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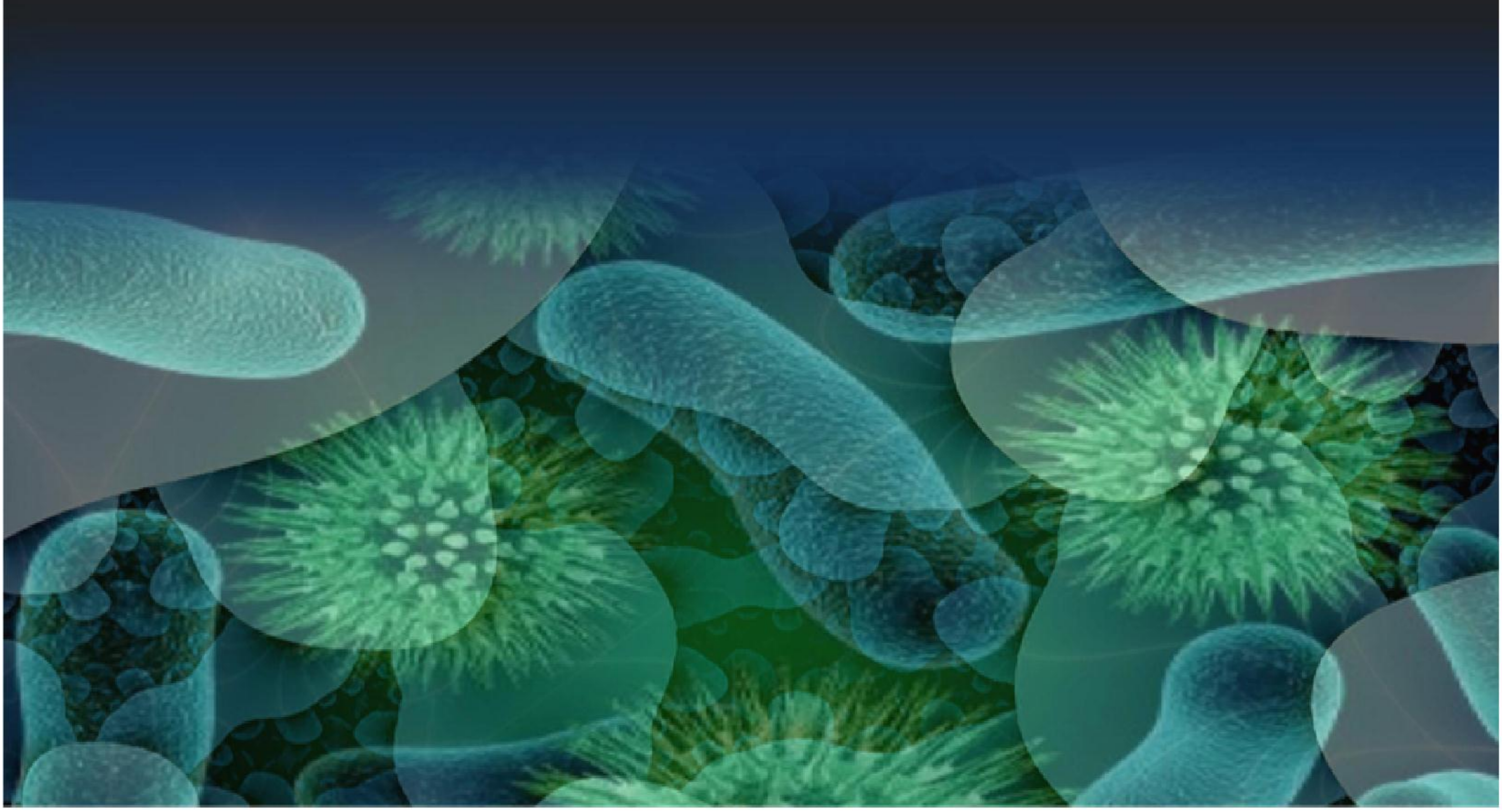
ReAct Action on Antibiotic Resistance

