghazi, Libya
Tel: +218928111426,
Email: naeima.houssein@uob.edu.ly

Epidemiology is the basic science of public health and preventive medicine. There is a pressing need in Libya to develop education and training programs in epidemiology to bridge professional gaps and address real-world public health issues. Classification of courses enables academic institutions to establish clear learning trajectories, ensuring that students build foundational knowledge before advancing to specialized subfields. A review of existing educational programs worldwide reveals some overlap between core public health and epidemiology courses. As an opinion, it is suggested that classifying epidemiology courses at both undergraduate and postgraduate levels can improve curriculum design. Such classifications can provide a structured basis for developing programs focused on three areas of competency: epidemiologic methods and measures, branches of epidemiology, and supporting courses. Additionally, employing diverse teaching approaches and conducting ongoing program evaluations are highly recommended. This insight into epidemiology education may contribute to improving student learning outcomes along with effective teaching methods. Therefore, effective epidemiology education requires a carefully structured curriculum that integrates methodological foundations, practical applications across subfields, and biostatistics and health informatics competencies, preparing graduates to address real-world public health challenges.

Keywords: Epidemiology, Public Health, Curriculum, Classification

تعليم علم الأوبئة في ليبيا: تصنيف المقررات وطرق التدريس

علم الأوبئة هو العلم الأساسي للصحة العامة والطب الوقائي. هناك حاجة ملحة في ليبيا لتطوير برامج تعليمية وتدريبية في علم الأوبئة لسد الفجوات المهنية ومعالجة قضايا الصحة العامة الواقعية. يُمكّن تصنيف المقررات الدراسية المؤسسات الأكاديمية من تحديد مسارات تعليمية واضحة، مما يضمن بناء الطلاب للمعرفة الأساسية قبل التقدم إلى التخصصات الفرعية المتخصصة. تكشف مراجعة البرامج التعليمية الحالية حول العالم عن بعض التداخل بين مقررات الصحة العامة الأساسية وعلم الأوبئة. ويُقترح، كرأي، أن تصنيف مقررات علم الأوبئة على مستوى البكالوريوس والدراسات العليا يمكن أن يُحسّن تصميم المناهج الدراسية. يمكن أن توفر هذه التصنيفات أساسًا منظمًا لتطوير برامج تركز على ثلاثة مجالات من الكفاءة: الأساليب والمقاييس الوبائية، وفروع علم الأوبئة، والمقررات المساندة. بالإضافة إلى ذلك، يُوصى بشدة باستخدام مناهج تدريس متنوعة وإجراء تقييمات مستمرة للبرامج. قد تُسهم هذه الرؤية الثاقبة لتعليم علم الأوبئة في تحسين نتائج تعلم الطلاب إلى جانب أساليب التدريس الفعالة. لذلك، يتطلب التعليم الفعال في مجال علم الأوبئة منهجًا منظمًا بعناية يدمج الأسس المنهجية والتطبيقات العملية عبر المجالات الفرعية والكفاءات في الإحصاء الحيوي والمعلوماتية الصحية، مما يعد الخريجين لمواجهة تحديات الصحة العامة في العالم الحقيقي.

