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Academic Educational Package for Antimicrobial Resistance: Views of Healthcare Sector Undergraduate Students

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ABSTRACT

Background: Antimicrobial resistance (AMR) is a major cause of morbidity and mortality worldwide. For that it is important to prepare healthcare professionals during the undergraduate study regarding principles of antimicrobial usage because the undergraduate students are the future healthcare providers and key stakeholders in the healthcare system. Therefore, efficient education about AMR, its effects, and preventative measures is mandatory. Integrated academic educational packages are increasingly being utilized to educate and improve students' knowledge and skills in a variety of disciplines, particularly when tailored to their views. **Aim:** The current study aimed to explore the views of the healthcare sector undergraduate students regarding the components and structure of an academic educational package of AMR. **Method**: A qualitative phenomenological study design was used for this study. The study included 96 final-year students registered in Mansoura University's faculties of medicine, nursing, pharmacy, and dentistry who were chosen by using convenience sampling technique. The data was gathered through focus group discussions (FGDs) by using FGDs' guide with open-ended questions. **Results**: The study revealed that most of the study participants need to know more about the fundamentals of microorganisms, antimicrobial action, and resistance. Participants suggested that the academic package should include interactive educational strategies that are illustrated clearly and concisely in an attractive manner. **Conclusion**: The study reveals that healthcare undergraduates prefer academic educational packages to improve their understanding of AMR which emphasizes the importance of content design.

Keywords: *Academic educational package, Antimicrobial resistance, Healthcare sector undergraduate students*

Introduction:

Antimicrobial resistance (AMR) is a significant healthcare concern with uncontrollable implications in the 21st century. It occurs when microorganisms, including bacteria, viruses, fungi, and parasites, adapt and become resistant to treatment (**Tadvi et al., 2019; Tshering, Wangda & Buising, 2021).**

According to the **World Health Organization (WHO), 2023,** AMR causes 4.95 million deaths annually and is expected to reach 10 million by 2050, costing 100 trillion dollars. It impairs the human immune system's ability to combat infections, leading to increased treatment failures and severity of infections. AMR strain infections are linked to lower quality of life, disseminated infections, increased recurrence rates, and future opportunistic infections with resistant pathogens **(Ahmed, et al, 2024; Ayukekbong, Ntemgwa, & Atabe, 2017; Murray, et al, 2022)**

Antimicrobial resistance is accelerated by misuse, overuse, inappropriate usage, and inappropriate prescription. Inadequate health regulations, and lack of proper diagnostics, contribute to this misuse of antimicrobial agents **(Kanyike, et al, 2022).** Furthermore, inadequate education and communication regarding drug compliance standards among healthcare professionals lead to improper regulations governing antimicrobial drug use. **(Aljeldah, 2022; Almansour, et al, 2023 Dadgostar, 2019; Nashwan, Shah, Hussain, Rauf, & Ahmed, 2024).**

The curricula of healthcare sector undergraduate students lack AMR courses making graduates unaware of proper prescription, indications, side effects, and proper application of antimicrobial medicines **(Fetensa et al., 2020; Shahpawee et al., 2020).** All healthcare graduates play a crucial role in preventing AMR. They prescribe antimicrobial drugs, provide consultation for patients to adhere to their treatment plans, and monitor the effect of antimicrobial drugs **(Adegbite et al., 2022; Jairoun, Hassan, Ali, Jairoun, & Shahwan, 2019; Sakr, Ghaddar, Hamam, & Sheet, 2020).**

In the clinical field, managing antimicrobial resistance (AMR) requires an interdisciplinary team that employs antimicrobial stewardship (AMS) strategies. Therefore, a standardized curriculum is important to enable healthcare professionals to work effectively in this team **(Robles, Langit, Jose & Belotindos, 2019; Tadvi et al., 2019).**

To achieve standardized performance educational strategies should be unified in an academic educational package. This package would use standardized learning-teaching strategies that strengthen academic achievement and consequently sustain the clinical practice **(Abozed, Abusaad, & Abd El Aziz, 2020; Sawangsri, 2016).**

To enhance the knowledge, abilities, and competencies of the participants, the academic educational package should be thoughtfully designed and executed based on their views. Thus, it is important to consider their views while developing the educational plan for educating healthcare undergraduate students about AMR **(McMaster, et al, 2020).**

Aim of the study:

To investigate the views of healthcare undergraduate students about academic educational packages about antimicrobial resistance.

