

SPECIAL ISSUE

“Applied Healthcare Management in Vietnam”

Topic Editors

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Applied Healthcare Management in Vietnam is an underexplored area in spite of its crucial position in society. For this special issue, we call for systematic reviews, original research, and methodology articles that address one or more significant issues in healthcare research in Vietnam. The objective of this special issue is to bring together research contributions on the design, specification, and implementation of architectures, protocols, and algorithms for current and future healthcare training system for effective education using technologically advanced facilities and programs. This special issue also provides a forum for researchers with high quality research work in the health field with the aim of improving the health planning, management and policy-making process toward the better healthcare system in Vietnam.

Special issue on “Applied Healthcare Management in Vietnam” invites papers that address problems at the patient level, provider level, or broader system level. Examples of specific topics that would fit this special issue include, but are not restricted to

- Healthcare management;
- Pharmacy policies and practices;
- Clinical pharmacy and Social, economic and administrative pharmacy;
- Psychological and mental health aspects; Public health policies and practices;
- Health promotion, education, and disease prevention among most vulnerable populations as defined by ethnicity, socio-economic status, geography, gender, age, risk status and identified as at-risk for health disparities.

Criteria for selection of research papers

- Original research or reviews, full in accordance with Journal guidelines.
- All papers undergo a blind peer review, and anonymous reviewers’ comments shall be notified to authors in a summary form. Paper deemed acceptable based on a peer review process. Submitted papers should be well formatted and use good English.

Registration

- Authors are encouraged to submit an abstract for initial review, and Guest Editor and Editor-in-Chief will encourage a full submission, if appropriate. The abstract should be less than 200 words, including tentative title, author(s), objectives, methods, results and conclusion.

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Abstract submission due date: March 01, 2018.

Please submit it your abstract via the following email: editor@asiapharmaceutics.info

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Before submission, authors should carefully read over the instruction for Authors which are located at <http://www.asiapharmaceutics.info/index.php/ajp/pages/view/guidelines>

LETTER OF APPROVAL TO PUBLISH

Dear Editor,

Department of Pharmacy Administration, Faculty of Pharmacy, University of Medicine and Pharmacy at Ho Chi Minh city, in collaboration with the Asian Journal of Pharmaceutics (<http://www.asiapharmaceutics.info/index.php/ajp/index>), is pleased to launch the papers for a journal special issue “Applied Healthcare Management in Vietnam” which is an underexplored area in spite of its crucial position in society.

We the undersigned declare that those manuscripts are original/review papers, have not been published before and are not currently being considered for publication elsewhere. This is to state that we have read and agreed the final version of the article above to be published the special issue namely “Applied Healthcare Management in Vietnam” in Asian Journal of Pharmaceutics.

The publication information should be arranged by the listed as follows **Appendix 1**.

I assure that this article does not have any plagiarism. Kindly consider the manuscript for publication in your journal. I abide all rules and regulations of the journal. In future if any litigation arises in this article I will cooperate with the editor to resolve the issue. I accept the decision of the editor would be final.

Thank you so much for your help.

Sincerely,



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Health Technology Assessment in Developing Countries: A Brief Introduction for Vietnamese Health-care Policymakers

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Abstract

As a middle-income country, Vietnam has faced multiple challenges and financial burdens in relation to the health-care sector. In many countries, policymakers make full use of health technology assessment (HTA) to guide decisions concerning health-care resource allocation. The aim of this article is to present perspectives on the historical development of HTA as well as the future of HTA as a tool for making policy decisions in Vietnam. Further, the article also illustrates how HTA can be used effectively and what is needed to establish a successful HTA agency. In addition, the characteristics and conducive factors of an effective HTA agency are thoroughly discussed. Vietnam has witnessed a rapid increase in health expenditure in recent years, which has led to a critical demand to apply HTA to obtain the maximum benefit from new and existing technologies. To meet that demand, the Health Strategy and Policy Institute was established by the Ministry of Health in 2013. Although the use of HTA in Vietnam is still at an early stage, HTA seems likely to become a necessary part of the health-care sector to support policymakers in making difficult decisions in Vietnam.

Key words: Decision-making, developing country, health policy, health technology assessment, Vietnam

OVERVIEW OF HEALTH TECHNOLOGY ASSESSMENT (HTA)

Definition of HTA

The International Network of Agencies for HTA (INAHTA) describes health technology as a wide range of health-care products that can be used for disease prevention, diagnosis, monitoring, or treatment, as well as for health promotion and quality of life improvement.^[1] In this context, “technology” is interpreted broadly to include pharmaceuticals, medical equipment, health-care services, diagnostics, procedures, information technology, and systems of organization in the health-care field.^[2,3] With the rapid growth of medical technology innovations in recent years, an increasing number of health technologies are being invented. As a result, it is vital to implement a system that can effectively direct investments in health technology. For this reason, HTA is progressively used.

According to the World Health Organization, HTA involves the systematic evaluation of

the features, consequences, impacts, and use of health technology.^[4] Similarly, HTA International (HTAi) defines HTA as the evidence-based analysis of related information concerning the direct and intended, as well as the indirect and unintended, results of technologies.^[3] The International Society for Pharmacoeconomics and Outcomes Research (ISPOR) further defines HTA as a process that analyzes the influences of the application of health technology for a short duration as well as in the long run.^[5] More specifically, the INAHTA considers HTA to be a multidisciplinary research process that seeks to comprehensively assess a health-care intervention from the medical, social, economic, legal, and ethical perspectives.^[6] Various other organizations, including

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the European Network for HTA (EUnetHTA), similarly consider that HTA summarizes knowledge regarding the clinical, economic, social, and ethical issues associated with the use of a health intervention using systematic, clear, and equitable methods.^[7]

Role of HTA

The economic evaluation of a new health technology plays a vital role in supporting decision-makers concerned with health-care policy and practice,^[8] especially in terms of pricing, reimbursement, and market access decisions. The impact of this role can be seen in two basic aspects. First, there is the link between HTA and the pricing and reimbursement (P and R) process, that is, whether HTA is a formal part of the P and R process or separate from it. The second aspect concerns the main effects of HTA in terms of pricing, reimbursement, and market access.^[9]

The National Coordinating Center for HTA of the United Kingdom suggests that HTA outcomes provide answers for the following questions concerning health technology: “When compared with existing alternatives, does the technology work, in whom does the technology work, and what is the cost impact?”^[10] This implies that HTA contributes to the determination of the relative “value for money” of a new intervention, thereby helping to guide policymakers and patients as to what is the most appropriate treatment option.^[11] Basically, an effective HTA program ensures the appropriate selection of the latest medical devices/ drug or healthcare services with the most affordable price. To fulfil this role, HTA needs to provide accessible and valuable information regarding the technical characteristics and properties, clinical effectiveness and safety, costs and economic evaluation, and other impacts of new technologies to all concerned stakeholders.

In this way, HTA also contributes to strike a balance between innovation in terms of medical interventions and delivery of adequate and appropriate care to patients, especially in low- and middle-income countries (LMICs) characterized by tight health-care budgets.

Characteristics of successful HTA agencies^[12]

The principal feature of a strong HTA agency is independence. Securing such independence one means that the HTA process can proceed without any political pressure to ensure particular objective outcomes.

The second key characteristic is financial sustainability, which refers to the consistent flow of financial resources into the HTA agency. One suggestion for achieving this is an annual budget allocated by the government. Yet, the operation of HTA agencies, which typically rely heavily on research sponsors, could be threatened if sufficient grants are not available.

The third factor that leads to an effective HTA agency is good management of any potential conflicts of interest (CoI). This is necessary because HTA agencies frequently confront problems when dealing with the different interests of various stakeholders in the health-care sector, for example, health professionals, politicians, civil society, and patient groups. Consequently, good management of any CoI is needed to maintain the neutrality of the HTA agency, which can only be accomplished if HTA agencies coordinate with private industry without receiving financial support from such organizations.

The fourth key characteristic is employing full-time academic staff. HTA is applied in many fields, including pharmaceuticals, medical equipment, health improvement, disease prevention, and health policy. Therefore, when performing HTA, the availability of a multidisciplinary staff who are able to continuously develop their skills is vital.

The fifth feature that contributes to a successful HTA agency is access to an extensive network of local and international partners for the purpose of sharing experiences and best practice.

The sixth element of a successful HTA agency is establishing a methodical process for determining relevant policy topics for assessment. Once interventions have been chosen, their possible effects are examined and then communicated to numerous stakeholders, such as decision-makers, health-care providers, and industry.

The final key characteristic is the ability to produce research with a qualified assurance (QA) mechanism to ensure the high quality of the assessment. Research studies implemented by agencies with a good QA mechanism can be published in academic journals and then widely acknowledged.

Conducive factors for establishing HTA agencies

After acknowledging the key characteristics of any successful HTA agency, it is necessary to consider the conducive factors for establishing an HTA agency. The Health Intervention and Technology Assessment Program (HITAP) has identified six key elements in this regard, which will be thoroughly discussed below.

First, HTA systems with a higher proportion of public investment than private contributions are more likely to be well-established. These systems stand a greater chance of investing in high-quality and cost-effective interventions.

Second, political will, leadership, and legislation all serve as strong encouragement for establishing effective HTA agencies due to legitimizing the role of HTA in the policy-making process, which creates both a requirement and a necessity for more HTA programs.

Third, a high capacity for health information promotes the use of HTA. The HTA process requires a wide range of information and large data sets for analysis. Therefore, an efficient and expansive information infrastructure will make it easier for the government to conduct HTA at an affordable price.

Fourth, the provision of local training in HTA-related disciplines is an essential action before the establishment of formal HTA agencies. Training postgraduates in pharmacoeconomics, health economics, and other relevant HTA disciplines in universities or further education intuitions will result in the availability of skillful and academic staff who can help to strengthen the existing or new capacity of a successful HTA agency.

Fifth, effective coordination between HTA associations and stakeholders serves to establish a link between studies and policy, since these stakeholders, including politicians, medical associations, civil society, and industry, are all involved in every stage of the HTA process. Such partnerships will contribute to widely accepted HTA outcomes and serve to legitimize the produced policies.

Sixth, establishing independence from international support or external assistance compels HTA agencies to spend their limited resources more effectively. The lack of external aid should lead to increased concern on the part of policymakers about making wise and efficient decisions.

Elements of the HTA process and principles of conduct

There are five main activities involved in the HTA process, namely, horizon scanning, topic determination, assessment and preliminary appraisal, dissemination of results and recommendations, and monitoring and evaluation of the organization.^[10] Some experts have suggested a series of 15 principles to be considered when evaluating the available HTA activities or establishing new ones.^[13] All five main activities as well as the application of HTA for policymaking should be conducted according to these principles. Hence, the five main activities will now be considered and the principles that inform them analyzed.

Horizon scanning refers to the early analysis of prominent technologies, potential evidence requirements, and budget allocation.^[10] The first principle that informs this activity is the notion that the aim and range of the HTA should be transparent and relevant to its use. To abide by this rule, the HTA agency's staff should develop a list of questions to be addressed by HTA and then follow-up on those questions.^[13]

Topic determination involves selecting priorities from ranked prominent technologies for assessment or reassessment.^[10] In general, HTA should consider all related technologies due to the existence of potential inefficiencies in all forms of health

care. However, in a situation where not all technologies are assessed, a transparent system for setting the priorities for HTA should be established.^[13]

Assessment and preliminary appraisal require the gathering, evaluating, and systematic examining of all the available data concerning the technology.^[10] Due to the complicated and often controversial nature of HTA-based decisions, the HTA process should be explicit and unbiased, applying suitable methods for evaluation and including a wide range of evidences and results to gain both stakeholder and public trust. In addition, HTA should clearly describe the uncertainty surrounding any estimates. As all information is estimated, the potential errors and limitations of the examination should be recognized. In addition, when conducting HTA, the complete social perspective as well as issues of generalizability and transferability should be considered to maximize efficacy and social benefits.^[13]

Dissemination of results and recommendations allows the HTA findings to be widely and effectively used. To achieve this, the HTA process should be timely, which means that HTA should be implemented when its findings can provide useful information concerning health-care technologies for policy decisions. Further, the assessments should be continuously updated. Moreover, the HTA results need to be communicated appropriately to different stakeholders due to potential CoI. Another principle that informs these activities suggests that the relation between HTA itself and the resulting decisions, as well as the HTA outcomes and policy-making process, needs to be explicitly defined.^[13]

Monitoring and evaluation of the organization ensure that the HTA program runs effectively and generates trustworthy outcomes. A number of issues need to be considered when constructing a monitoring organization for a successful HTA program. First, all the main stakeholders should be involved in all the steps of the HTA program, since this leads to a greater opportunity for outcomes to be implemented as well as serving to guarantee higher quality technology assessments. Second, those conducting the HTA should actively seek out all available data to maintain transparency and gain trust in their decisions. Finally, the HTA process needs to be monitored so as to ensure that it is fairly being implemented and the original investment in conducting HTAs is fruitful.^[13]

Barriers for applying HTA policy decisions

One of the main aims of HTA is to inform decision-makers in relation to policy development. However, a number of problems can prevent HTA from fulfilling its role. The most common barriers to implementation that have been identified in the Asia-Pacific region include the silo-based policy-making process, low quality policy-making standard, limited dissemination of research, and high respect for expert opinions.

A silo-based decision-making process occurs when no other relevant stakeholders besides the chairman participate in making decisions. This means that the leader of the policy-making body often has a greater impact on other committee members than the HTA findings in terms of making decisions, which reduces the use of HTA in policymaking.

Another barrier concerns the fact that policymakers often utilize poor decision-making criteria when allocating resources. More specifically, policy considerations mainly focus on the unit costs of health technologies or safety and short-term outcomes rather than long-term consequences or the link between cost and effectiveness.

At the same time, there is less chance of research results that offer no benefits to policymakers being used during the decision-making process. Simply put, HTA findings that are inconsistent with policy will prove difficult to disseminate to stakeholders. This barrier could represent the main reason for preventing the development of policies that benefit society.

The final common barrier is the fact that expert opinions are generally considered to be more important than evidence-based findings, especially in Asia, where respect for seniors is frequently higher than that seen elsewhere in the world. Therefore, applying strong HTA findings when making decisions may prove challenging.