EDUCATION ON ANTIBIOTIC RESISTANCE IN MEDICAL AND PHARMACY SCHOOLS: FINDINGS FROM CURRICULUM SURVEY IN SELECTED SOUTHEAST ASIAN UNIVERSITIES



EDUCATION ON ANTIBIOTIC RESISTANCE IN MEDICAL AND PHARMACY SCHOOLS: FINDINGS FROM CURRICULUM SURVEY IN SELECTED SOUTHEAST ASIAN UNIVERSITIES

A joint project by Discipline of Social and Administrative Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia

And

Action on Antibiotic Resistance (ReAct)
Uppsala University, Sweden

Education On Antibiotic Resistance In Medical And Pharmacy Schools: Findings From Curriculum Survey In Selected Southeast Asian Universities

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Executive summary

Antibiotic resistance (ABR) is a growing problem worldwide, with an often negative impact on patient outcomes. Within this context, Southeast Asia (SEA) is home to many driving forces of emerging infectious diseases however systematic studies to understand the epidemiology of antimicrobial resistance have not been undertaken in the region. It is evident from available data for selected diseases that ABR is a burgeoning and often a neglected problem in the area. A number of reasons are count accountable for this development of resistance. Many experts argue that diseases are not treated with the respect they deserve. Over-use, misuse and non-medical use of antibiotics are largely to blame for the problem of resistance. Antibiotics are often prescribed before the presence of an infection has been verified. People tend to discontinue taking antibiotics as soon as they feel better, saving the unused portion for future self-medicating. Either way, improper usage fails to eliminate the disease agent completely and encourages growth of both tolerant and resistant strains.

In order to have an in depth knowledge of antibiotic resistance, its mechanism and control, studies in the particular area are the need of time. There is scarcity of data that how ABR is handled at the medical and pharmacy schools and to what manner the concept of ABR is incorporated in the current curriculum. Therefore, this survey was constructed to assess teaching patterns of ABR among pharmacy and medical schools in South East Asia.

The salient findings of the study revealed that:

- ✓ Pharmacy and medical school place different emphasis on ABR in their curriculum.
- ✓ ABR is focused as a compulsory subject in medical schools.
- ✓ The study highlighted that pharmacy curriculum emphasizes more on criteria of selecting antibiotics.
- ✓ The medical curriculum is more directed to treatment response as compared to pharmacy curriculum.

- ✓ Topics related to infection control are thoroughly taught in medical schools in the current study.
- ✓ Interestingly, topics related to pharmacoeconomics are more focused by medical schools.

Based on these findings, a global and national multi-sectoral response is urgently needed to combat the growing threat of ABR. All key stakeholders, including policy-makers and planners, the public and patients, practitioners and prescribers, pharmacists and dispensers, and the pharmaceutical industry have to act and take responsibility for combating ABR.

Effecting change in antibiotic use requires interventions at multiple levels to all types of health care professionals and to lay audiences. These interventions work best when performed in different settings (e.g., community health talks, education forums for health professionals, or media messages), and through the combined efforts of both public health and medical education organizations.

Introduction

Infectious diseases have been a great threat to humankind. With the passage of time, the antibiotics armamentarium continues to evolve and antibiotics therapy emerged as a viable proposition to innumerable pathologies, and thus become a solid foundation of modern medicine (Hawkey, 2008, Abraham and Chain, 1940). Irrespective of whether proper or improper, the use of antibiotics is related with pressures due to the development of nascent resistant bacterial strains and this undermines the magnitude of their use to seize the growth and development of bacteria (Fishman, 2006). In the current era of sluggish development of newer antibiotics molecules and many more years still required for the pipeline molecules to hit the market (Payne and Tomasz, 2004, Projan and Bradford, 2007) there is a need to exercise fullest potential of available molecules and derivatives. The *WHO Global Strategy for the Containment of Antibiotics Resistance* defines cost effective use of antibiotics which maximizes clinical therapeutic effect while minimizing both drug-related toxicity and the development of antibiotics resistance (WHO, 2001).Understanding and recognition of the issue of antibiotics resistance and the measures to arrest or eradicate it are part and parcel of the educational outreach to prescribers and providers and thus serve as a backbone to decelerate the phenomenon of resistance.