Method:

Design:

A qualitative phenomenology study design was utilized to analyze the healthcare sector undergraduate students' views on the academic educational package of AMR.

Setting:

The current study was conducted at faculties of the healthcare sector, namely, The Faculties of Medicine, Nursing, Pharmacy, and Dentistry at Mansoura University.

Participants and sampling:

A convenient sampling technique was used in this study to recruit healthcare undergraduate students from previously mentioned faculties. The study included 96 students who registered at the final level.

Tools for Data Collection

The researchers developed two tools for data collection after reviewing the literature review and constructed as follows:

Tool I: Demographic and Academic Characteristics Structured Self-administered Questionnaire: This questionnaire was used to determine the academic and demographic characteristics of the healthcare sector undergraduate students. This questionnaire was utilized by the researchers to gather information from students regarding their age, gender, level, faculty, and attendance at AMR workshops.

Tool II: Focus Group Discussion Guide: The researcher used this guide to explore the views of healthcare sector undergraduate students toward the intended academic educational package. The guide was composed of six open-ended questions to obtain participants' views about content, components, and educational strategy.

Face and content validity: The content validity of the developed FGD guide was evaluated by a jury committee consisting of five experts in the fields of education and microbiology. **Face validity:** is concerned with testing the clarity, relevance, and appropriateness of the developed FGD guide.

Pilot study on one FGD that included 10 healthcare sector undergraduate students (10% of the study sample) who were excluded from the study sample.

Procedure:

Administrative procedure:

The researcher acquired ethical approval from the Research Ethics Committee of the Faculty of Nursing, Mansoura University, and formal informed consent from participants. The researcher described the study's goal and ensured the confidentiality of the data. Students were also informed that they might withdraw from their studies at any time without giving a reason.

Data Collection:

The researchers conducted focus group discussions (FGDs) from March 2023 to the end of May 2023. After sending invitations via social media **(WhatsApp messages)** and selecting the students, the researchers created four WhatsApp groups. Each participant joined their respective group, introduced themselves, and provided a brief explanation of the study's objectives. The online focus group discussions (FGDs) were scheduled to accommodate the healthcare undergraduate students' availability. Each focus group lasted 30-45 minutes and was conducted on the Zoom and Microsoft Teams platforms. The researchers carried out a total of eight online FGDs, with each FGD involving 10–12 students. The focus group discussions (FGDs) were conducted by sending out a Google Form to collect information about the academic and educational characteristics of the participants, using **Tool I**. The FGD guide **Tool II.**

Data analysis:

The demographic and academic data were analyzed using the SPSS program version 22 for descriptive statistical analysis. Thematic analysis was used to analyze qualitative data to present the collected information. The FGD transcripts were analyzed to identify common themes, similarities, and variations in the views of healthcare sector undergraduate students. The data were coded, categorized, and organized into themes and subthemes.

Results

Table 1 reveals that 38.5% of healthcare sector undergraduate students were 23 years old, with a mean age of 21.9 (0.984) years. About 58.3% of these students were female. In terms of faculty allocation, approximately 31.3% of these students belonged to the Faculty of Nursing. 79.2% of students did not attend antimicrobial resistance workshops.

The views of healthcare sector undergraduate students related to academic educational packages are explored in two main themes :**(Diagram 1)**

First theme: Components of academic educational package

Learning Objectives and Content

Students are keen to explore the field of antimicrobial resistance, focusing on the fundamental aspects of microorganisms and the various categories of antimicrobials. The study participants concluded that the proposed academic package would provide an introductory overview of antimicrobial resistance and drug resistance mechanisms. The package must discuss diagnostic measures for detecting antimicrobial resistance and strategies and interventions designed to combat AMR including antimicrobial stewardship programs. It will also address the pivotal roles played by healthcare professionals in implementing and adhering to these programs.