INTRODUCTION OF HTA IN VIETNAM

Historical development

In March 2013, the Ministry of Health (MoH) of Vietnam decided to establish and operate the Health Strategy and Policy Institute (HSPI) to foster efficient cooperation between policymakers, research agencies, and other stakeholders. The HSPI is responsible for conducting studies to provide scientific evidence that the MoH can use to build and modify health strategies, as well as collaborating with international partners in relation to health policy and the health-care system.^[13] The United Kingdom's National Institute for Health and Care Excellence (NICE), a long-term partner of the MoH of Vietnam, completed the first step in supporting the design of the basic package of health care subsidized at Vietnamese health facilities in November 2013. The NICE International aims to support the HSPI on the journey toward achieving universal health coverage (UHC). However, the health benefit package has not yet been applied, while a link between research institutions and policymakers in Vietnam has also not been completely created.

The HSPI organized a consultation workshop concerning the development of a strategic roadmap for HTA in Vietnam in 2014.^[14] In the same year, the HSPI also participated in the 3rd HTAsiaLink conference held in China in an attempt to further promote international collaboration. In addition, the

NICE International and HITAP Thailand both participated in a week-long training course on HTA that was held in the capital of Vietnam in July 2014.

Health system context in Vietnam

Vietnam is a middle-income country that applies centralized governance of the health-care system. The MoH plays a vital role in planning and implementing all health plans. High-ranking officers from around 20 departments are responsible for making decisions at every level in the health-care sector, which leads to the majority of policy decisions being made personally.^[12]

The Vietnam Social Security (VSS) agency, which is the implementing agency for Vietnam's social health insurance, operates independently under the Vietnamese Government.^[12] In 2014, the health insurance coverage rate in Vietnam was 70% although the aim is to achieve 90% coverage by 2020.^[15,16]

Due to recent increases in the burden of disease and health problems such as non-communicable diseases, as well as the existence of an aging society, Vietnam spent 7% of its gross domestic product on health in 2011, which exemplifies the rapid increase in health expenditure seen in recent years.^[12] In addition, due to the absence of a process for setting relevant health priorities, the use of health technology is generally unwise and incoherent. Indeed, the foundation of the selected health-care services that are paid by the National Health Insurance Fund is not based on scientific evidence or HTA studies, such as a cost-benefit analysis, cost-effectiveness evaluation, or cost-utility analysis.^[14] It can take up to 2 years to make a choice regarding investment coverage and even longer for choices concerning a drug or vaccine.^[12]

Based on the current health system context, there is certainly a need for HTA when establishing health priorities, including building a national list of essential medicines (NLEM) and constructing the official benefits package using HTA evidence. The HSPI is currently at an early stage of development in this regard with support from various international partners.

Current practice

The HTA process is well-established and implemented in developed countries such as the United Kingdom, the United States, and Canada, while in developing countries such as Vietnam, the use of HTA remains limited. Currently, the Vietnamese MoH is the response for conducting HTA as well as reviewing the health system based on all published evidence. However, HTA has not yet been utilized for regulatory and reimbursement decisions.^[16] In addition, a review conducted in a number of LMICs such as Vietnam has revealed that although HTA is increasingly used, the associated research studies are not often used to inform policy-making at the national level in LMICs, with Vietnam being no exception.^[15]

In recent years, due to the demand for advanced health technologies and the rapidly growing pharmaceuticals market, the use of a health benefits package has increasingly been promoted. A health benefit package is defined as the services, activities, and goods reimbursed or directly offered by sponsored public insurance or national health services. The methods, processes, and policies that influence the design of such packages are crucial to accomplishing and sustaining UHC within the insurance field. The International Decision Support Initiative (iDSI) and HITAP engaged with the VSS agency to explore practical ways to achieve efficient and high-quality UHC during their visit to Hanoi in 2017.^[7]

The National Health Insurance Policy Consulting Committee (NHIPCM), which was established in 2016, encompasses an HTA group that is responsible for advising and consulting with the NHIPCM in the technical review of HTA evidence.^[2]

Several HTA studies and systematic reviews have been conducted in Vietnam in recent years, including (i) Cost-effectiveness of peginterferon alfa-2b or alfa-2a with ribavirin for hepatitis C in Vietnam, (ii) cost-effectiveness of magnetic resonance imaging services in Vietnam, and (iii) cost-effectiveness of trastuzumab in metastatic breast cancer in Vietnam.^[2] Although there exists some good individual HTA capacity, HTA and other priority-setting tools still represent new innovations in Vietnam.^[8] Currently, the main HTA aim is to cooperate with other local units to conduct policy-related HTA research with support from external intuitions.

HTA IN VIETNAM: A WAY FORWARD

There are many potential applications of HTA in Vietnam, including supporting policymakers in health reimbursement decisions, providing evidence-based information about new drugs or drug classes for pricing strategies and clinical practice guidelines, and establishing an NLEM.^[10] However, to convert these potential uses into reality, Vietnam needs to establish a strong HTA agency, which should be based on the financial and social contexts and demonstrate characteristics that were mentioned above. Some additional considerations include the annual budget size, sources of funding, professional workforce, reporting system, and capacity of the database.^[11]

How to design the framework for a HTA system

To date, health technology is a vitally important factor in health-care system. However, health technology itself has both pros and cons. It promotes the capacity for prevention, diagnosis, and treatment, but it also has some negative impacts, including the side effects of technology, the increase in health expenditure, and the social and ethical impacts of technology. Vietnam is still a developing country with limited health resources. This situation results in enormous pressure on the health-care system in terms of how to deliver affordable and effective vital health care as well as health technology to

the whole of society. Therefore, HTA represents a significant opportunity to tackle such issues in a transparent, evidence-based fashion. With regard to the development of an HTA system, there are five main strategies available, which are illustrated in Figure 1.

RECOMMENDATIONS FOR DEVELOPING THE HTA CAPACITY

Develop human resources

HTA research agencies and policy-making bodies as well as other related stakeholders that use HTA all require experts and people who are equipped with the appropriate knowledge and skills. One solution for this issue is to implement more HTA training courses within medical and pharmacy universities as well as other related academic institutions in Vietnam.

Establish a core HTA team or institute

The HTA process involves multiple stakeholders, which renders it essential to have a focal HTA agency to coordinate the HTA activities and cooperate with partners. This focal organization not only must be committed to HTA work but also should be responsible for establishing the trust of all stakeholders. The HTA agency in general and the HSPI of Vietnam in particular should also be independent from the government, refuse financial support from private sources, and have an explicit process for dealing with CoI involving different stakeholders. In addition, since conducting HTA is very technical and time-consuming, the HSPI should employ full-time academic staff. Although the necessary number of full-time staff members depends on the scope and responsibility of the core team or HTA institute, the focal organization must have the ability to retain staff to make a significant impact.

Link HTA outcomes to policy-making mechanisms

If they do not serve to support policy-making decisions, all HTA studies and results will become worthless. Therefore, it is essential for the HSPI to have a close connection to policy-making decisions. The appropriate mechanism for establishing this link will vary based on the context and design of the health-care system. For instance, the link between HTA and coverage decisions includes the pharmaceutical reimbursement list or essential drugs list, immunization programs, high-cost medical device packages, and public health programs.

HTA legislation

HTA legislation is not a prerequisite for a well-functioning HTA system, for example, in the case of the HITAP

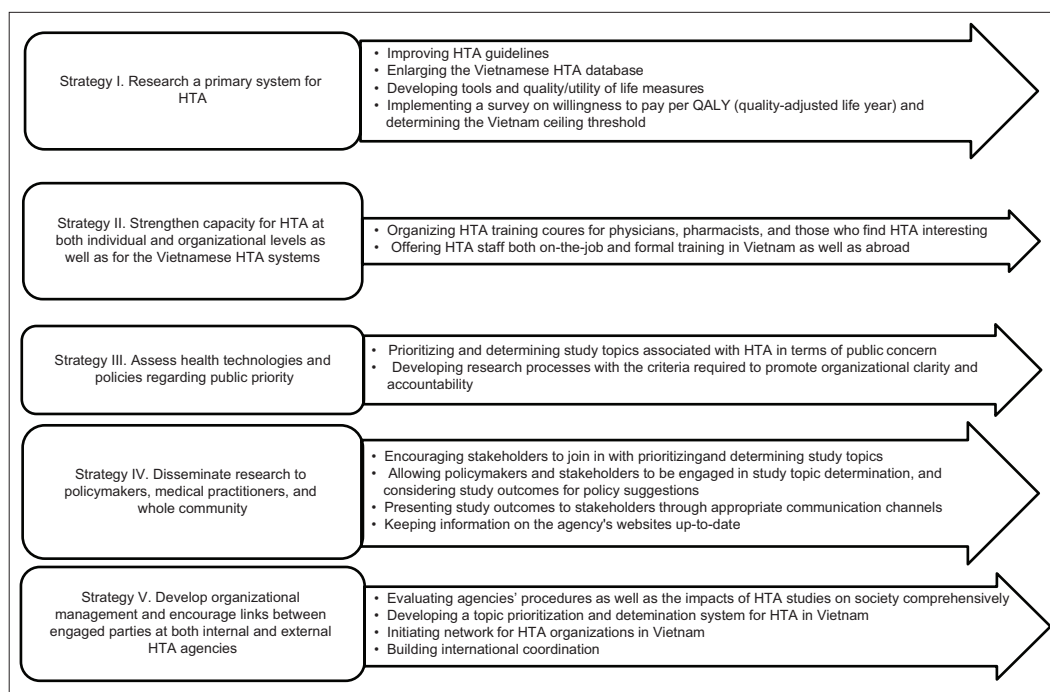


Figure 1: Five suggested strategies for developing the health technology assessment system in Vietnam^[17]

in Thailand. In other words, HTA legislation does not necessarily guarantee the successful implementation and use of HTA. Nevertheless, the existence of appropriate legislation may help to sustain the long-term and successful use of HTA. Such HTA legislation should ensure the presence of key components such as participation, transparency, and systematic application within the HTA process rather than focusing on technical issues.

International collaboration

The HTA agencies of the seven countries all received international support and formal overseas training for staff. International technical support is very useful, especially during the formative stages. As to the establishment of the database, resources are widely available at the international level through international agencies. However, some resources offer policy advice rather than building the capacity of local researchers, and therefore, they are rarely adaptable to local policy questions. As a result, a gap between international support and in-country technical support, which involves hands-on supervision and working closely on local studies, may occur.

Moreover, the experience of using HTA when making policy decisions in one setting can be influenced by the context, especially in places that have similar economic and health infrastructure. Therefore, regional networking, such as HTAsiaLink, is equally important when compared to international or global networking, which is widely available in many forms, including the HTAi, ISPOR, and INAHTA.

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Hospital Cost Analysis in Developing Countries: A Methodological Comparison in Vietnam

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Abstract

Context: Health-care expenditure is increasing worldwide. To control costs and increase efficiency, health economics has been applied by hospital management. Determining the unit cost of medical services is essential for health economics analysis, including health-care financing. **Aims:** The aim of this study is, therefore, to explore the unit cost analysis of medical services in Vietnam as well as the effects of applying different costing methods. **Materials and Methods:** A standard costing approach was applied to calculate the unit cost of medical services in two provincial hospitals. During the unit cost calculation, the micro-costing method and the ratio of cost to charge (RCC) method were compared. For both hospitals, the total cost as well as the proportion of capital, labor, and material costs were calculated and compared. The unit cost analysis covered 776 services in Ha Nam Hospital and 2064 services in Thu Duc Hospital. **Results:** Although both hospitals offer the same level of service, they differ in terms of other characteristics. Hence, their costs are quite different. Comparing the results calculated using the micro-costing method and the RCC method, the unit costs of the same services were also found to be quite different. The present study should prove particularly valuable in relation to the methodological comparison of hospital service cost analysis in developing countries such as Vietnam. **Conclusions:** The micro-costing method proved to be the most accurate method when calculating the unit cost of medical services since it was best able to reflect the consumption of resources.

Key words: Medical services, micro-costing, ratio of cost to charge, unit cost, Vietnam

INTRODUCTION

Nowadays, the prices of medicine and health-care services are often so expensive as to be barely affordable, not only for the majority of low- and middle-income countries but also for a sizeable segment of the global population who do not receive adequate social protection or insurance such as that available in high-income countries.^[1,2] As a consequence, both cost containment and efficiency management are considered to be urgent policy issues. For many countries, health economics is applied as a tool for providing information to policymakers.^[3] As evidence-based policy making rarely relies on individual studies, policymakers and the researchers who support them typically attempt to make the best

possible use of the various partially relevant studies that are already available.^[4] Consequently, the standardized methods and reference values used in health economics studies are vital to the achievement of reliable and comparable results. In the field of health economics, the cost analysis of health-care

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services is necessary for the evaluation of the efficiency of routine services and intervention choices. In addition, it is also used in health financing in relation to both the government budget and the reimbursement of health insurance.

In recent years, the health status of Vietnamese people has been significantly enhanced. Many fundamental health indicators concerning the Vietnamese are higher when compared to those of other countries with an equivalent average income. However, some essential indicators have remained poor, while regional differences in terms of such health indicators persist. The Vietnamese population was estimated to be around 89.71 million in 2013.^[5] The Vietnamese health-care system is comprised a highly unregulated group of both public and private medical facilities and services. The health-care establishments within the public system consist of four levels of hospital facilities, namely, central, provincial, district, and community facilities. Further, the public sector plays a leading role in providing inpatient health services in 1063 hospitals, with a total of 222,025 patient beds being available in 2014.^[6] In developing countries, the government typically provides hospitals that account for more than 50% of all medical resources. In the case of Vietnam, this figure was 41.9% in 2010.^[7,8]

According to the standard costing method, there are alternative calculation methods available for each step. These different methods result in a variation in the unit costs of medical services, which has been demonstrated in countries such as Canada,^[9,10] the Netherlands,^[11] India,^[12] Thailand,^[3] and the Philippines.^[13] Therefore, the present study aims to explore a unit cost analysis of hospital medical services in Vietnam as well as the effects of different costing methods.