Previous studies suggested a core curriculum in disciplines like clinical pharmacology and pharmacotherapeutics and evaluated the short-term impact of incorporation of fundamentals of rational therapeutics in medical, dental, and pharmacy curriculum (de Vries et al., 1995, Flockhart et al., 2002, Sahin and Akcicek, 2004, Paterson Davenport et al., 2005, Öcek et al., 2008). In a study done in UK in 25 medical schools students not only viewed deficient learning opportunities and assessment related to judicious use of drugs but also urged to review undergraduate training in this area (Heaton et al., 2008). Likewise, in a *de novo* model of rational pharmacotherapy training in Turkey the interns showed high level of satisfaction with the training program and integration of rational pharmacotherapy training program into the medical curriculum was suggested (Sahin and Akcicek, 2004). Similarly in a multi-center randomized controlled study a short training course in pharmacotherapy designed on the basis of WHO draft manual was administered to 219 undergraduate medical students in Netherlands, Nepal, Nigeria, Australia, India, United States, and Indonesia (de Vries et al., 1995). In this study the students were taught to generate a standard pharmacotherapeutic approach to common disorders resulting in first choice drugs called Personal drugs (P drugs). The impact of the course measured in three stages showed that both the transfer effect and the retention effect were maintained at least six months after the training session in all seven medical schools (de Vries et al., 1995).

To the best of knowledge, it is relatively unknown to what extent graduates from both developing and developed countries have been exposed to issues related to antibiotics resistance. Furthermore, there is no published evidence to what extent this issue been covered in their medical and pharmacy schools curricula. In order to explore the issue in depth, the current project was undertaken. Three organizations, Discipline of Social and Administrative Pharmacy (DSAP) from Universiti Sains Malaysia, Action on Antibiotics Resistance (ReAct) based at Uppsala University, Sweden and Chulalongkorn University, Thailand decided to undertake a web based survey to evaluate the current curriculum contents towards rational use of antibiotics in South East Asian medical and pharmacy schools.

Objectives

1. To evaluate the current curriculum contents towards rational use of antibiotics in selected South East Asian (SE Asian) medical and pharmacy schools.

2. To document that how graduates of SEA universities are exposed to issues related to antibiotics resistance

Methodology

Study design

A cross-sectional web based survey was employed for data collection and conduction of the project.

Survey instrument

A standard paper based questionnaire was developed through extensive literature review and consultations with partners from ReAct. The survey was field-tested for its content, readability, and time to complete by senior researchers and academics that were part of ReAct SEA Working Committee. The survey questionnaire composed 19 questions on various areas concerning the existing curriculum on issues related to antibiotics resistance. Information on number of teaching faculty members in the university, number of students in an academic session, number of academic staff with expertise in rational use of antibiotics, type of funding received by the university (public or private) and availability of affiliated teaching university.

Administration of survey instrument

The final version of the paper survey was transformed into online format. A professional web designer was employed to undertake this task. The online format of the questionnaire was tested for visual mechanics as to avoid any difficulties in responding to the survey online. Feedback from all researchers and relevant ReAct members was taken on the layout of the web-based questionnaire before the said questionnaire was available for respondents. The survey was tested for its functionality, especially in terms of data capture and connectivity at different sites by using ‘dummy’ responses, which were removed before the actual survey went online. After the success of the pilot blast, formal blast of invitations was send to the respective emails of the respondents identified. By using Acajoom™ mail hosting system, the first email blast was sent to respondents on 21st Dec, 2010. Second blast was sent on 10th Jan, 2011 where as the third and final blast was sent on 19th Feb, 2011. The survey was closed on 31st March, 2011.