"We studied a microbiology course, but the content is not sufficient, so we need to understand the basics of microbiology", "I need to study the structure of bacteria-virus-fungi and parasites", "Studying different antimicrobial actions this helps to easily understand resistance" **(FG2 nursing students).** "In my opinion, within the field of medicine, I have thoroughly studied microbiology and pharmacology, but I am particularly interested in learning about the components and objectives of the antimicrobial stewardship program" **(FG3 medical students).** "In our pharmacy studies, it's crucial to understand the AMS to recognize our role in addressing this widespread issue", "As pharmacist students, we play a key part in developing new medications to combat this problem" **(FG5 pharmacist students).** "I would like to learn about the various mechanisms of action of different antimicrobials (antibacterial, antiviral, antifungal) and antimicrobial resistance mechanisms in the context of oral infections in the dental field", "Oral infections can take various forms, and the most prescribed drugs for patients are antibiotics, antifungals, and analgesics. As well as appropriate diagnostic tests using related AMR **(FG7 dental students)**

Most healthcare sector undergraduate students prefer learning objectives to be clear, specific, and relevant to the content. "We believe that the objectives should provide a general understanding of the topic's significance and be presented in a clear and specific manner" **(FG1 nursing students, F3 medical students, and FG8 dental students)**

Teaching method

Most participants recommended interactive lectures to foster critical thinking, with case studies utilized at the beginning to stimulate brainstorming and capture attention. They also promise to use new teaching approaches to help students master new skills.

"We need to implement new teaching strategies to enhance our learning of this topic supported by interactive lectures". "This could involve integrating methods such as games and role-playing to make the material more engaging and enhance our attention" (**FG2 nursing students & FG8 dentists)**

Evaluation methods

Participants agreed that incorporating evaluation components like quizzes would enhance retention and progress assessment. They preferred closed-ended questions and recommended incorporating multiple-choice questions in theoretical exams. For practical components, they advocated for an Objective Structured Clinical Examination (OSCE) with multi-station skill lab scenarios and simulations to assess problem-solving skills.

"I prefer using closed questions to assess specific objectives", and "Each question should have a single interpretation, and the number of questions should match the exam time". "These questions can be in formats such as true/ false, multiple-choice, and matching". "For the practical component, I believe it should include a case study and hands-on applications to effectively evaluate

our practical skills" ***(FG2 nursing students, FG4 medical students, FG6 pharmacist students, FG7 pharmacist students).***

Second theme: Design of academic educational package

Illustration

All healthcare sector undergraduate students emphasized the importance of using illustrations to enhance content comprehension, increase engagement, and improve readability. These illustrations include figures, drawings, tables, audio, videos, and PowerPoint presentations.

"Choose attractive images and figures that are relevant to the content which is clear and simple and relevant" Use figures, drawings, tables, audio, videos, and PowerPoint presentations to summarize the content appropriately.

Language, Layout, and Typography Participants preferred clear, simple language without complex terminologies and content listed in bullets instead of long paragraphs.

"...The first thing that attracts me to a package and keeps me reading is the language used. Please make the written content simple and concise. I prefer a limited number of points on a page, and don't like long paragraphs that would discourage further reading..." **(FG3 medical students, FG4 medical students, FG6 pharmacist students).**

Table 1 *Healthcare sector undergraduate students' demographic and educational characteristics (n=96)*

Characteristics	N= 96	%
Age		
20 years	8	8.3
21 years	23	24.0
22 years	28	29.2
23 years	37	38.5
Mean *(SD)* 21.9(.984)		
Sex		
Male	40	41.7
Female	56	58.3
Faculty		
Nursing	30	31.3
Medicine	23	24.0
Pharmacy	22	22.9
Dentistry	21	21.9
Attend training program about antimicrobial resistance	20	20.8
Number of training programs		
None	76	79.2
Once	11	11.5
Twice and more	9	9.3