SUBJECTS AND METHODS

Study design

The economic cost of medical services was determined by the standard costing approach, which was performed from the hospital's perspective.^[14] The unit cost of medical services was estimated by employing the micro-costing method and comparing it to the ratio of cost to charge (RCC) method.^[15,16] The overall costs consist of the monetary value of the materials, labor, and capital assets used to provide the services.

Study hospitals

Two hospitals in different regions of Vietnam were selected on the basis of their willingness to participate in the study such as Ha Nam Hospital and Thu Duc Hospital. Ha Nam Hospital is located in Phu Ly City, Ha Nam Province, which is in the north of Vietnam some 60 km away from Hanoi. Ha Nam Hospital, which was established in 1954, is a Level II infirmary with a capacity of 662 beds, 124 inpatient admissions, and 540 outpatient visits per day as of 2012. Some 655 health-care staff are employed

in 35 departments in Ha Nam Hospital. Meanwhile, Thu Duc Hospital is located in Ho Chi Minh City, which is the largest city in the South of Vietnam. Similar to Ha Nam Hospital, Thu Duc Hospital is a Level II infirmary with a capacity of 700 beds. In 2014, the numbers of visits and admissions per day were over 1,500 for outpatients and almost 100 for inpatients, respectively. The total number of hospital staff working in the 31 departments that comprise Thu Duc Hospital is 780. Furthermore, in 2012, the occupancy rate of Thu Duc Hospital was only 86%, while that of Ha Nam hospital was 123%.

Costing methodology

The term "cost" in this study refers to the economic cost, which is defined as the monetary value of the resources that are consumed to create goods or services.^[17] The standard or conventional method of determining cost was employed in this study.^[18-20] Figure 1 provides information about the analysis process concerning the unit cost analysis of medical services based on the standard costing methodology, which consists of six steps: (1) Study design and planning, (2) organization analysis and cost center classification, (3) direct cost of cost centers determination, (4) indirect cost determination, (5) full cost (FC) determination, and (6) unit cost of hospital services calculation.

Step one - study design and planning

This step requires the identification of the objectives, cost objects (or cost products), perspective, level of the organization involved, time horizon, and cost component.

Step two - Organization analysis and cost center classification

The structure of the relevant hospital organization is analyzed and then classified into two groups, namely, transient cost centers (TCCs), which are cost centers that support other cost centers, and absorbing cost centers (ACCs), which are cost centers that provide services that need to be calculated.

Step three - direct cost determination

The direct costs of each cost center are determined by accumulating the values of its capital costs, labor costs, and materials costs. Then, the capital cost method and useful years are added.

Step four - indirect cost determination

In this step, the allocation criteria are used to rearrange and allocate the cost allocation. In this study, several allocation methods were considered, namely, direct allocation, step-down allocation, double allocation, and simultaneous allocation. However, simultaneous allocation, which is the most accurate method, was ultimately employed in this study. The allocation

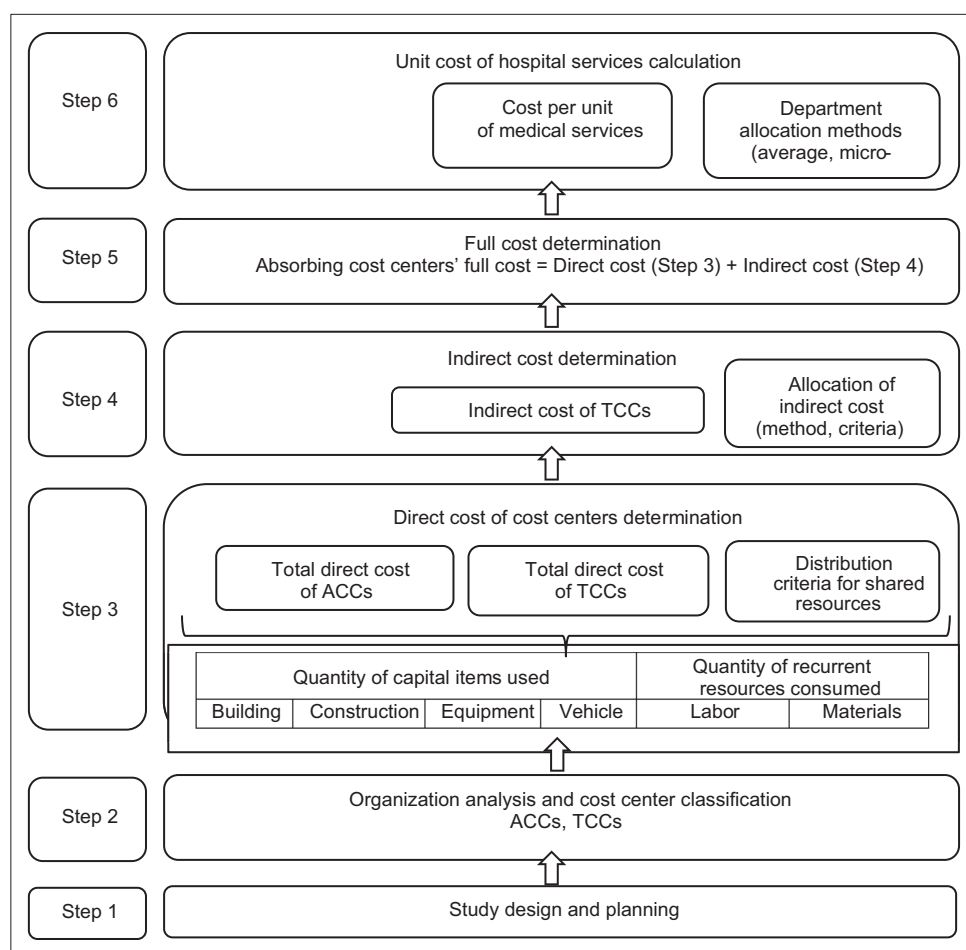


Figure 1: Analysis process based on the standard unit cost analysis of medical services.
ACCs - absorbing cost centers, TCCs - transient cost centers

criteria of TCCs (T1, T2, and T3) were applied as the full-time equivalents of the department of administration, personnel, and finance, respectively, while in the case of the amount of infectious garbage, the revenue was used to allocate the infection control cost center, including laundry (T6) and planning (T4).

Step five - FC determination

The FC of an ACC is calculated based on the summation of the total direct cost (TDC) and all indirect costs (IDCs):

$$FC = TDC + \text{sum of indirect costs (IDCs)}$$

Step six - unit cost of hospital services

In the unit cost analysis, the unit cost calculation is defined using multiple methods, including the average method, the micro-costing method, the relative value unit (RVU) or weight procedure method, and the RCC method.

In cases where the ACC produces only one output (a cost object) or a number of homogeneous outputs (e.g. an outpatient service), the average unit costs are used. For

multi-product cost centers, a number of methods are available. The most accurate such method, which does not require a greater workload, is the micro-costing method since it is based on actual resource use.^[21] The micro-costing method first determines the direct cost of each service (that is, the amount of countable resources that are used during the provision of the service). The second utilized method is the RCC method.^[22] This method is relatively less accurate, but it requires a lower workload. The RCC is computed based on historical records. It is used to estimate the cost of each service based on the relevant charge information obtained from patient bills.

In this study, we employed micro-costing as a base case, while the RCC method was used to explore the difference. Micro-costing is measured by the cost estimation that relates to "direct enumeration and costing out of every input consumed in service production." The time spent using equipment and the total working time of laborers (including doctors, nurses, and technicians) in practicing specific services were calculated as a proportion of the remainder of the cost. The costs are then calculated by assessing the average working time measured using the labor cost of doctors, nurses, and technicians or the capital cost. This calculation is considered

to be fairly simple. First, the total capital cost per department as multiplied by the total time spent using equipment for each service is determined. It is then divided by the total time spent using equipment per department, which results in the unit capital cost of a service.

Second, the unit labor cost of a service is calculated by multiplying the labor cost per department by the time spent working on each service, which is then divided by the total working time of laborers per department. Third, the unit materials cost of a service is calculated by multiplying the total materials cost per department by the unit price of the service and then dividing it by the total revenue per department. Finally, the unit cost of hospital services is the sum of the unit capital cost, unit labor cost, and unit materials cost.

The RCC is calculated by establishing the total cost of the department, prices, and number of services produced. In the first step, the unit prices and the number of services practiced are used to compute the total expected charge. After that, the RCC equals the total cost divided by the total expected charge. Finally, the unit cost of each service is determined by multiplying that ratio and unit price. For instance, when the full charges are 200,000 VND (Vietnam dong), and the total costs are 50,000 VND, the RCC is computed as 0.25. Next, the RCC is applied to determine the costs of services. Then, the unit cost of each service equals the charge (unit price) for each service multiplied by the RCC (0.25), which is used to determine the cost of hospital services.

Data collection and management

The period of time spent collecting the data necessary for the research is defined as a year as well as the period of time during which the costs and outputs are to be considered. Normally, the unit cost analysis of a whole year is practiced so as to avoid the effect of seasonal variations in the number of patients, which might ultimately affect the cost per unit of the fixed cost. This study was conducted during the fiscal year 2012 for Ha Nam Hospital and in the fiscal year 2014 for Thu Duc Hospital.

All data were retrospectively collected. The utilized data collection tools were developed by the research team. The tools were piloted and tested in one hospital. In each of the studied hospitals, staff members with access to data and information concerning finance, equipment, and hospital activities as well as the ability to conduct calculations and use a computer (including representatives of each department) were selected for a 1-day training course regarding the methods of data collection. They were then responsible for collecting data at their hospitals. The two hospitals' activity and annual financial reports represent the main sources utilized from the medical record database, which includes information about outpatient visits, admissions, and

inpatient days. In terms of the hospitals' annual accounting report, we retrieved the recurrent expenditures, for example, office materials, maintenance costs spent on equipment or the building and cleaning, electricity, telephone, mail, and internet.

Data analysis

All costs were obtained and presented in the monetary unit of Vietnam (VND), while the total cost of each hospital is presented together with the proportion of the cost component. The unit costs of all medical services derived using the two costing methods are presented with the percentage of the difference. The unit costs of services in Ha Nam Hospital in 2014 were calculated from the unit costs in 2012 by adjusting the consumer price index between 2012 and 2014 with the formula

$$\text{Cost}_{2014} = \frac{\text{CPI}_{2014}}{\text{CPI}_{2012}} \cdot \text{Cost}_{2012} \quad \text{with} \quad \frac{\text{CPI}_{2014}}{\text{CPI}_{2012}} = 110.96 \quad [23,24]$$

RESULTS

Organization analysis and cost center classification

As shown in Table 1, the organizational structures of Ha Nam Hospital and Thu Duc Hospital were based on their functions as supporting departments or patient service producing departments. They were classified as either TCCs or ACCs. The overall cost centers proved similar, comprised eight TCCs for both hospitals as well as 23 ACCs for Thu Duc Hospital and 27 ACCs for Ha Nam Hospital. Each cost center was coded using either the letter "T" or "A" to indicate the group it belongs to TCCs or ACCs.

Direct costs

Table 2 displays the figures for the TDC obtained by multiple the different types of cost centers. From the information displayed in the table, it can be seen that the TDC (including drugs) can be determined by adding factors such as the capital cost, labor cost, and materials cost (drugs cost or other materials) together. At Ha Nam Hospital (in 2012), the value of the TDC without drugs was only 60,662,426,620 VND (2,910,761 USD), whereas the value of the TDC including drugs was 104,949,174,620 VND (5,039,092 USD). As seen in Table 2, the TDC without drugs for Ha Nam Hospital was divided between TCCs (15%) and ACCs (85%), while it was similarly divided between TCCs (17%) and ACCs (83%) for Thu Duc Hospital. Yet, the percentages of TCCs and ACCs were 9% and 91%, respectively, in the case of Ha Nam Hospital, whereas in the case of Thu Duc Hospital they were 14% and 86%, respectively. From the data, it is evident that the labor cost of Ha Nam Hospital and the material cost of Thu Duc Hospital accounted for the largest part of the ACCs cost. In Ha Nam Hospital, the labor cost comprised 46% of the

Table 1: Organization analysis and cost center classification

| Ha Nam Hospital in 2012 | Thu Duc Hospital in 2014 |
|---|---|
| Transient cost centers - TCCs Administration (T1), Personnel (T2), Planning (T3), Finance (T4), Supply and Equipment (T5), Infection Control (incl. laundry) (T6), Nutrition (T7), Nursing (T8) | The same as for Ha Nam Hospital |
| Absorbing cost centers - ACCs Pharmacy (A1), Laboratory (A2), Pathology (A3), X-Rays (A4), Functional Probe (A5), Artificial Kidney (A6), Dental (A7), Examination (incl. OPD) (A8), Emergency (A9), Recovery–Toxic (A10), Surgery/Anesthesiology/Recovery (A11), Internal Medicine I (A12), Internal Medicine II (A13), Internal Medicine III (A14), Internal Medicine A (A15), Pediatrics (A16), Infectious Disease (A17), Surgery (A18), Urinary Surgery (A19), Maternity/Gynecology (A20), Trauma (A21), Rehabilitation (A22), Ophthalmological (A23), Ear-Nose-Throat (ENT) (A24), Dermatology (A25), Cancer (A26), Traditional Medicine (A27) | Pharmacy (A1), Laboratory (A2), Imaging (A3), Endoscopic (A4), Examination (incl. OPD) (A5), Emergency (A6), Trauma (A7), Artificial Kidney (A8), Recovery–Toxic (A9), Ophthalmological (A10), Ear-Nose-Throat (ENT) (A11), Dental (A12), Maternity/Gynecology (A13), Pediatrics (A14), Infectious Disease (A15), Endocrinology (A16), Surgery/Anesthesiology/Recovery (A17), Surgery (A18), Neurosurgery (A19), Internal Medicine I (A20), Internal Medicine II (A21), Internal Medicine III (A22), Traditional Medicine (A23) |