الكلمات المفتاحية: علم الأوبئة، الصحة العامة، المناهج الدراسية، التصنيف

لیبیا میں وبائی امراض کی تعلیم: کورسز اور تدریسی طریقوں کی درجہ بندی

ایپیڈیمولوجی صحت عامہ اور احتیاطی ادویات کی بنیادی سائنس ہے۔ لیبیا میں وبائی امراض میں تعلیم اور تربیتی پروگرام تیار کرنے کی اشد ضرورت ہے تاکہ پیشہ ورانہ خلا کو پر کیا جا سکے اور حقیقی دنیا میں صحت عامہ کے مسائل کو حل کیا جا سکے۔ کورسز کی درجہ بندی تعلیمی اداروں کو واضح سیکھنے کی رفتار قائم کرنے کے قابل بناتی ہے، اس بات کو یقینی بناتے ہوئے کہ طلباء خصوصی ذیلی شعبوں میں آگے بڑھنے سے پہلے بنیادی معلومات حاصل کریں۔ دنیا بھر میں موجودہ تعلیمی پروگراموں کا جائزہ بنیادی صحت عامہ اور وبائی امراض کے کورسز کے درمیان کچھ اوورلیپ کو ظاہر کرتا ہے۔ ایک رائے کے طور پر، یہ تجویز کیا جاتا ہے کہ انڈرگریجویٹ اور پوسٹ گریجویٹ دونوں سطحوں پر ایپیڈیمولوجی کورسز کی درجہ بندی کرنے سے نصاب کے ڈیزائن کو بہتر بنایا جا سکتا ہے۔ اس طرح کی درجہ بندی قابلیت کے تین شعبوں پر مرکوز پروگراموں کو تیار کرنے کے لیے ایک منظم بنیاد فراہم کر سکتی ہے: وبائی امراض کے طریقے اور اقدامات، وبائی امراض کی شاخیں، اور معاون کورسز۔ مزید برآں، متنوع تدریسی طریقوں کو بروئے کار لانا اور پروگرام کے جاری جائزوں کے انعقاد کی انتہائی سفارش کی جاتی ہے۔ وبائی امراض کی تعلیم کے بارے میں یہ بصیرت موثر تدریسی طریقوں کے ساتھ طالب علم کے سیکھنے کے نتائج کو بہتر بنانے میں معاون ثابت ہو سکتی ہے۔ لہذا، مؤثر وبائی امراض کی تعلیم کے لیے ایک احتیاط سے ترتیب شدہ نصاب کی ضرورت ہوتی ہے جو طریقہ کار کی بنیادوں، ذیلی شعبوں میں عملی ایپلی کیشنز، اور بایوسٹیٹسٹکس اور ہیلتھ انفارمیٹکس کی مہارتوں کو مربوط کرتا ہے، جو گریجویٹوں کو حقیقی دنیا میں صحت عامہ کے چیلنجوں سے نمٹنے کے لیے تیار کرتا ہے۔

کلیدی الفاظ: وبائی امراض، صحت عامہ، نصاب، درجہ بندی

آموزش اپیدمیولوژی در لیبی: طبقه‌بندی دروس و روش‌های تدریس

اپیدمیولوژی علم پایه بهداشت عمومی و پزشکی پیشگیری است. در لیبی نیاز مبرمی به توسعه برنامه‌های آموزشی و تربیتی در اپیدمیولوژی برای پر کردن شکاف‌های حرفه‌ای و پرداختن به مسائل بهداشت عمومی در دنیای واقعی وجود دارد. طبقه‌بندی دروس، مؤسسات دانشگاهی را قادر می‌سازد تا مسیرهای یادگیری روشنی را ایجاد کنند و اطمینان حاصل کنند که دانشجویان قبل از پیشرفت به زیرشاخه‌های تخصصی، دانش پایه را کسب می‌کنند. بررسی برنامه‌های آموزشی موجود در سراسر جهان، مقداری همپوشانی بین دروس اصلی بهداشت عمومی و اپیدمیولوژی نشان می‌دهد به عنوان یک نظر، پیشنهاد می‌شود که طبقه‌بندی دروس اپیدمیولوژی در هر دو سطح کارشناسی و کارشناسی ارشد و بالاتر می‌تواند طراحی برنامه درسی را بهبود بخشد. چنین طبقه‌بندی می‌تواند مبنایی ساختارمند برای توسعه برنامه‌هایی با تمرکز بر سه حوزه شایستگی: روش‌ها و اقدامات اپیدمیولوژیک، شاخه‌های اپیدمیولوژی و دروس پشتیبان را فراهم کند. علاوه بر این، به‌کارگیری رویکردهای متنوع تدریس و انجام ارزیابی‌های مداوم برنامه اکیداً توصیه می‌شود. این بینش در مورد آموزش اپیدمیولوژی می‌تواند به بهبود نتایج یادگیری دانشجویان همراه با روش‌های مؤثر تدریس کمک کند. بنابراین، آموزش مؤثر اپیدمیولوژی نیازمند یک برنامه درسی با ساختار دقیق است که مبانی روش‌شناختی، کاربردهای عملی در زیرشاخه‌ها و شایستگی‌های آمار زیستی و انفورماتیک سلامت را در هم ادغام کند و فارغ‌التحصیلان را برای پرداختن به چالش‌های بهداشت عمومی در دنیای واقعی آماده سازد.

واژه های کلیدی: اپیدمیولوژی، بهداشت عمومی، برنامه درسی، طبقه‌بندی

INTRODUCTION

As the foundational science of public health and preventive medicine, epidemiology plays a crucial role in addressing ongoing health issues (1). To bridge professional gaps and meet the growing demand for skilled practitioners (2), well-structured education and training programs in epidemiology are essential. Organizing courses into categories helps ensure a logical learning sequence, enabling students to progress from core principles to specialized disciplines effectively. It also assists in defining course prerequisites, guiding academic advising, and aligning competencies with the evolving needs of the public health workforce. Furthermore, course classification promotes transparency in curriculum mapping and helps educators assess whether learning objectives are being effectively met across educational stages.