Survey Respondents

The target population for this survey was deans, program chair, and faculty members of SE Asian medical and pharmacy schools involved in antibiotic curricula. Information was extracted from official world list of pharmacy schools published by the International Federation of Pharmacy (FIP). For medical schools, the list was taken from World Health Organization (WHO). In addition, information from Ministry of Education website from respect countries was also taken into account. Personal contacts of the entire research team were used in cases where the information was not available.

Five countries of the SEA region were targeted. The list included Malaysia, Thailand, Singapore, Indonesia and the Philippines. Two hundred and two potential respondents were identified and a list comprised of their current institutes, position held and email addresses was created. In addition to this data sheet, another list was also created which contained the information of serve members from ReAct and its associates, DSAP, and Chulalongkorn University, Thailand were involved in the survey.

Research Team

In order to initiate the survey process, research team was constituted by DSAP comprising of three faculty members, two research associates and a web programmer. The web programmer was held responsible for the designing and functioning of the web page. The research associates were assigned the task for data collection. Faculty members were assigned to monitor the whole process. The whole process took one month to complete and the research team of DSAP held continuous meetings to ensure the authenticity of the information obtained.

Data analysis

All the responses were collected by using the MySQL database, an open source database which exists on the web server, and exported to Microsoft Office EXCEL 2003 for Windows for data cleaning. The cleaned data was analyzed by SPSS Version 16 for relevant statistical analysis. Descriptive analysis was carried out to summarize the data. Chi Square test/Fischer Exact test was used to find association between variables.

Ethical issues

Participation in the survey was entirely voluntary. Consent was obtained from the respondents before they answered the survey. No finding which could identify any individual respondent was published.

Results

A total of 202 respondents were identified (132 medical schools and 70 pharmacy schools) in the SEA region. However, data from only 52 respondents was available for analysis with a response rate of 25.7%. Moreover, 10 responses were discarded as they contained incomplete information. The final analysis included 42 respondents giving a successful response rate of 20.8%. There were more respondents from Singapore and Malaysia compared to other countries (Table 1). Of the 42 respondents, 27 (64.3%) were received from pharmacy schools while 15 (35.7%) were received from medical schools. Majorities (78.6%) of the institutes were public in nature and also 81% were affiliated with a teaching hospital.

Table 1: Description of respondents according to countries

Variables	**Countries n (%)**					**Total**
	Indonesia	**Malaysia**	**Philippines**	**Singapore**	**Thailand**	
Survey response rate*	3 (5.1)	19 (54.3)	10 (29.4)	3 (60.0)	7 (10.0)	42 (20.8)
Programs by schools						
Pharmacy	2 (66.7)	16 (84.2)	3 (30.0)	1 (33.3)	5 (71.4)	27 (64.3)
Medical	1 (33.3)	3 (15.8)	7 (70.0)	2 (66.7)	2 (28.6)	15 (35.7)
Institution Funding Source						
Public	2 (66.7)	14 (73.7)	7 (70.0)	3 (100.0)	7 (100.0)	33 (78.6)
Private	1 (33.3)	5 (26.3)	3 (30.0)	0 (0.0)	0 (0.0)	9 (21.4)
Affiliation with teaching hospital						
Yes	3 (100.0)	13 (68.4)	10 (100.0)	3 (100.0)	5 (71.4)	34 (81.0)
No	0 (0.0)	6 (31.6)	0 (0.0)	0 (0.0)	2 (28.6)	8 (19.0)

**Response rate was calculated for each country. Total response rate was 20.8%*

Tables 2 discuss ABR-related topics in the existing curriculum. Out of the entire responses, 76.2% of the schools documented that ABR-related topics are a compulsory part of their curriculum. Table 2 also shows the methods of teaching ABR in which 92% from pharmacy schools and 93.3% from medical schools reported that they are still engaged in the traditional "lecture" methods.