Table 2: Total direct costs by type of cost center

| Ha Nam Hospital (VND in 2012) | | | |
|--------------------------------|---------------------|----------------------|--------------------------|
| Group | TCCs (%) | ACCs (%) | Total cost (%) |
| Capital cost | 2,319,862,385 (25) | 16,845,313,547 (33) | 19,165,175,932 (32) |
| Labor cost | 4,577,357,434 (49) | 23,543,449,254 (46) | 28,120,806,688 (46) |
| Materials cost | | | |
| Drugs cost | - | 44,326,748,000 | - |
| Other materials | 2,485,087,396 (26) | 10,851,356,604 (21) | 13,336,444,000 (21) |
| TDC (including drugs) | 9,382,307,215 (9) | 95,566,867,404 (91) | 104,949,174,620 (100) |
| TDC (excluding drugs) | 9,382,307,215 (15) | 51,240,119,405 (85) | 60,622,426,620 (100) |
| Thu Duc Hospital (VND in 2014) | | | |
| Capital cost | 1,772,162,441 (5) | 15,061,429,792 (8) | 16,833,592,233 (7) |
| Labor cost | 9,914,307,519 (25) | 64,399,377,638 (32) | 74,313,685,157 (31) |
| Materials cost | | | |
| Drugs cost | - | 40,287,480,339 | - |
| Other materials | 28,426,131,369 (70) | 122,598,749,157 (60) | 151,024,880,526 (62) |
| TDC (including drugs) | 40,112,601,328 (14) | 242,347,036,926 (86) | 282,459,638,254 (100.00) |
| TDC (excluding drugs) | 40,112,601,328 (17) | 202,059,556,587 (83) | 242,172,157,915 (100.00) |

TDC: Total direct cost

total ACCs cost, while the material cost accounted for 60%. The TDC (excluding drugs) was comprised three components, namely, the capital cost, labor cost, and materials cost, which are accounted for 32%, 46%, and 21%, respectively, in the case of Ha Nam Hospital. With regard to the TCCs cost, 49% was recorded as the cost of labor, while the values of the capital cost and labor cost in the TCCs accounted for 25% and 26%, respectively. However, the labor cost of the ACCs accounted for a higher proportion (46%) when compared to the capital cost (33%) and labor cost (21%) of those ACCs. In Thu Duc Hospital, differences were found in the proportions of each group (capital cost, labor cost, and materials cost). In terms of the total cost, the capital cost, labor cost, and materials cost contributed 7%, 31%, and 62%, respectively. The materials

cost also accounted for the largest proportion of cost in both the TCCs and ACCs, representing 70% and 60% of the total cost, respectively. The labor cost accounted for the second largest proportion, representing 25% and 32% of the total cost related to TCCs and ACCs, respectively. The remaining cost (capital cost) of the TCCs accounted for only 5% of the total cost, while it accounted for 8% of the total cost of the ACCs.

Indirect cost determination

This step presents the indirect cost determination through the allocation criteria for the eight TCCs, which are coded from T1 to T8 for both Ha Nam Hospital and Thu Duc Hospital. The FC of all the TCCs was transferred to the ACCs, in

which the transferred cost is referred to as the indirect cost of the ACCs. The simultaneous method was used for the indirect cost allocation. In our study, the allocation criteria for each cost center were selected from one product provided by the TCCs. For example, full-time equivalent represents the allocation criteria for the cost centers of administration (T1), personnel (T2), and finance (T3). Both the nutrition (T7) and nursing (T8) cost centers are considered based on patient-day criteria. Moreover, the revenue, cost of supply, and amount of infectious garbage were allocated to the cost centers of planning (T4), supply and equipment (T5), and infection control (T6), respectively.

FC determination of ACCs without drugs

Table 3 displays the FC determination without drugs for the ACCs in Ha Nam Hospital (2012, VND). It can be seen that the values of the 27 ACCs were added together to determine the value of the FC of the ACCs (60,622,426,621 VND = 2,910,761 USD). After the direct and indirect costs were determined, the FC of the ACCs (6) could be determined through the sum of the indirect cost (5) and the TDC (4), which was derived by adding the values of the capital cost (1), labor cost (2), and materials cost (3). More specifically, the values that contributed to the TDC (4) were 21% (10,851,356,603 VND) for the materials cost, 33% (16,845,313,545 VND) for the capital cost, and 46% (23,543,449,257 VND) for the labor cost. As the summation needed to calculate the FC of the ACCs is already presented in the table, it is possible to see that the FC of the ACCs (60,622,426,621 VND) in Ha Nam Hospital (2012) was comprised two factors, namely, the TDC, which accounted for 85% (51,240,119,407 VND) of the total ACCs FC, and the indirect cost, which accounted for 15% (9,382,307,212 VND).

In terms of the FC of the ACCs, the three departments with the highest value cost (VND) were the pharmacy (A1), emergency (A9), and X-ray (A4) departments, which, respectively, accounted for 5,220,535,796 (9%), 6,444,992,766 (11%), and 7,396,739,810 (12%). However, the TDC ranged from 74% to 95%, with the former figure belonging to the cancer department (74%) and the latter to the X-ray department (95%). The percentage of the labor cost ranged from 12% to 83%, with the lowest percentage (12%) being seen for the X-ray (A4) department and the highest (83%) for the dental (A7) department. Despite of approximately vibration of relatively large value, 11 of the 26 cost center values were greater than 70%. In addition, the average capital cost and materials cost were 33% and 21%, respectively. The ranges of the capital and materials cost values were very similar, being between 3% and 85%.

Unit cost of hospital services

The unit cost analysis covers 776 services and 2064 services in Ha Nam Hospital and Thu Duc Hospital, respectively. Table 4 displays the relevant information regarding the sample unit cost (VND) of each service provided by the

Laboratory (A2) cost center as calculated using the micro-costing method in Ha Nam Hospital in 2012 and 2014. In terms of the values of the unit cost, it is recognized that the values for the Cross-match in blood service were the largest during both surveyed years (16,789 VND and 18,672 VND). This was followed by the figures for the Test Coombs service and Blood Sedimentation (Handiwork) service, which were 13,764 VND and 15,271 VND for the Test Coombs service and 14,386 VND and 15,961 VND for the Blood Sedimentation (Handiwork) service in 2012 and 2014, respectively. Yet, the three lowest unit cost statistics, which had similar values at 1,239 VND (2012) and 1,375 VND (2014), belonged to the red blood cell count service, white blood cell count service, and platelet (Plt, quantitative, and machine) service, respectively. In terms of the TDC sector, there are a number of noticeable features, one of which is the value of the HBsAg (qualitative and quick test) service being 107,722,951 VND. Meanwhile, the HIV (quick test) service cost is slightly lower than the HBsAg service at 93,023,815 VND. Ultimately, the retic index (Handiwork) has the lowest cost, with a value of 3493 VND.

In terms of the cost allocation taken from the departments to their units of services, the unit costs of medical services in every department of the two hospitals were calculated using both the micro-costing and RCC methodologies. The latter method was computed by dividing the FC by the total revenue. The analysis of the RCC at Ha Nam Hospital revealed that the variation in the RCC ranged from 0.27 to 16.73 at 2.94 of the average of the RCC. Of the 27 ACCs (apart from the Pharmacy [A1]), seven cost centers had an RCC under 1.0, which renders the RCC the most profitable department. Most of the cost centers exhibited a current price of hospital services dissimilar to the real cost experienced in these services. The RCC of the artificial kidney (A6) department was 0.11, which indicated that the department made the largest profit. This was also proven by its unit cost per department, which was 400,352 VND, followed by the X-ray (A4) department at 125,578 VND. On the contrary, the Department of Surgery/Anesthesiology/Recovery (A11) had the highest RCC at 16.73. The results revealed that the average RCC in Thu Duc Hospital was 6.04 (range from 0.49 to 270), which means that the cost for practicing the service is higher than the current price of the service itself; hence, there is an unnecessary monetary loss. Of the remaining 23 cost centers, only the laboratory (A2) department's RCC was lower than 1.0 (0.49), meaning that providing the service in this department is profitable.

Comparison of the unit cost between the micro-costing method and the RCC method

Table 5 presents a comparison of the unit cost between the RCC method and the micro-costing method, which provides information about the unit costs (VND) of both Ha Nam Hospital and Thu Duc Hospital in 2014. The figures collected

Table 3: Full cost (FC) determination without drugs of ACCs in Ha Nam Hospital (2012, VND)

| Cost center | Capital cost (%) (1) | Labor cost (%) (2) | Materials cost (%) (3) | TDC (%) (4) = (1)+(2)+(3) | Indirect cost (%) (5) | FC of ACCs (6) = (4)+(5) | Revenue (7) | RCC (8)=(6)/(7) |
|-------------|-------------------------|-----------------------|---------------------------|------------------------------|--------------------------|-----------------------------|----------------|--------------------|
| A1 | 105,359,309 (3) | 1,124,184,205 (28) | 2,796,584,820 (69) | 4,026,128,334 (77) | 1,194,407,462 (23) | 5,220,535,796 | 44,326,748,000 | 0.12 |
| A2 | 525,141,436 (23) | 1,047,209,297 (46) | 720,280,282 (31) | 2,292,631,015 (81) | 543,277,745 (19) | 2,835,908,760 | 10,508,510,000 | 0.27 |
| A3 | 84,938,071 (19) | 337,987,045 (74) | 33,687,347 (7) | 456,612,463 (78) | 125,905,984 (22) | 582,518,447 | 55,801,000 | 10.44 |
| A4 | 5,423,887,361 (77) | 832,107,614 (12) | 760,871,919 (11) | 7,016,866,893 (95) | 379,872,917 (5) | 7,396,739,810 | 6,061,787,000 | 1.22 |
| A5 | 1,034,392,260 (51) | 677,581,695 (34) | 299,641,918 (15) | 2,011,615,873 (89) | 261,135,377 (11) | 2,272,751,250 | 2,527,964,000 | 0.90 |
| A6 | 66,389,164 (15) | - | 377,784,925 (85) | 444,174,089 (75) | 149,021,006 (25) | 593,195,095 | 5,464,400,000 | 0.11 |
| A7 | 61,933,314 (6) | 917,162,454 (83) | 124,702,574 (11) | 1,103,798,342 (84) | 208,407,115 (16) | 1,312,205,457 | 389,707,000 | 3.37 |
| A8 | 1,089,388,060 (29) | 1,978,951,928 (52) | 716,097,818 (19) | 3,784,437,806 (83) | 748,361,310 (17) | 4,532,799,117 | 3,892,598,000 | 1.16 |
| A9 | 4,454,082,178 (74) | 1,117,659,762 (18) | 484,946,439 (8) | 6,056,688,380 (94) | 388,304,386 (6) | 6,444,992,766 | 940,463,000 | 6.85 |
| A10 | 235,758,023 (13) | 1,329,852,008 (73) | 243,761,022 (14) | 1,809,371,053 (79) | 493,523,399 (21) | 2,302,894,452 | 827,706,000 | 2.78 |
| A11 | 1,904,111,764 (44) | 1,958,765,260 (46) | 437,298,012 (10) | 4,300,175,036 (91) | 424,720,394 (9) | 4,724,895,430 | 282,338,000 | 16.73 |
| A12 | 94,860,665 (9) | 750,924,680 (68) | 258,418,900 (23) | 1,104,204,245 (78) | 316,251,627 (22) | 1,420,455,872 | 856,409,000 | 1.66 |
| A13 | 105,760,481 (10) | 699,057,669 (67) | 243,748,413 (23) | 1,048,566,564 (79) | 281,626,793 (21) | 1,330,193,357 | 769,152,000 | 1.73 |
| A14 | 93,440,039 (9) | 697,411,774 (70) | 202,872,020 (21) | 993,723,833 (83) | 197,316,256 (17) | 1,191,040,089 | 571,277,000 | 2.08 |
| A15 | 121,221,501 (15) | 454,413,465 (58) | 212,721,340 (27) | 788,356,307 (82) | 170,831,259 (18) | 959,187,566 | 297,760,000 | 3.22 |
| A16 | 505,940,484 (20) | 1,464,898,533 (58) | 567,834,282 (22) | 2,538,673,299 (83) | 535,541,393 (17) | 3,074,214,691 | 2,187,803,000 | 1.41 |
| A17 | 92,157,035 (10) | 684,080,781 (71) | 189,119,691 (19) | 965,357,506 (83) | 196,133,234 (17) | 1,161,490,740 | 524,606,500 | 2.21 |
| A18 | 85,437,686 (4) | 1,436,582,032 (76) | 377,222,738 (20) | 1,899,242,457 (79) | 510,083,459 (21) | 2,409,325,916 | 2,915,144,000 | 0.83 |
| A19 | - | - | - | - | - | - | - | - |
| A20 | 315,940,194 (12) | 1,668,956,605 (62) | 690,498,370 (26) | 2,675,395,169 (79) | 705,569,375 (21) | 3,380,964,545 | 3,558,754,000 | 0.95 |
| A21 | 88,237,792 (5) | 1,218,942,314 (74) | 340,790,561 (21) | 1,647,970,667 (80) | 402,413,493 (20) | 2,050,384,160 | 2,082,990,000 | 0.98 |
| A22 | 53,610,696 (8) | 472,764,282 (74) | 111,132,768 (18) | 637,507,747 (79) | 171,213,584 (21) | 808,721,331 | 312,333,000 | 2.59 |
| A23 | 75,073,144 (11) | 512,560,829 (72) | 120,010,905 (17) | 707,644,878 (77) | 216,989,562 (23) | 924,634,440 | 378,533,000 | 2.44 |
| A24 | 88,632,530 (9) | 758,633,513 (77) | 137,813,378 (14) | 985,079,420 (83) | 205,865,246 (17) | 1,190,944,666 | 618,721,000 | 1.92 |
| A25 | 34,805,595 (7) | 389,149,198 (78) | 76,979,650 (15) | 500,934,444 (84) | 98,254,200 (16) | 599,188,644 | 138,976,000 | 4.31 |
| A26 | 53,663,883 (9) | 403,032,658 (68) | 132,307,634 (23) | 589,004,175 (74) | 210,378,920 (26) | 799,383,095 | 349,132,500 | 2.29 |
| A27 | 51,150,880 (6) | 610,579,656 (71) | 194,228,877 (23) | 855,959,412 (78) | 246,901,716 (22) | 1,102,861,129 | 1,144,311,000 | 0.96 |
| Total | 16,845,313,545 (33) | 23,543,449,257 (46) | 10,851,356,603 (21) | 51,240,119,405 (85) | 9,382,307,215 (15) | 60,622,426,620 | 47,657,176,000 | 1.27 |

from the two sites were calculated using both the MC and RCC methods. Later on, in terms of the MC and RCC results, the percentage of difference was determined by subtracting particular MC figures from their RCC counterparts, with the calculation of the percentage of difference (%dif) = $([\text{cost by RCC method}] - [\text{cost by MC method}]) / (\text{cost by RCC method})$. Comparing the results calculated using the ratio cost to charge method to those obtained using the micro-costing method revealed that generally the percentages of difference of Ha Nam Hospital and Thu Duc Hospital were decreased by 2245% and 96%, respectively, when calculating using the MC and RCC methods. Thus, there were a medium amount of cases with a %dif with negative results (eight cases) when compared to those with positive results (seven cases) in Ha Nam Hospital. Meanwhile, in the case of Thu Duc Hospital, the MC values were generally greater than the RCC values, resulting in a higher number of %dif cases with positive results (nine cases) than those with negative results (six cases). By taking a more detailed look at the figures, it is recognizable that in the case of Ha Nam Hospital, the X-Ray Cardiopulmonary (Straight) service and X-ray Lung (Tilt) service had a similar percentage of difference (44%), which were also the highest values in the %dif section. On the other hand, the lowest percentage of difference (2%) belonged to the LDL Cholesterol service. Meanwhile, in Thu Duc Hospital, the highest percentages of

difference were those of the X-ray cardiopulmonary (straight), X-ray Lung (Tilt), and stool examination services, with the respective values being 285%, 512%, and 157%. Furthermore, the percentage of difference of the TSH service was the lowest in value (9%). For the whole hospital, the X-ray Lung (Tilt) service had the highest percentage of difference, with a value of 278%. In contrast, the HB1Ac service had the lowest %dif (1%). In addition, the %dif of the LDL cholesterol, TSH, and HB1Ac services were all lower than 10% (8% for LDL cholesterol, 4% for TSH, and 1% for HB1Ac).