In the context of developing undergraduate and postgraduate epidemiology programs at the Faculty of Public Health, University of Benghazi in Libya, a review of international epidemiology education programs reveals a notable overlap between public health and epidemiology curricula. Accordingly, the classification of epidemiology courses is proposed as a strategy to strengthen curriculum structure and coherence. Such approach supports the systematic development of competencies across three domains: epidemiologic methods and measures, specialized branches of epidemiology, and supporting courses. This classification should differentiate between foundational courses, such as introductory epidemiology, study design, and biostatistics, and advanced or specialized courses that are diverse into subfields like cancer epidemiology, or health policy epidemiology, etc. consequently, categorization of courses not only aids academic planning and progression but also ensures students acquire essential competencies in a logical sequence. Furthermore, it supports institutions in aligning their curriculum with accreditation standards and public health workforce needs. More importantly, adopting varied teaching methods and implementing ongoing evaluations are essential for maintaining program quality.

In the following discussion, some existing epidemiology educational models and teaching methods will be reviewed concisely. Further, the proposed model will be introduced.

Existing Epidemiology Education Models

There are several existing epidemiology education models. These models serve as foundational references for constructing competency-based epidemiology curricula, including, the Competency-Based Medical Education (CBME) framework or the Applied Epidemiology Competencies developed by public health associations (3). Integrating such models helps ensure that the curriculum aligns with internationally recognized standards, real-world demands, and supports consistent skill development across institutions. For instance, the Centers for Disease Control and Prevention (CDC) utilizes Applied Epidemiology Competencies (AEC) to guide workforce training (4), while the European Centre for Disease Prevention and Control (ECDC) employs competency-based approaches in their Field Epidemiology Training Programs (FETPs), specifically through the European Programme for Intervention Epidemiology Training (EPIET) and the European Public Health Microbiology Training Programme (EUPHEM) (5).

Similarly, many universities adopt the CBME framework to align learning outcomes with public health competencies defined by national accrediting bodies. Table 1 summaries comparison of some existing academic models based on published competency frameworks. These programs are structured around core competencies developed in consultation with relevant stakeholders, ensuring that fellows acquire the necessary knowledge, skills, and attitudes to perform effectively in public health fields. The curriculum emphasizes practical, on-the-job training, allowing fellows to apply epidemiological methods to a wide range of public health problems (3).

A Proposed Model for Epidemiology Curriculum

Figure 1 illustrates a proposed conceptual framework for designing undergraduate epidemiology curricula. It is divided into three interconnected components: 1) epidemiologic methods and measures, 2) branches of epidemiology, and 3) supporting competencies. The relevance of each discipline in an epidemiology curriculum has been widely documented (6-8). However, considerable variation remains across institutions regarding course classification and organization to achieve optimal learning outcomes. As the figure 1 shows, the first domain provides the foundational basis for understanding disease patterns and causal inference. It encompasses epidemiologic methods or study designs, including descriptive, analytic, and experimental. As well as key epidemiologic measures such as measures of morbidity, mortality, and effect. The second domain categorizes epidemiologic branches into exposure-based and disease-based subfields, enabling students to explore practical applications. The exposure-oriented subfields explore how external factors affect health (e.g., environmental or occupational epidemiology). The disease-oriented subfields address specific health domains such as communicable and non-communicable diseases, with possible further specialization in cancer epidemiology, cardiovascular epidemiology, maternal and child health, and social epidemiology, depending on the institution's goals. Some parts of the model are flexible and can be adapted based on

Table 1. Comparison of academic models informing epidemiology education

Model/Framework	Organization/Origin	Key Features
Applied Epidemiology Competencies (AEC)	Centers for Disease Control and Prevention (CDC), USA	Defines core skills for practicing epidemiologists; guides training and evaluation in public health agencies
Field Epidemiology Training Programs (FETPs)	European Centre for Disease Prevention and Control (ECDC), Europe	Emphasizes hands-on, in-field training tailored to national/regional priorities
Competency-Based Medical Education (CBME)	Various medical and public health institutions globally	Focuses on defined learning outcomes and competencies rather than time-based training