Table 2: ABR-related topics in the curriculum and Methods of teaching ABR of the respondents' institutions

Variable	Pharmacy n (%)	Medical n (%)	Total n (%)	*P* value
ABR topics are part of compulsory curriculum				0.286*
Yes	19 (70.4)	13 (86.7)	32 (76.2)	
No	8 (29.6)	2 (13.3)	10 (23.8)	
Lectures				1.00*
Yes	23 (92.0)	14 (93.3)	37 (92.5)	
No	2 (8.0)	1 (6.7)	3 (7.5)	
Small group discussion				0.074*
Yes	15 (60.0)	13 (92.9)	28 (71.8)	
No	10 (40.0)	1 (7.1)	11 (28.2)	
Role play				0.276*
Yes	1 (4.5)	3 (21.4)	4 (11.1)	
No	21 (95.5)	11 (78.6)	32 (88.9)	
Video documentary				0.519*
Yes	2 (9.1)	0 (0.0)	2 (5.7)	
No	20 (90.9)	13 (100.0)	33 (94.3)	
Response to case Scenarios				0.315**
Yes	12 (50.0)	9 (69.2)	21 (56.8)	
No	12 (50.0)	4 (30.8)	16 (43.2)	

**Fischer's Exact* Test, ** *Ch Square Test*

In terms of barriers to ABR teaching, inadequate time allocation for ABR teaching was mentioned by both pharmacy and medical schools (57.5% and 42.5%) respectively (Table 3). Lack of interest from other faculty members were reported by 75% of pharmacy schools respondents and by 78.6% from those of medical schools as shown in Table 3.

Table 3: Barriers in teaching ABR

Variable	Pharmacy	Medical	Total	*P* value
Inadequate time allocation in curriculum				0.749**
Yes	15 (60.0)	8 (53.3)	23 (57.5)	
No	10 (40.0)	7 (46.7)	17 (42.5)	
Lack of interest from other faculty members				1.00*
Yes	18 (75.0)	11 (78.6)	29 (76.3)	
No	6 (25.0)	3 (21.4)	9 (23.7)	
Lack of integration of education about ABR in curriculum				0.467*
Yes	16 (66.7)	11 (73.3)	27 (69.2)	
No	8 (33.3)	4 (26.7)	12 (30.8)	
Pharmaceutical industry financing of student activities in my institution				0.394*
Yes	0 (0.0)	1 (7.1)	1 (2.8)	
No	22 (100.0)	13 (92.9)	35 (97.2)	
Perceived irrelevance to students' work after graduation				1.00*
Yes	2 (9.1)	1 (7.7)	3 (8.6)	
No	20 (90.9)	12 (92.3)	32 (91.4)	
Lack of continuation during students' clinical training				0.101**
Yes	8 (34.8)	9 (64.3)	17 (45.9)	
No	15 (65.2)	5 (35.7)	20 (54.1)	

***** *Fischer's Exact* Test, ** *Ch Square Test*

With regards to antibiotic selection, both schools share the same criteria as to procurement dose, route and administration of antibiotics (Table 4). The medical schools were directed towards issues related to cost, resistance patterns and mechanism in our study, as shown in Table 4.

Table 4: Selection of antibiotics and other issues related to ABR

Variable	Pharmacy	Medical	Total	*P* value
The most prudent first line choice				0.419*
Yes	18 (100.0)	12 (92.3)	30 (96.8)	
No	0 (0.0)	1 (7.7)	1 (3.2)	
The contraindications to the first choice drug(s) and what alternatives should be used	17 (94.4)	12 (92.3)	29 (93.5)	0.429*
Yes	1 (5.6)	1 (7.7)	2 (6.5)	
No				
Dose, route and duration of treatment	18 (100.0)	11 (84.6)	29 (93.5)	0.168*
Yes	0 (0.0)	2 (15.4)	2 (6.5)	
No				
List of restricted antimicrobials				1.00*
Yes	13 (76.5)	7 (70.0)	20 (74.1)	
No	4 (23.5)	3 (30.0)	7 (25.9)	
Cost of antibiotic resistance				0.229**
Yes	7 (43.8)	8 (66.7)	15 (53.6)	
No	9 (56.3)	4 (33.3)	13 (46.4)	
Antibiotic resistance pattern				0.093*
Yes	10 (62.5)	12 (92.3)	22 (75.9)	
No	6 (37.5)	1 (7.7)	7 (24.1)	
Resistance development mechanism	14 (82.4)	12 (100.0)	26 (89.7)	0.246*
Yes	3 (17.6)	0 (0.0)	3 (10.3)	
No				