DISCUSSION

TDCs of cost centers

In terms of the cost center groups, the TDCs of the ACCs, which were 51,240,119,404 VND (84.52%), were greater than those of the TCCs at 9,382,307,215 VND (15.48%) in 2012 in Ha Nam Hospital. With regard to the TDCs, the labor cost accounted for the largest proportion and the materials cost for the lowest proportion, being 28,120,806,688 VND (46.39%) and 13,336,444,000 VND (22%), respectively. In contrast, in Thu Duc Hospital (2014), the TDCs of the ACCs were greater than those of the TCCs, accounting for 202,059,556,587

Table 4: Sample unit cost of each service (VND) provided by the Laboratory cost center (A2) calculated using the micro-costing method in Ha Nam Hospital

| Service | Direct cost | | | | Indirect cost | Total cost | |
|--|-------------|--------------|----------------|--------|---------------|-------------------|-------------------|
| | Labor cost | Capital cost | Materials cost | TDC | | Unit cost in 2012 | Unit cost in 2014 |
| Retic index RI (handiwork) | 2,533 | - | 960 | 3493 | 827 | 4320 | 4793 |
| RBC count | 422 | 237 | 343 | 1002 | 237 | 1239 | 1375 |
| Anti-hepatitis C virus (qualitative, quick test) | 1689 | 947 | 2947 | 5583 | 1323 | 6906 | 7662 |
| Cross-match in blood | 7599 | 4260 | 1714 | 13,573 | 3216 | 16,789 | 18,627 |
| HbsAg (qualitative, quick test) | 1689 | 947 | 2947 | 5583 | 1323 | 6906 | 7662 |
| HIV (qualitative, quick test) | 1689 | 947 | 2947 | 5583 | 1323 | 6906 | 7662 |
| Prothrombin time (quick test) | 844 | 473 | 206 | 1523 | 361 | 1884 | 2091 |
| Test coombs | 5066 | 2840 | 3222 | 11,127 | 2637 | 13,764 | 15,271 |
| ABO test | 422 | 237 | 685 | 1344 | 319 | 1663 | 1845 |
| Rhesus test | 422 | 237 | 1028 | 1687 | 400 | 2087 | 2315 |
| WBC count | 422 | 237 | 343 | 1002 | 237 | 1239 | 1375 |
| Platelet (Plt, quantitative, machine) | 422 | 237 | 343 | 1002 | 237 | 1239 | 1375 |
| Osmotic fragility | 1689 | 947 | 1302 | 3938 | 933 | 4871 | 5404 |
| Platelet (quantitative, handiwork) | 5066 | - | 1302 | 6368 | 1509 | 7877 | 8740 |
| Saignement time | 422 | 237 | 411 | 1070 | 254 | 1324 | 1469 |
| Platelet - aggregation | 2533 | 1420 | 617 | 4570 | 1083 | 5653 | 6272 |
| ABO test (blood transmission: RBC, WBC) | 422 | 237 | 823 | 1481 | 351 | 1832 | 2033 |
| ABO test (blood transmission: Plt, plasma) | 422 | 237 | 685 | 1344 | 319 | 1663 | 1845 |
| Blood sedimentation (handiwork) | 10,807 | - | 823 | 11,630 | 2756 | 14,386 | 15,961 |

*Inflation: Adjusted values from the cost in 2012, RBC: Red blood cell, WBC: White blood cell

Table 5: Comparison of unit cost between the ratio of cost to charge (RCC) method and the micro-costing method

| Service | Unit cost (VND) in 2014 | | | | | | Average of the % difference |
|---|-------------------------|---------|--------------|------------------|-----------|--------------|-----------------------------|
| | Ha Nam Hospital | | | Thu Duc Hospital | | | |
| | MC | RCC | % difference | MC | RCC | % difference | |
| | (1) | (2) | (3) | (4) | (5) | (6) | |
| HBsAg (qualitative) | 7662 | 12,875 | 40 | 20,484 | 29,488 | 31 | 36 |
| CT scanner-32 Slice (not including drugs) | 547,566 | 586,200 | 7 | 489,880 | 1,299,318 | 62 | 34 |
| Ferritin | 6345 | 8,683 | 27 | 24,491 | 36,860 | 34 | 30 |
| PSA | 14,498 | 17,366 | 17 | 25,025 | 41,775 | 40 | 28 |
| Glucose (quantitative) | 5028 | 4,491 | -12 | 8,304 | 5,898 | -41 | -26 |
| X-ray cardiopulmonary (straight) | 101,088 | 70,398 | -44 | 320,242 | 83,156 | -285 | -164 |
| X-ray lung (Tilt) | 101,088 | 70,398 | -44 | 318,242 | 51,973 | -512 | -278 |
| LDL cholesterol | 5216 | 5,090 | -2 | 8,838 | 10,812 | 18 | 8 |
| FT4 | 12,804 | 11,976 | -7 | 18,881 | 29,488 | 36 | 15 |
| Uric acid test | 5028 | 4,491 | -12 | 8,464 | 31,945 | 74 | 31 |
| T3 | 12,804 | 11,976 | -7 | 4,456 | 29,488 | 85 | 39 |
| TSH | 12,334 | 10,479 | -18 | 26,895 | 29,488 | 9 | -4 |
| Doppler color ultrasound (heart/fetus) | 78,725 | 114,709 | 31 | 614,850 | 389,795 | -58 | -13 |
| Stool examination | 4574 | 7,186 | 36 | 11,349 | 4,423 | -157 | -60 |
| HB1Ac | 11,069 | 17,965 | 38 | 8,249 | 5,898 | -40 | -1 |
| Average of 15 medical services | | | 3 | | | -47 | -22 |
| Average of all healthcare services | | | -2245 | | | -96 | -1171 |

(3) = [(2)-(1)]/(2), (6) = [(5)-(4)]/(5)

VND (83.44%). Considering the TDCs, the labor cost accounted for the largest proportion and the materials cost for the lowest proportion, being 151,024,880,526 (62.36%) and 16,833,592,233 (6.95%), respectively. Considering the direct cost, the golden ratio of labor cost to materials cost to capital cost was 20:50:30. It was, therefore, found that many departments had an acceptable cost ratio. The departments often had a low labor cost ratio and low capital cost ratio (about 14 departments had an acceptable percentage value). However, two departments, namely, the Imaging and Surgery/Anesthesiology/Recovery Departments, had labor cost rates and capital cost rates that were too high. These two departments did not achieve an appropriate proportion of costs.

Unit costs of medical services

The most important information required to determine the unit costs of medical services is complete and accurate cost data. These data include the standard practice guidelines and detailed records of the resource consumption involved

in performing such services. Further significant information includes the amount of time spent on each activity by worker(s) to calculate the labor cost. Similarly, information regarding the time spent using equipment is needed for the depreciation cost calculation. A record of the materials used is also very important. It is vital that all the outputs should be counted since they are all very significant in relation to the cost analysis. The remainder (FC of the ACCs - TDC of all services) was the shared cost or the indirect cost of an individual service, which was allocated based on a selected criterion. In reality, micro-costing often results in difficulties when collecting the hospital data required for the cost analysis. Said data include information about the amount of time spent on each activity, the cost/value of materials used per activity, and the time spent using each capital item, which are needed to calculate the depreciation in the cost per service. Thus, a lot of time needs to be spent gathering information. Another key problem concerns the skill of the staff tasked with collecting the data. In addition, some errors cannot be prevented due to the staff members' individual

ways recording data (i.e., if they pay attention to detail, the direct cost will be higher than expected).

According to the RCC methodology, it is the less complicated method in practice, since it is easy to use and requires only data concerning the charges for medical services when calculating the unit cost of those medical services. This is also useful when analyzing the rate of return, which is important in terms of financial or business management. However, the charge or price setting should reflect the actual unit costs. Therefore, this method should be employed following price standardization based on the unit cost derived from the micro-costing method.

Analysis of variation of the unit cost of some services between the two hospitals: RCC methodology versus micro-costing methodology

To determine how the unit cost of hospitals is analyzed, Tracey *et al.*^[25] conducted a literature review, which showed that the proportion of hospitals using each cost derivation method consisted of the RCC method alone or a combination of the RCC method and other costing approaches (66%), actual cost (12%), RVU (9%), actual cost and RVU (3%), and other methods, or no method (10%). However, recent developments in the field of costing studies of health-care interventions have led to renewed interest in the micro-costing method, the use of which is widespread in various countries to inform efficient resource allocation. In a study conducted by Riewpaiboon,^[3] it was found that the micro-costing method has been proven to be reliable.

From the results of the present study, it can be seen that almost all the services supplied by Ha Nam Hospital had a unit cost that is higher than that seen for Thu Duc Hospital according to both the MC and RCC methods. For instance, the unit costs of the T3 Test and CT scanner-32 Slice (not including drugs) in Ha Nam Hospital are higher than those in Thu Duc Hospital at 187.34% and 11.78%, respectively. When using the RCC method, the unit costs of all services exhibited a positive decrease, except for the X-ray lung (Tilt), and stool examination services, which exhibited increases of 35.45% and 62.47%, respectively, between Ha Nam Hospital and Thu Duc Hospital. The average percentages of difference between the two methods in Ha Nam Hospital and Thu Duc Hospital are minus 3.44% and 46.97%, respectively, while the average of the percentage of difference is 21.77%. Riewpaiboon *et al.*'s^[14] analysis of the RCC method revealed that the variation in the unit costs of medical services was high, ranging from -85% to +32%, which suggested that the existing prices (charges) of the medical services were not related to the real costs of those medical services.

RECOMMENDATIONS

Before the conducting of the present study, the micro-costing method was considered the most accurate method in terms of calculating the unit cost of medical services, since it can best reflect the consumption of resources. Indeed, the micro-costing method was found to be most suitable for calculating the unit costs of medical services. However, in the future, a standard cost list should be developed in the Vietnamese context based on the results of the micro-costing method. Similarly, the RCC method should prove efficient after the prices have been adjusted based on the results of the micro-costing method.

CONCLUSIONS

The present study is particularly valuable due to comparing different costing methods for hospital service cost analysis in a developing country that is Vietnam. In addition, a number of potential avenues for future investigations using the same methodologies have been identified in this study. It is expected that the method described in this study will prove valuable in terms of conveying costs for researchers in many countries as well as a topic publicly open for valuation. Thus, the present study serves to validate and expand this methodological area.

To cover the expenses of various hospitals as well as their multiple levels (which range from central to provincial and district), a considerable amount of work must be performed. More information regarding the unit cost of health-care services would be helpful in relation to establishing a reference unit cost list for accurate health economics evaluations. As far as hospital financial management is concerned, the results regarding the unit cost of hospital services are needed when implementing and planning the operational and financial regimes that are applicable for public health non-business units. Further, they are also relevant to the prices of medical examinations and treatment services, as well as to the treatment establishments found in Vietnamese hospitals.

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Development of Relative Value Units for Unit Cost analysis of Medical Services in Vietnam

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Abstract

Context: The unit costs of hospital services are essential for hospital and public health management. There are alternative methods on the costing with different results. The relative value unit (RVU) method, which is also known as the “weight procedure method”, is a method universally used in many countries due to its applicability. **Aims:** This study is aimed to develop RVU of hospital medical services for unit cost calculation in Vietnam. **Settings and Design:** Development of the RVU is designed by objective data approach where the RVUs were estimated based on results of unit cost analysis employing micro-costing from two provincial hospitals. **Materials and Methods:** From 776 services of Ha Nam Hospitals and 2064 services of Thu Duc Hospital, a reference list of 1,464 medical services was developed. **Results:** The standard unit cost used for health economic evaluation in Vietnam can possibly be developed thanks to the RVUs from this study. **Conclusions:** Due to the constant improvement of the health service’s framework, the RVUs should be developed and updated continuously. Moreover, the RVUs of health centers and the other types of hospital should be studied further to complete for health economic evaluation.

Key words: Hospital, medical service, relative value units, unit cost, Vietnam

INTRODUCTION

Economics is a science of using limited resources in producing goods or services with efficiency. In health context, the term “efficiency,” a much broader concept, is defined as “the relationship between the level of resources invested in the healthcare system and the volume of services, or what amounts to the same thing, improvements in health achieved.”^[1] In the efficiency management, information of unit cost is pivotal. In health care, to evaluate efficiency, unit costs of hospital medical services are basically compared. In addition, they are used in the cost of illness study and economic evaluation of health interventions. To estimate unit cost, we require accuracy and feasibility. In public health management, standard or reference unit cost is usually developed. Recently, standard unit costs

have been introduced into economic evaluation analyses to measure the potential differences in resource use resulting from the selection of one intervention over another,^[2] for instance, analyze cost effectiveness of new drugs to the list of national essential drugs, new vaccines for the national immunization programs, new medical procedures in the package of the health insurance benefits. Standard costs are

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deemed to be desirable in evaluation studies to ensure that the study results will not vary with the costing methods used.