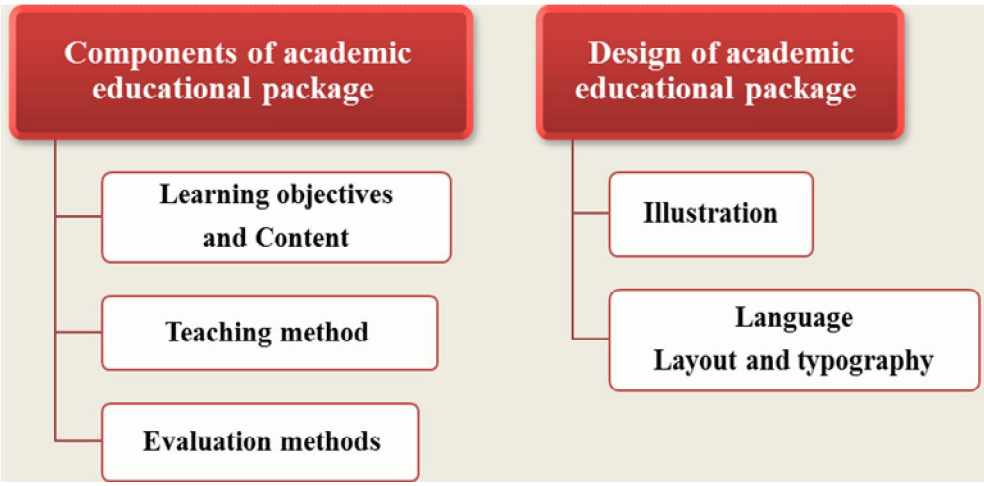

Diagram 1 *Themes of focus group discussions among healthcare sector undergraduate students regarding components, and design of academic educational package*

Discussion

AMR is a global public health concern; it is presenting a significant threat to healthcare systems not only in *developing* nations but all around the world. The complicated interactions of different microorganisms such as bacteria, viruses, fungi, and parasites, as well as the inability to treat prevalent infectious diseases, raise concerns about the future of the human and ecological systems in general. Even though healthcare sector students study AMR in their specific curricula, there still exist significant gaps between what they have learned and what they know **(Ferraz, 2024; Salam et al 2023)**. It is crucial for healthcare students, particularly those in the pre-clinical years, to receive education on AMR. It is essential to introduce innovative and effective educational approaches covering all facets of AMS like the academic package (**Njeru, et al, 2024)**. Therefore, the current study aims to explore the views of healthcare sector undergraduate students regarding the academic educational package of AMR.

According to healthcare sector undergraduate students, the content should include an overview of microorganisms, *mechanisms* of action of antimicrobials, as well as resistance. Additionally, it should cover appropriate diagnostic tests and preventive measures to tackle AMR and antimicrobial stewardship. Concepts should be simple, relevant, and well-organized according to the objectives sequence. These suggestions are compensated with several studies that focus on the importance of well-structured curricula with rigorous objectives and attractive learning strategies **(Courtenay, et al, 2019; Dhaliwal, et al, 2022; McMaster, et al, 2020)**. The clear and feasible learning objectives are foster the understanding and attract the attention of learners **(Budak, Kpokiri, Abdoler, Tucker, & Schwartz, 2019; Rassi, Sudha, Viveka, & Sharafudeen, 2021).**

The current study suggested a range of interactive educational strategies that are confirmed by previous research. These strategies include participatory learning such as role plays, online interactive lectures, technical procedure demonstrations, *hands*-on practice sessions, and teamwork projects. Using visual aids like videos and animations can facilitate the learning process, give constructive criticism, and save time. **(Laks, Guerra, Miraglia, & Medeiros, 2019; Mittal, et al, 2024).**

Moreover, most students reported using a variety of assessment methods such as quizzes and reflective exercises to evaluate their understanding of the main objectives. These findings are supported by **Laibhen- Parkes, 2014**; **Palmer, Samson, Triantis, & Mullan, 2011.** Effective evaluation gives a chance to improve and revise the curriculum. Many students have recommended that all modules incorporate multiple-choice questions for assessing understanding. **(Nazir, Al-Ansari, AlKhalifa, Gaffar, & AlHumaid, 2020; Njeru, et al, 2024).**

The current study emphasized that to improve comprehension, focused on the layout of academic instructional materials as well as the application of clear, straightforward visual aids including pictures, videos, and diagrams. It was advised to utilize both simple language and bullet points. Participants underlined the significance of adopting bullet points rather than extended paragraphs as an efficient organizational communication technique. **Ahmed, & Mohamed,**

2019; Elsayed, Ahmed, & Khalil, 2024; Lau, et al.., 2019).

Conclusion

The study found that the majority of healthcare undergraduate students prefer using academic educational packages to enhance their understanding of AMR. They also emphasized the importance of adhering to effective educational principles in designing and developing content based on their views.

Recommendation

- Collaboration among healthcare sectors is crucial for delivering scientifically accurate and locally relevant education
- Incorporating AMR into the undergraduate curriculum is critical for preparing future healthcare professionals to address this global health issue.

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Declaration of Conflicting Interests

The authors declared no potential conflicts of interest regarding the research or publication of the article.

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