**Fischer's Exact* Test, ** *Ch Square Test*

Discussion

Antibiotics have substantially reduced the threat posed by infectious diseases. By helping to bring many serious infectious diseases under control, these drugs have contributed to the major gains in life expectancy. These gains are now seriously jeopardized by the development and emergence as well as spread of microbes that are resistant to cheap and effective "first-line" antibiotics. A greater the duration of exposure is associated with a greater risk of the development of resistance, irrespective of the severity of the need for antibiotics. This is the first study to explore the types and depth of curriculum for antimicrobial resistance being taught by medical and pharmacy schools in SEA.

ABR is a global concern in pharmacotherapy for which intensive research data is available. One of the target populations where intervention studies can benefit the most is healthcare professionals in training. However, this intervention has not been generalized enough. Fakih and Hilu (Fakih and Hilu, 2003) reported that 91% of resident physicians in Michigan agreed that the overuse of antibiotics has a major role in increasing antimicrobial resistance. Twenty percent answered that antibiotics are useful in the treatment of the common cold and 30% responded that they would prescribe antibiotics when the diagnosis is not certain. Furthermore, only 21% knew that there is no resistance to penicillin for *Streptococcus pyogenes*.

Another study was conducted on senior medical students in 21 medical schools in New England and the Mid-Atlantic States to evaluate their knowledge and compliance with the principles of judicious antimicrobial use, as defined by the Centers for Disease Control. Ninety-nine percent of the students were aware of the increase in antimicrobial resistance, but almost 50% had read none of the principles, and only 2.9% had read all the principles. Thirty percent answered that they would treat a 4-year old child with pharyngitis (with no positive culture) with antibiotics, and 60% thought that an 18-month old toddler with purulent rhinitis and wheezing should be treated with an antimicrobial drug (Ibia *et al.*, 2005). Mora et al. reviewed 500 charts in a tertiary care teaching hospital to assess use, misuse, and abuse of antibiotics. Of the 500 patients, 175 (35%) did not receive antibiotics, no appropriate cultures were obtained in 45 patients (14%), no record or justification for the prescription was documented in 130 patients (40%), no cultures were obtained before modifying therapy in 80 patients (46%), no planned duration of therapy was stated in 180 patients (55%) and an incorrect weight-based dosage was prescribed in 23 patients (8%) (Mora *et al.*, 2002).

Apisarnthanarak evaluated the impact of education and an antibiotic control program on antibiotic prescribing practices in a tertiary care teaching hospital in Thailand (Apisarnthanarak *et al.*, 2006). After the intervention, there was a 24% reduction in the rate of antibiotic prescription and the incidence of inappropriate antibiotic use was significantly reduced. Rates of use of third-generation cephalosporins and glycopeptides were significantly reduced. Significant reductions in the incidence of infections due to methicillin-resistant *Staphylococcus aureus*, extended-spectrum betalactamase-producing *Escherichia coli* and *Klebsiella pneumonia* were found. Third generation cephalosporin-resistant *Acinetobacter baumannii* was significantly reduced. A total cost savings of $32,231 during the one-year study period was also reported.

Knowledge on the appropriate use of antibiotics among pediatric residents in a tertiary care teaching hospital was evaluated in another study. These pediatric residents were surveyed using a questionnaire that included very basic knowledge of antibiotics and practice experiences. The questions were as simple as ‘‘How do beta-lactam antibiotics work?’’ ‘‘Does cefotaxime belong to the third-generation cephalosporins?’’ ‘‘What is the difference between bacteriostatic and bactericidal antibiotics?’’ ‘‘What is the use of antibiotics in upper respiratory tract infections and diarrhea?’’ Unfortunately, third-year residents did not achieve a significantly superior grade when compared with first-year residents. The most surprising finding was that third-year residents were not able to attain 65% correct answers. Their scores were significantly lower compared to the positive control group that included infectious disease fellows (Pineda *et al.*, 2007). Insufficient education at undergraduate level could be a reason for those findings.