Reference or standard unit cost of medical services has been developed in various countries including Australia,^[3] Canada,^[4] The Netherlands,^[5,6] The United Kingdom,^[7] Philippines,^[8] Thailand,^[9] and India.^[10] In general, unit cost analysis of medical services is based on standard costing methodology. It is composed of six steps, i.e. (1) Study design and planning, (2) organization analysis and cost center classification, (3) direct cost of cost centers determination, (4) indirect cost determination; (5) full cost determination, and (6) unit cost of hospital services calculation.

Vietnam as well as many other countries have endeavored to decrease such hurdle by developing a standard or reference list of unit cost of health-care service. Currently, these countries have made attempt to create a list of standard unit costs of medical services. The purpose of this study is to develop reference relative value unit (RVU) of hospital medical services for using in the unit cost analysis of hospitals pursuing development of standard unit cost in the future.

SUBJECTS AND METHODS

Study design

RVUs can be developed using a ranking method or an objective data method.^[11,12] The ranking method employs a subjective technique of comparing the amount of resources used, commencing from the least amount, and then estimating the subsequent amounts in multiples of the first one. By comparing each service to the first service, this method is arranged in order of various relative consumption of resources. On the other hand, magnitude estimation can be defined with a survey-based methodology through measuring subjective perceptions and judgments by the rate of consumption in diversified services. The objective data method is to determine the RVU from database that is based on the real resource consumption: Either on consumption of a major selected resource such as fee, price, cost, time required, or material use to perform each service or on costing data came from other studies. In case of assigning to service, the unit cost is divided by a number of currency resulting RVU. In this study, an objective data method was applied.

A retrospective descriptive study was conducted, of which the data and the cost of all the health-care services were collected using the methodology adopt from Vo *et al.* study.^[13] The RVU list of medical services was calculated at two public provincial hospitals using micro-costing method which was chosen for its qualified functions in measuring costs for health-economic evaluation during the current context of Vietnam.^[13]

Some of unit cost analysis of hospital medical services

A list of health-care services in Ha Nam Hospital and Thu Duc Hospital was established with the reference to these places' database, which showed that there were, respectively, 767 and 2064 health-care services.

Scope of the study

To receive all unit costs of hospital services for RVU's development, the unit cost analysis of the health-care service was explored at two of the largest hospitals, which are Ha Nam General Hospital in Northern Vietnam and Thu Duc Hospital in Southern Vietnam, to represent for Vietnam health-care facilities. The study was conducted in the fiscal year 2014 and with Vietnam's official units of currency (VND) being selected to represent the value of the costs.

To calculate the unit costs of hospital medical services, the standard costing approach was brought into usage.^[14] The costs were presented by basing on the values back in 2014. The selected studied sites were two Vietnamese provincial hospitals (General Hospital of Ha Nam province/Ha Nam Hospital - North of Vietnam and Thu Duc General Hospital/Thu Duc hospital - South of Vietnam), in which there were approximately 700 beds for patients. Only these hospitals met the specific criteria of efficiency, which includes efficiency performance of hospital with its percentage being at least 80%. The occupancy rate of Ha Nam Hospital is believed to be overloaded with the percentage of 123% in 2012 compared to that of Thu Duc Hospital (86%) in 2014.

The model proposed for the implementation of this study in all of health-care service can be seen in Figure 1.

RVU development is composed of three steps, i.e., Step one: Development of a list of hospital medical services. A list of hospital medical services was developed from medical services of two provincial hospitals. Step two: Determining average cost of all services in the list tests available in two hospitals and average unit cost per health-care services in the list from Ha Nam and Thu Duc Hospital. Step three:

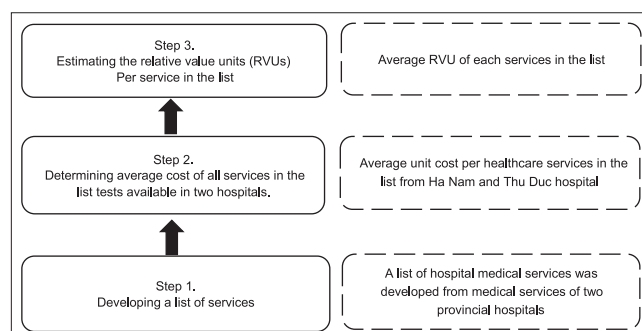


Figure 1: The process of developing the relative value unit in Vietnam

Estimating the RVUs per service in the list and average RVU of each services in the list.^[9]

Data analysis and presentation

Calculation of cost per unit of medical service in the six steps is conducted by alternative methods, i.e., the average method, the ratio of cost to charge, the RVU, and the micro-costing method.^[12] The micro-costing method is more accurate than the others. Regarding its convenience and relatively accuracy, the RVU is more widely favoured in many countries such as Thailand^[13] and India,^[15] and RVU is applied for unit cost analysis in hospitals selected as representative of the country. Then, reference costs are derived from repeated measurements of costs within a representative facility.

Application of RVU method for unit cost analysis starts with the development of standard or reference RVU for each medical service. Then, the standard or reference RVU is used in unit cost analysis of each hospital. In the process of unit cost analysis, the total RVUs used by the hospital are calculated by multiplying standard RVU of each service by the number of service produced in the study year. Total RVUs of all medical services are summed to be total hospital RVUs. After that, the cost per RVU is calculated by dividing the total cost of the hospital by the total RVUs of the hospital. Finally, the cost per RVU is multiplied by the number of standard RVU for each service to obtain a unit cost.

Data management and analysis are presented using the computer program Microsoft Excel 2013. The result is presented in the RVUs of medical service which consist of service name, unit, code, and relative value.

Ethical consideration

The research process was approved by the Research Ethics Council at Ha Nam General Hospital, Vietnam (IORG0007245), and Thu Duc Hospital, Vietnam (IORG0007136). Data are confidential and are only available for research; some sensitive information will be encrypted.

RESULTS

The results are presented regarding three steps of the RVU development as the followings:

To develop a list of hospital medical services

After all the services with similar names practiced in different departments collected and required calculations were done, the results displayed the total number of health-care services in both Ha Nam Hospital and Thu Duc Hospital which were 601 and 1,063 medical services, respectively. Then, 1464 medical services which were 200 services by coincidence

in two hospitals, and 863 distinctive services for Thu Duc Hospital were developed for a list of hospital medical services [Figure 2].

The average unit cost of medical services practiced in different departments of Ha Nam and Thu Duc Hospital was calculated using micro-costing methods and later is delineated (mentioned in some of unit cost analysis of hospital medical services part). It can be recognized that the services conducted in different departments have different unit cost and quantity. The average unit cost of one service was calculated by the average of unit costs of every department which supplied that service. Successively, a list of health-care services for Ha Nam Hospital was established with the exclusion of the services bearing the same name practiced in different departments. In this study, the value of the average unit cost was computed by practicing the based-on-weight method.^[16,17]

Determining average cost of the services in the list including 2 steps

- Making average of the same service produce by different departments.
- Making average of the same service produce by different hospital.

As can be seen from Table 1, measurement intraocular pressure and gastric lavage service occupied in two cost centers. It is measurement intraocular pressure service taking in two cost centers of A8 and A23 while gastric lavage service occupying in cost centers of A6 and A9. It is noticed that average weight cost (Y) of each service above was unequal. Value Y of measurement intraocular pressure service was 7,265,262 VND, whereas that value of gastric lavage service was only 141,335 VND.

Suction phlegm service and bladder wash service (excluding chemical service) were two services occupying in five cost centers. Suction phlegm service was carried out in A9, A10, A13, A16, and A17 cost center while bladder wash service (excluding chemical service) was occupied in cost centers of A6, A9, A18, A19, and A22. The unit cost of suction phlegm service can be ranged from 320,721 VND (A9 cost center) to 2,546,696 VND (A17 cost center), and the average weight cost was 149,015 VND. On the contrary, the average weight cost of bladder wash service (excluding chemical service) was much higher with 5,380,087 VND ranged from the lowest at 1,003,314 VND (A6) to the highest at 11,790,442 VND (A19).

The case of lumbar puncture service, emergency intubation service, aspirate pleural service, and bladder wash service can be classified into services occupying in six cost centers. Among cost centers related lumbar puncture service, A11 cost center had the lowest unit cost (752,472 VND), whereas A9

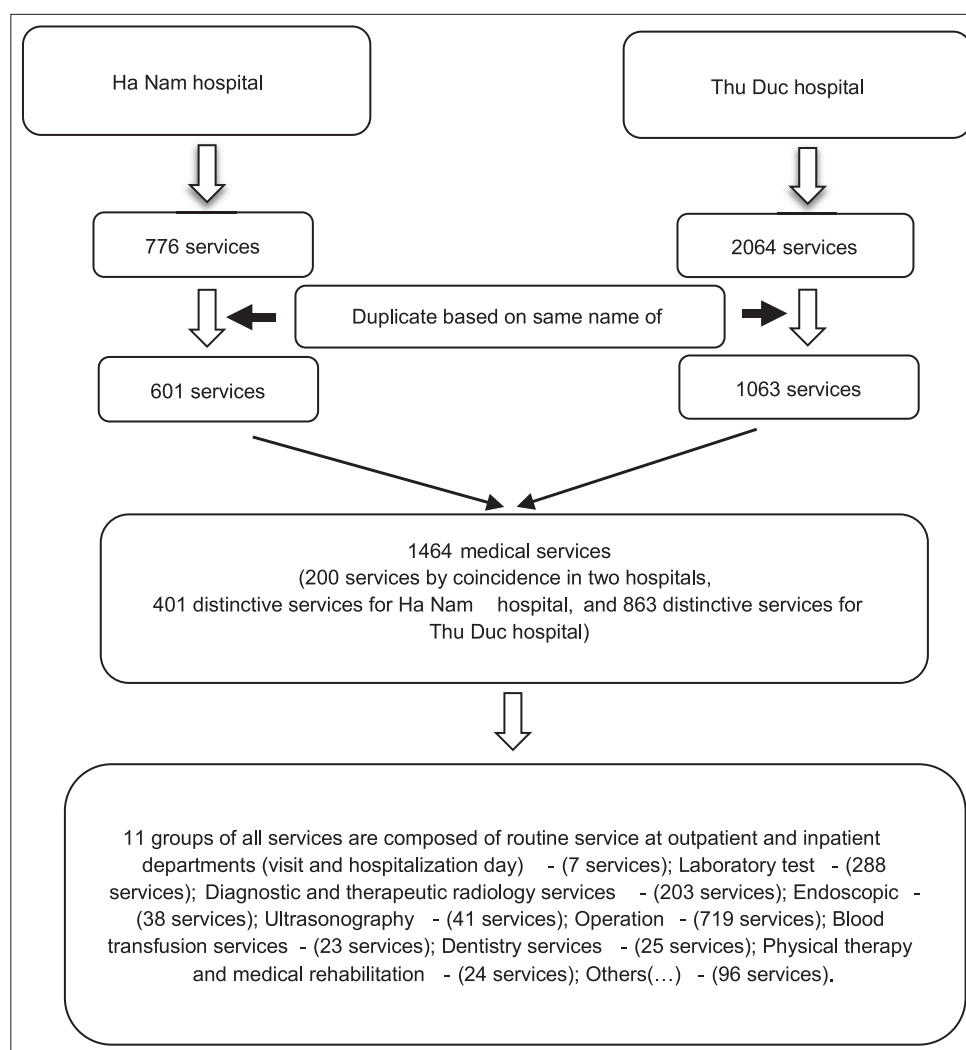


Figure 2: Process of development a list of hospital medical services

cost center had the highest unit cost (19,386,526 VND). In emergency intubation service, the highest unit cost belonged to A12 cost center with 5,373,462 VND while the lowest cost belonged to A16 cost center with 196,134 VND. In addition, aspirate plural service's unit cost ranged from 2,203,912 VND (A18 cost center) to 11,660,682 VND (A9 cost center). Moreover, bladder wash top unit cost was 6,471,381 VND in A20 cost center and bottom unit cost was 44,369 VND in A9 cost center. Of four services above, lumbar puncture is the service with the highest value of average weight cost (Y) (12,237,196 VND). Meanwhile, bladder wash service had the lowest average weight cost calculated for 546,941 VND. The value Y of emergency intubation service and aspirate pleural service was 7,788,910 VND and 820,162 VND, respectively.

There are three services carrying out in seven cost centers included endotracheal intubation service, nebulized service, and changing bandages under 15cm service. The nebulized service occupied in seven cost centers of A9, A10, A13, A14, A15, A16, and A24. Of those cost centers, the unit cost of nebulized service in A15 was highest with 30,633,933 VND while that value in A24 was lowest with 170,861 VND. The

seven cost centers of changing bandages <15 cm service were A7, A11, A18, A20, A21, A23, and A24. Further, the unit cost in A11 was highest (1,551,582 VND) while the unit cost in A20 was lowest (31,412 VND). The endotracheal intubation service was taken in seven cost centers including A6, A8, A9, A15, A18, A20, and A22. Of this, A15's unit cost was highest (33,413,733 VND) while A8's unit cost was lowest (1,305,551 VND). The average weight cost of nebulized service and changing bandages under 15 cm service was 525,517 VND and 103,987 VND, respectively. On the other hand, the value Y of endotracheal intubation service was much higher than other services above with 10,302,938 VND per unit.

Contrary to the cases above, put sonde in gastric service can be seen in nine cost centers including A9, A10, A11, A12, A13, A14, A16, A17, and A18. The unit cost of put sonde in gastric service was differed between cost centers. That can be seen that the unit cost of put sonde in gastric service in A16 cost center was only 18,522 VND while that cost in A12 was 5,187,362 VND. Using the equation, we calculated that the average weight cost for this service in nine cost centers was 368,618 VND.