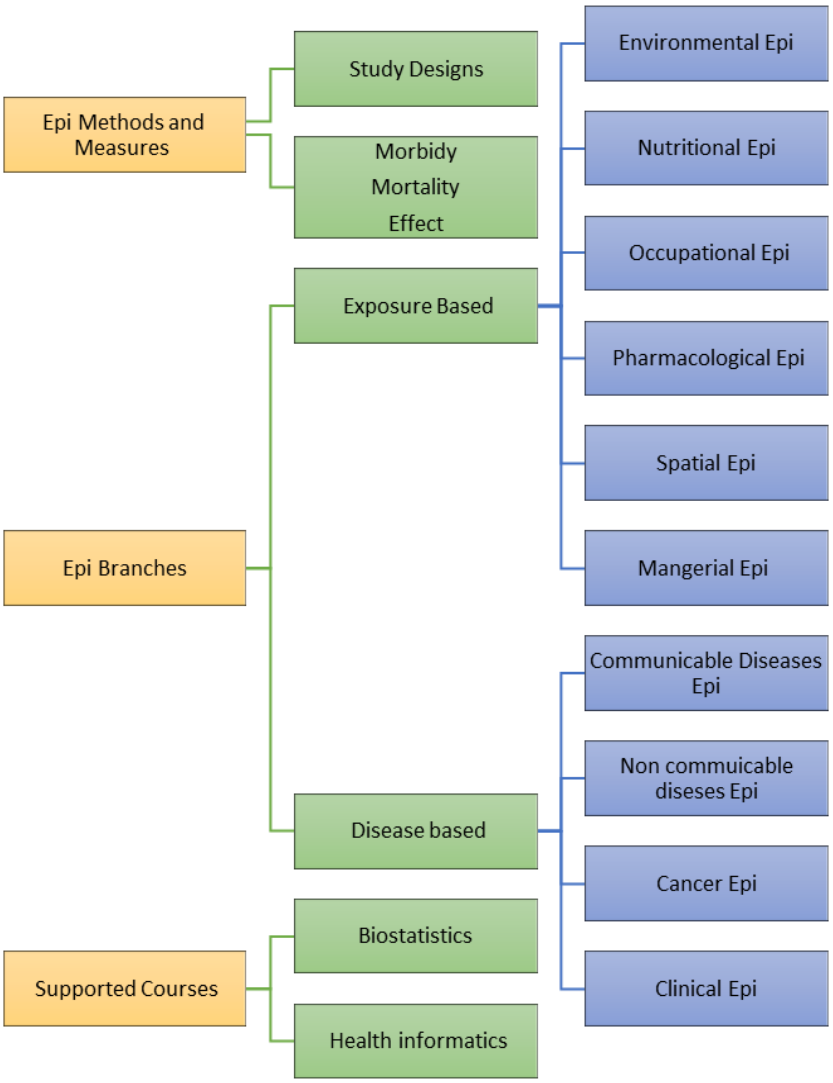

Figure 1. A conceptional framework of curriculum design for epidemiology education

institutional priorities or local health challenges.
For example, a program in an area with high rates of communicable disease may emphasize those branches more heavily. The third domain integrates biostatistics and health informatics as supportive skills necessary for modern data-driven public health practice.
Several studies report difficulties in epidemiology among students at the undergraduate medical education levels (9-14). The findings suggest that course structure and teaching methodology significantly influence students' attitudes and learning outcomes. Therefore, this framework is structured to support the logical progression of students learning through the clear classification of courses. Accordingly, foundational knowledge in epidemiologic methods provides the analytical tools needed to engage with specialized branches of the field. Supporting competencies like biostatistics and informatics enhance students' ability to apply this knowledge in real-world scenarios. By aligning coursework with this framework, educational institutions can ensure students develop a comprehensive skill set, from critical thinking and data analysis to applied fieldwork in public health settings.
Based on this model, epidemiology courses can be sequenced across an undergraduate program ensuring a gradual and logical build-up of competencies, enabling students to transition from theoretical foundations to applied and specialized domains. This could be outlined as foundation level, core competencies, applied branches, specialization, and integration.

Teaching Methods in Epidemiology

Given the clear classification of epidemiology courses, the selection of appropriate teaching methods is of great importance. Commonly-used teaching strategies in epidemiology education include a combination of traditional lectures, case-based learning, flipped classrooms, and experiential learning (15). Case studies allow students to apply theoretical knowledge to real-world public health scenarios (16), while flipped classrooms encourage active learning by having students engage with core content before class and apply it through discussions and problem-solving during class (17). Fieldwork and practicum experiences are vital for developing applied skills, especially in collaboration with public health agencies (18). Simulation exercises and the use of epidemiological software tools also enhance students' analytical capabilities and decision-making under realistic constraints (19). Incorporating these diverse teaching methods helps overcome any difficulty in epidemiology, ensures a more engaging, competency-based learning experience, and better prepares students for practical roles in the field. This approach is consistent with the World Health Organization guidelines which emphasize the important of structured and measurable learning outcomes in public health education (20).

CONCLUSION

In summary, this insight into epidemiology education may contribute to improving student learning outcomes along with effective teaching methods. To achieve this, epidemiology education programs require carefully structured curricula that integrate methodological training, practical applications across various branches of epidemiology, and supportive skills in biostatistics and health informatics. Further research is recommended to explore epidemiology education among medical students in Libya.

Ethical Considerations:

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors.

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