In light of these studies, one of the basic deficiencies reported was less attention towards the appropriate use of antibiotics in medical and pharmacy colleges. Keeping the seriousness of the issue in mind, ABR should be introduced early in training in medical school, residency and fellowship programs. These interventions must also include general practitioners, especially in rural areas of developing countries where physicians are required to work with scarce resources and often ignore basic concepts of antimicrobial prescription (Okeke *et al.*, 1999).

Shifting our concerns to the results of current study from SEA universities, majority of respondents agreed that ABR is a part of their compulsory curriculum but that they utilize the traditional method of lectures to conduct these sessions. In response to "role of pharmaceutical companies in antibiotic prescribing", 82% agreed that the role played by pharmaceutical industries towards ABR awareness is very poor. Lack of continuation of rational antibiotic use and ABR in clinical training was another identified area. Forty-eight percent stated that ABR is not frequently focused on in clinical settings. ABR is a clinical phenomenon and it should be given high priority in clinical practice. Internship calendars should be restructured and it should focus more on realistic and rational practices. The majority of our respondents (69.4%) mentioned that the ABR curriculum is not integrated. Fifty-two percent of respondents admitted that the cost of ABR is not covered by their curriculum.

Our findings in relation to how ABR is taught (Table 2) suggest that medical and pharmacy schools of the SEA region need to extend and improve the existing curriculum. An example of such an extension can be taken from the Universidad Nacional Autónoma de México (UNAM) School of Medicine, where a "rational use of antibiotics" course has been designed by infectious diseases specialists. It is given every year to third- and fourth-year medical students as an optional course, but it is included as part of the curriculum to gain credits. The agenda of this rational use of antibiotics course includes a description of antibiotic families and an explanation of the evidence for the antibiotic treatment of selected diseases. A review on antimicrobial resistance mechanisms, clinical impact, and regional data is also covered. Infectious disease experts in different fields are invited to each class not only to give a lecture but also to explain their own and international experience regarding antibiotic prescription behavior on the specific topic and how this could be linked to antibacterial resistance. At the end of each class, a message on the appropriate use of antimicrobial drugs is always underscored.

Conclusion

Antimicrobial resistance that has emerged in the last 50 years will continue to grow in the future. The number of multi-resistant bacteria will expand and some antibiotics will become obsolete. A multi-faceted strategy is required to improve antibiotic prescribing and control the emergence of antibiotic resistance. Education of both health care professionals and patients should form the corner stone of the strategy. This should be supplemented by evidence-based clinical practice guidelines and audits to assess compliance with these guidelines. All stakeholders, including government, professional societies and the public should be involved in formulating, implementing and reviewing the strategy. Another effective way to achieve a real change is by means of an integrated and structured approach, focused on the rational use of antibiotics, involving health administrations, health-care agencies, scientists, physicians, the public as well as the agricultural and pharmaceutical industries. It is also obvious that we need to approach this strategy in a different way to inculcate a deep sense of the importance of appropriate antibiotic use. Antibiotic resistance is a major clinical problem worldwide, and failure to take adequate steps to control the problem will have dire consequences for the entire human population.

Limitations

There are some important limitations in our study. The low response rate of the study participants may limit the generalizability of the findings. However, because the study was a web based (email) data collection, a low response rate was expected. Generally, low response rate of an email survey studies was documented and ranged between 6% to 75% (Sheehan and Hoy, 1999, Sheehan, 2001). The limited time available to conduct the study was one major issue. The unavailability of a reliable sampling frame was another important concern which resulted in difficulties on identifying potential respondents. There were some technical issues related to respondents' institutional internet security, hence the emails were bounced or discarded and did not reach the target population.

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