Table 1: Sample of adjusted unit cost of services (medical procedures) provided by different departments (2014)

| Ha Nam Hospital | | | Thu Duc Hospital | | |
|----------------------------------|---|---------------|-----------------------------------|---|---------------|
| Services | Cost center - unit cost (VND) - quantity | Y=Weight cost | Services | Cost center - unit cost (VND) - quantity | Y=Weight cost |
| Measurement intraocular pressure | (A8-182,959-2,046) (A23-45,324-887) | 141,335 | Lumbar puncture | (A6-7,717,008-1) (A9-19,386,526-9) (A11-752,472-1) (A15-2,824,001-2) (A19-5,592,931-3) (A20-2,657,326-1) | 12,237,196 |
| Put sonde in gastric | (A9-208,741-34) (A10-249,093-255) (A11-1,022,430 – 22) (A12-5,187,362-12) (A13-875,907-53) (A14-2,527,197-56) (A16-18,522-269) (A17-7,616,990-3) (A18-37,370-337) | 368,618 | Gastric lavage | (A6-363,115-16) (A9-34,873,849-4) | 7,265,262 |
| Suction phlegm | (A9-320,721-510) (A10-254,402-269) (A13-1,740,404-10) (A16-15,732-1,205) (A17-2,546,696-12) | 149,015 | Endotracheal intubation | (A6-6,028,300-65) (A8-1,305,551-1) (A9-11,747,115-119) (A15-33,413,733-1) (A18-7,954,460-1) (A20-32,304,188-4) (A22-10,994,546-9) | 10,302,938 |
| Emergency intubation | (A9-454,651-36) (A10-431,526-18) (A12-5,373,462-3) (A13-1,071,853-3) (A16-196,134-2) (A17-7,807,074-1) | 820,162 | Aspirate pleural | (A6-7,915,690-1) (A9-11,660,682-7) (A18-2,203,912-6) (A20-12,830,895-20) (A21-2,302,822-2) (A22-2,564,740-16) | 7,788,910 |
| Nebulized | (A9-601,871-21) (A10-730,645-94) (A13-3,476,344-63) (A14-2,522,474-59) (A15-30,633,933-20) (A16-41,617-1,024) (A24-170,861-1,216) | 525,517 | Bladder wash | (A7-923,638-3) (A9-44,369-18) (A16-948,610-5) (A20-6,471,831-1) (A21-987,885-1) (A22-508,776-12) | 546,941 |
| Changing bandages <15 cm | (A7-1,148,895-228) (A11-1,551,582-32) (A18-57,785-2,196) (A20-31,412-3,253) (A21-101,323-1,881) (A23-135,512-20) (A24-447,505-167) | 103,987 | Bladder wash (excluding chemical) | (A6-1,003,314-1) (A9-11,664,473-8) (A18-3,491,241-17) (A19-11,790,442-3) (A22-2,078,150-10) | 5,380,078 |

$$\text{Average-weight cost} = \frac{\sum_{i=0}^n (\text{Unit cost of Cost center}_i * \text{Quantity of Cost center}_i)}{\sum_{i=0}^n (\text{Quantity of Cost center}_i)}$$

Estimating the RVUs per each test of Ha Nam Hospital and Thu Duc Hospital and all-tests cost average per test

Table 2 illustrates data about samples taken from a list of health-care services after categorizing the similar services in two opted hospitals (Ha Nam Hospital and Thu Duc Hospital). Moreover, the surveyed subjects do not solely include services practiced in both the hospitals but those

which are exclusively conducted in one particular hospital as well. This results in the average unit cost from two hospitals' values. Moreover, the surveyed subjects do not solely include services practiced in both the hospitals, but those which are exclusively conducted in one particular hospital as well. This results in the average unit cost from two hospitals' values (possibly being equivalent to the weight average unit cost' values of either Ha Nam or Thu Duc Hospital) or it could

Table 2: Sample of adjusted unit cost and standard RVU of services

| Service | Unit cost | | RVU | No. | Service | Unit cost | | Average unit cost | RVU | Unit cost | | Average unit cost | RVU |
|----------------------|-----------------|------------------|------|-----|--|-----------------|------------------|-------------------|----------|-----------------|------------------|-------------------|-----|
| | Ha Nam Hospital | Thu Duc Hospital | | | | Ha Nam Hospital | Thu Duc Hospital | | | Ha Nam Hospital | Thu Duc Hospital | | |
| Platelet (numbering) | 1375 | - | 0.07 | 16 | Suction phlegm | 149,015 | - | 149,015 | 7.45 | | | | |
| Leukemia (numbering) | 1375 | - | 0.07 | 17 | Dystocia | 249,070 | - | 249,070 | 12.45 | | | | |
| Bilirubin (indirect) | 5028 | | 0.25 | 18 | Nebulized | 525,517 | 41,083 | 283,300 | 14.17 | | | | |
| Albumin | 5028 | 8536 | 0.34 | 19 | Put sonde in gastric | 765,096 | - | 765,096 | 38.25 | | | | |
| ALT | 5028 | 8464 | 0.34 | 20 | Put sonde in gastric | 368,618 | 1,453,606 | 911,112 | 45.56 | | | | |
| AST | 5028 | 8464 | 0.34 | 21 | Changing bandages <15 cm | 103,987 | 1,725,497 | 914,742 | 45.74 | | | | |
| Amylase urine | - | 7983 | 0.40 | 22 | Bladder wash | 1,485,263 | 546,941 | 1,016,102 | 50.81 | | | | |
| ASLO | 7191 | 10,600 | 0.44 | 23 | Measurement intraocular pressure | 141,335 | 2,414,413 | 1,277,874 | 63.89 | | | | |
| A/G | - | 9532 | 0.48 | 24 | Emergency intubation | 820,162 | 5,989,293 | 3,404,728 | 170.24 | | | | |
| ADA | - | 13,003 | 0.65 | 25 | Gastric lavage | 713,970 | 7,265,262 | 3,989,616 | 199.48 | | | | |
| AFP | 14,215 | 23,422 | 0.94 | 26 | Aspirate pleural | 644,860 | 7,788,910 | 4,216,885 | 210.84 | | | | |
| Anti-HCV (ELISA) | 7662 | 32,237 | 1.00 | 27 | Bladder wash (excluding chemical) | - | 5,380,078 | 5,380,078 | 269.00 | | | | |
| ECG | 34,534 | - | 1.73 | 28 | Endotracheal intubation | 462,690 | 10,302,938 | 5,382,814 | 269.14 | | | | |
| EEG | 82,842 | - | 4.14 | 29 | Lumbar puncture | 2,517,098 | 12,237,196 | 7,377,147 | 368.86 | | | | |
| Adrenalin | - | 94,949 | 4.75 | 30 | Removing extraneous out of gastrointestinal tract by endoscopy | 113,198,088 | - | 113,198,088 | 5,659.90 | | | | |

RVU: Relative value unit, ALT: Alanine transaminase, AST: Aspartate transaminase, HCV: Hepatitis C virus, ECG: Electrocardiogram, EEG: Electroencephalogram, ADA: American Diabetes Association, AFP: Alpha-fetoprotein

even be equal to the average value of the figures from both said columns. The operation needed to calculate the average cost of the service that is performed in two hospitals is simple average method.

It was also proved that the diversification in the types of services relied on with the specific characteristics of each particular region (central, province, or district). As a consequence, this feature resulted in the disparity in the number of patients in each hospital service. For instance, ECG test is the service that is performed most regularly in Ha Nam Hospital with the frequency of around 11,000 times, yet such service is not practiced in Thu Duc Hospital.

Estimating RVUs is dividing average cost by cost per RVU with cost value equal to 1 RVU is 20,000 VND. Sample Standard RVUs of medical obtained from the analysis of this study are presented in Table 2.

DISCUSSION

To test the accuracy of the unit cost analysis with the use of RVU, the result should be compared with that from micro-costing method which reflects the resource of consumption more accurately than the other methods. In this study, the researchers analyzed the unit cost of health services in the fiscal year of 2014 using micro-costing method. Nevertheless, some service subjects were taken from Trung *et al.* study.^[11,13] As a consequence, there are discrepancies found during the progress of matching and comparison the results of two researches with each other.

Overall, the total number of services in Ha Nam Hospital is 1,270,166 compared to 710,662 services in Thu Duc Hospital [Table 2]. Nevertheless, the entire unit cost in Ha Nam is considerably lower than that in Thu Duc Hospital (61.5 billion VND compared to 234 billion VND). Furthermore, it appears that roughly all services in Thu Duc Hospital have higher prices than in Ha Nam. For instance, anti-HCV (ELISA) is just 7,662 VND in Ha Nam Hospital but costs 32,237 VND in Thu Duc Hospital which is approximately 4 times greater. By dividing the total unit cost for 20,000 VND, RVU value can be achieved. As a result, the total RVU of Ha Nam Hospital ranges from 0.07 to 1,085.17, while the highest total RVU of Thu Duc Hospital is 5,659.90. This causes the highest overall RVU after accumulating two statistics from two hospitals to fluctuate between 0.07 and 5,659.90. Overall, the Ha Nam Hospital's RVU is considered to be quite low due to the difference in expenses that hospitals have to cover in disparate types of services being highly various, including spending on machinery, human resource, medical devices, and chemicals.

The RVU of a service is a constant value that can be used to compute the precise cost of a particular service in different

years. For instance, to calculate the cost of a service in a specific year, we need to recover it by multiplying the value of RVU by 20,000 VND and later on by that year's consumer price index.

Applications of RVUs

The standard unit cost used for health economic evaluation in Vietnam can possibly be developed thanks to the RVUs from this study which is considered to be simple and does not require much data to be practiced. Hospitals can apply the cost information to establish rates and comply with both internal and external reporting requirements, then determine whether departments are operating within budget, construct budget for a department, or even allocate budgets among departments.

Limitations of the study

This study developed the RVUs of health services for the health settings under the public health-care sector. The RVUs of health services from this study were developed based on the assumption that the resource equally consumed in the same service in every type of hospital. Even though RVUs have been developed, it has yet been tested in other hospitals in Vietnam context.

Suggestions for future research

Due to the constant alteration in the framework of health services, it is vital that further studies should be ceaselessly conducted. This cost would make economic evaluations more convenient, fast, and reliable for decision-maker.^[9] Furthermore, to cover the expense of the Health economic evaluation, the RVU should be advanced and continuously kept up-to-date. Furthermore, as there are a vast variety of hospitals with diversified features affected by specific regions, disparate frameworks, and policies, it is likely that the difference in resource consumption ratio for each service will experience changes. Thus, further research is required to evaluate the suitability of using this RVU for costing in the other hospital type. For instance, the RVU normally applied for the provincial hospitals should be put under investigation to test its availability when practiced in other hospitals of central, district, or community level. Furthermore, further research should develop the additional RVU for health centers based on unit cost data from good performance health center.

CONCLUSION

The RVUs of health services in this study consist of 1,464 items. The outcome of this research would be useful for the future research using unit cost and make the policymaker more convenient and reliable.

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National Reference Unit Cost of Health-care Services: International Experiences

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Abstract

Introduction: Costing information is vitally important for public health management. It is applied in relation to priority setting concerning health problems, cost control, health economic evaluation, and health-care financing. When calculating the cost of illness as well as the cost of the health-care program, the cost of the same quantity of utilized services can be different if their unit costs are different. Many countries have attempted to alleviate such difficulties by developing a standard or reference list of the unit cost of health-care services. **Aims:** This review aimed to explore the situation of the national reference unit cost (NRUC) of health-care services in various countries. **Materials and Methods:** The study was designed as a systematic review. We searched articles from the PubMed and Google Scholar databases in November 2015 using a combination of keywords, MeSH terms, and other free text terms considered suitable for the purpose. The study only included complete peer-reviewed publications that were reported in the English language. Editorial, reviewed, or methodological articles were excluded. **Results:** Of the 437 identified citations, seven articles related to the unit cost of medical services studies met the selection criteria. These studies were conducted in Canada, the Netherlands, Australia, Thailand, the Philippines, the United Kingdom, and India. The NRUC has been introduced into economic evaluation analysis or reimbursement. Australia was the first country to publish a standard unit cost study in 1992, while the standard costs list for health economic evaluation in Thailand, which was published in 2014, is the newest available list. The standard unit cost list in England is updated annually and provided to all hospitals. Both top-down and bottom-up costing methodologies were used to validate the accuracy of the results. **Conclusion:** This first systematic review concerning the NRUC of medical services clearly showed that the current situation, as well as the international methodological guidelines for conducting and reporting the NRUC of health-care services, should be developed as soon as possible.

Key words: Health-care service, price, reference cost, standard cost, unit cost

INTRODUCTION

The methodologies associated with health economics do not replace socio-political decision-making; however, they do play an important role in rational decision-making regarding necessary changes to the social and health system.^[1] For instance, unit costs help managers to improve budgeting by monitoring costs as well as the efficiency of the intervention by identifying potential cost savings. Unit costs are also used to estimate the resources required to sustain the intervention by seeking an accurate estimate of the budget necessary to maintain it and the resources required to expand the intervention.^[2] In developed countries,

unit costs help economic evaluation experts to establish repayment rates and determine reimbursement by social security systems. Recently, standard unit costs have been introduced into economic evaluation analyses to measure

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the potential differences in resource use that result from the selection of one intervention over another.^[3] For instance, analyzing the cost-effectiveness of new drugs to be added to the list of national essential drugs, new vaccines for national immunization programs, and new medical procedures in the package of health insurance benefits. Standard costs are deemed to be desirable in evaluation studies because they serve to ensure that the study results will not vary based on the utilized costing methods.

Nowadays, the prices of medicine and health-care services are often high and unaffordable, not only for large sectors of the population in low- and middle-income countries but also for sizeable segments of the population who are without adequate social protection or insurance in high-income countries.^[4,5] When seeking to increase the quality and efficiency of health-care resources, health economics should be a special concern. It uses models to estimate the comparative costs and usage of interventions within the health-care field. Cost, according to the economic definition, refers to the opportunity cost (which is equal to the value of a resource in its best alternative use).^[6] Costing information is, therefore, important for public health management. It is applied in relation to priority setting concerning health problems, cost control, health economic evaluation, and health-care financing. When calculating the cost of illness as well as the cost of the health-care program, the cost of the same quantity of utilized services can be different if their unit costs are different. Many countries (the most well-known being Australia,^[7] Canada,^[8,9] the Netherlands,^[10-12] and the United Kingdom [UK])^[13] have tried to alleviate such difficulties by developing a standard or reference list of the unit cost of health-care services.

Yet, hospitals consume the largest share of health resources in most countries. They received 50% or more of the government's health resources in 19 out of 29 developing countries for which data were available^[14] (in Vietnam, the figure was 54.3% in 1996).^[15] This suggests that hospitals' resources should be managed for the benefit of the community in both developing and developed countries. Information regarding hospital costs is also needed to inform many types of policy decisions. It can help health planners to allocate resources, determine budgets for facilities and services,^[16] and assess the comparative efficiency of health-care services across settings.^[17] Therefore, the cost of health-care services in hospitals should be explored with the purpose of helping not only to manage finances and budgets but also to improve both performance and the health economics research.^[18,19] In general, identifying and valuing, all costs from a societal perspective are likely to prove challenging (e.g. not available and/or difficult to measure), although analysts should do their best to identify, measure, and value resource use wherever possible in an economically feasible way.^[16,20]

In recent years, many countries worldwide (with the most well-known being Australia,^[7] Canada,^[8,9] the Netherlands,^[10-12] and the UK)^[13] have implemented the

calculation of the standard unit cost using many different methods, perspectives, discount rates, and so on. This review, therefore, aimed to explore the situation of the national reference unit cost (NRUC) of health-care services in various countries, which could express an overview to manage the policy of the government.

MATERIALS AND METHODS

The present study, which was updated in November 2016, was designed to be a systematic review. Publications were searched in the PubMed and Google Scholar databases using the following keywords: (standard* OR reference*) AND (cost* OR price*) AND (national*) AND (list*) with the following filter criteria 20 years ago; (standard* or reference*) AND (cost* OR price*) AND (national*) AND (list*). We also hand searched the reference lists of relevant papers and reviews. This study aimed to identify and include all published articles that included a reference or standard unit cost of health-care service study. We considered studies conducted from 1995 to the present. We limited our search to studies published in English language. All the identified titles, abstracts, and full-text articles were reviewed. Studies were rejected, if they were editorial, reviewed, or methodological articles.

RESULTS

A total of 437 abstracts were identified during the search performed in November 2016. Two reviewers then individually screened the abstracts and excluded 408 titles and/or abstracts. At this stage, 17 full-text articles were found to be eligible for inclusion in the study. After the second round of double screening, seven articles were judged to be eligible for inclusion in the review; however, ten reviewed or methodological articles were excluded. Two reviewers then performed the data abstraction. Figure 1 presents a flow diagram of the selection process for this systematic literature study.

Of the 437 citations identified, seven articles were found to be related to studies concerning the unit cost of medical services; hence, they met the selection criteria. These studies were conducted in Canada, the Netherlands, Australia, Thailand, the Philippines, the UK, and India whose details were shown in Table 1. The NRUC has been introduced into economic evaluation analysis or reimbursement. Australia was the first country to publish a standard unit costs study in 1992, while the standard costs list for health economic evaluation in Thailand, which was published in 2014, is the newest available list. The standard unit cost list in England is updated annually and provided to all hospitals.

In particular, in Asia, three countries have estimated the standard unit costs (42.8%), which render it the continent with the most relevant studies. In addition, Europe has two

studies from two countries (28.6%), while America and Australia have the least papers, with just one paper being found for each continent.

Australia was the first country to publish a standard unit costs study in 1992. The study has been updated fairly regularly, with four versions having been published so far. Despite having the most studies concerning standard unit costs, the first paper in Asia was published just 6 years ago. Europe has seen the most versions published despite the continent only having two studies, since the standard unit cost list of the UK, which is known as National Health Service (NHS) Costing Manual, is updated annually and provided to all hospitals.

Hospital unit costs are essential ingredients of many policy decision-making processes in the health-care sector. They can be used to assess the efficiency of units, treatments, and facilities, as well as for budgeting and resource allocation. They may also serve as inputs to further analysis, such as benefit incidence analysis and economic evaluation of health-care programs. Moreover, standard costs have been

introduced into economic evaluation analyses so as to measure the potential differences in resource use that result from the selection of one intervention over another. Therefore, studies concerning unit costs are vitally important. However, only a small group of countries is presently concerned with this issue. The developed countries, with access to modern science and technology, first realized the importance of this issue within the health-care sector and hence became pioneers with regard to the researching of unit costs. The first article was published in Australia, followed by the UK, the Netherlands, and Canada. While it is true that the number of research studies published in Asia is higher than the number published in other continents, these studies have not been updated and edited over the years. This is one of the reasons why Asian health-care systems struggle to deal with many troubles and ultimately achieve less success than those in developing countries.

The nine identified countries have all implemented the estimated unit costs in many different ways due to having different objectives. In general, the most common objective is to conduct economic evaluations, which was the case in the Netherlands, Australia, and Thailand. Economic evaluations should include long-term costs, and the results of these studies are occasionally used to support decision-making at a national level. The main problem with economic evaluations conducted to date concerns the quality and consistency of studies as well as the degree to which the results can be compared among studies. The lack of a uniform methodology is often considered to be a weakness of these studies since it prevents the use of such assessments in practice. Therefore, some authors have encouraged the standardization of the methods used in economic evaluations “promoting high standards of conduct, scientific credibility and for explaining and comparing the results of studies in similar and different settings.”

Another popular objective is the estimation of the unit cost for a regional hospital or several hospitals, as seen in the Philippines and India. Canada had assessed two provincial cost lists from two viewpoints and compared them. The objectives of UK in this regard are particularly detailed. The choice of a specific

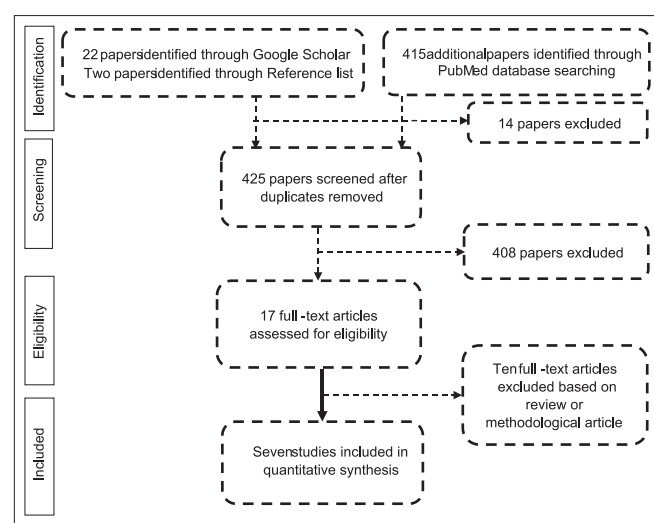


Figure 1: Flow diagram of the systematic literature study selection process

Table 1: Characteristics of the NRUC studies

| Countries | NRUC studies <i>n</i> (%) | Country | Number of versions | Published year |
|-----------|------------------------------|-------------|--------------------|------------------------------------|
| America | 1 (14.3) | Canada | 1 | 2000 |
| Europe | 2 (28.6) | Netherlands | 3 | 2000, 2004, 2010 |
| | | UK | 19 | Since 1997–1998 (updated annually) |
| Australia | 1 (14.3) | Australia | 4 | 1992, 1993, 2002, 2009 |
| Asia | 3 (42.8) | India | 1 | 2013 |
| | | Thailand | 1 | 2014 |
| | | Philippines | 1 | 2009 |
| Total | 7 (100) | | | |

NRUC: National reference unit cost

setting for the calculation of unit costs is thus very important. Some authors have argued that unit costs can differ considerably between health-care providers, so that the selection of a center(s) may seriously affect the cost calculations. It has been recommended that we should collect unit costs in more than one center and, further, that we should change the unit costs in a sensitivity analysis based on differences in unit costs that were discovered or according to estimates taken from other studies.^[11]

In Table 2, the majority of studies were conducted by specific government health departments or institutes. This was the case in Canada, the Netherlands, the UK, Thailand, and Australia. This suggests the important role and concern of governments and institutes in monitoring, inspecting, and systematizing unit costs. They are certainly the first entities to introduce lists of unit costs and relative guidelines. The identified studies allow us an overview of the financial situation in the health-care sector. Hence, orientations and appropriate solutions intended to improve the quality as well as the performance of

this sector can be identified based clear guidance concerning unit costing processes. Focusing on research regarding unit costs will help to improve health-care systems through both balancing budgets and achieving expenditure efficiency.

Interestingly, the study from the Philippines was the result of a program financed by the European Commission. It, therefore, represents a positive example of developed countries being interested in supporting developing countries in terms of organizing and developing many fields, including the health-care system.

Table 3 represents the sample characteristics of the NRUC studies. The sample sizes differ between the studies. The studies from the Philippines, Thailand, and India clearly listed the number of hospitals that participated in the research. In particular, the size of the sample involved in the study from the Philippines was the largest, comprising six tertiaries and two secondary hospitals. The use of a large

Table 2: The objectives and the organizations that conduct NRUC studies

| Country | Objective | Organization |
|-------------|--|---|
| Canada | Provide a summary of the two provincial cost lists. Assess them from two viewpoints. Use in pharmacoeconomic submissions for listings on the drug formulary. | MCHPE CIHI |
| Netherlands | Conduct EE Provide a cost study action plan to researchers and policymakers to facilitate the implementation and assessment of costing studies in EE. | Issued by the Dutch Health-care Insurance Board and approved by the Ministry of Public Health, Welfare, and Sports. |
| UK | Used to support Development of the national tariff; Monitoring of performance and service delivery; Efficiency targets; Benchmarking of services across all sectors; Consideration of investment decisions; Commissioning to meet health needs; and Negotiation of revised levels of funding. | Department of Health (NHS Reference Costs) |
| Australia | Conduct EE and financial analyses. Strike a balance between comparability and accuracy in the determination of unit costs. | Pharmaceutical Benefits Advisory Committee |
| India | Estimate unit costs of the most basic services provided at different levels or types of hospitals in India. | Individual (*) |
| Thailand | Use in HEE. Increase the efficiency of study implementation, improve the reliability of data, and allow more accurate cross-study comparisons. | HITAP of the Ministry of Public Health |
| Philippines | Estimate unit costs of some key hospital services at selected hospitals in the Philippines. Support current hospital payment system reform efforts | PhilHealth European Commission-funded technical assistance for Health Sector Policy Support Reform program |

The UK: The United Kingdom. *Susmita Chatterjee, Researcher, Research and Policy, Public Health Foundation of India, New Delhi, India. MCHPE: Manitoba Centre for Health Policy and Evaluation, CIHI: Canadian Institute for Health Information, EE: Economic evaluations, HITAP: Health Intervention and Technology Assessment Program, HEE: Health economic evaluation, NHS: National Health Service

Table 3: The samples of the NRUC studies

| Country | Sample size | Sample methods |
|-------------|--|---|
| Canada | Two provinces Manitoba Alberta | N/A |
| Netherlands | N/A | N/A |
| The UK | N/A | N/A |
| Australia | N/A | Casemix Classification for Hospital-Based Ambulatory Services |
| India | Charitable hospital District hospital Tertiary care hospital Private hospital Private teaching hospital | Five hospitals of different types were chosen for this study based on their willingness to cooperate and the accessibility of hospital data The district and tertiary care teaching hospitals are government hospitals, while the charitable hospital is funded by a charitable trust Five hospitals (two in the north and three in the south) were located in four states in India |
| Thailand | Three regional/provincial hospitals and two district hospitals Regional (>500 beds), provincial (120–500 beds), district (10–120 beds). | Ref: Efficiency of hospital costs management (MOH: Ministry of Health) |
| Philippines | Six tertiary and two secondary hospitals in five provinces located in three island groups | 15 hospitals were selected based on a predefined set of criteria followed by testing of the survey instruments at Quirino Memorial Medical Center and Mother Regina Hospital |

The UK: The United Kingdom, N/A: Not available, MOH: Ministry of Health. NRUC: National reference unit cost

sample size in combination with an appropriate research method should lead to highly accurate results. The studies from India and Thailand both included five participating hospitals. Although the study from Canada listed the location of the sampling, it did not mention the number of hospitals involved. The studies from the Netherlands, the UK, and Australia failed to mention the sample size, which represents a major shortcoming in the eyes of readers who hope to refer to the utilized research methods as well as when evaluating the accuracy of the results.

The study from the Philippines initially selected 15 hospitals and then tested the survey instruments. Finally, the study was implemented in eight hospitals. In India, the participant hospitals were chosen based on their willingness to cooperate as well as the accessibility of hospital data. Five hospitals from four states (two in the north and three in the south) were included in the study from India. The sample of the study from Thailand comprised three regional/provincial hospitals and two district hospitals, while the Canadian study involved two hospitals from two provinces.

In Table 4, each country to have conducted a study chose or combined different methods in different steps based on both the objectives and the availability of data. Canada used four methods, while the UK applied a mixed approach. The Netherlands, India, and Thailand all employed three methods in their studies. Top-down and bottom-up costing methodologies were typically used to validate the accuracy

of the results. Depending on the purpose of study, quantities of resources can be measured for individual patients (“bottom-up” approach) or the average number of patients (“top-down” approach) (10-12). The top-down methodology is more feasible and can be applied in the case of departments characterized by relatively homogeneous production. It is less costly, less time-consuming, and more accurate than the bottom-up approach, although it fails to collect cost data directly for specific patients who incur costs. Conversely, the bottom-up costing approach provides more detailed and precise cost data for each disease and patient treated at a hospital, which means that it allows for the identification of costs directly accrued for a particular patient as well as for insight into patient subgroups. However, it has not been widely used in economic evaluations, since it takes more time and requires more resources than the top-down approach. It is commonly used to determine case-specific costs for selected common diseases as well as to validate the estimates produced using the top-down costing methodology.

In Australia, six categories of health care were identified, including drugs, medical services, hospital services, diagnostic services, investigational services, and community-based services. The services included in the manual are based on economic evaluations and financial analyses conducted in both Australia and overseas, and they have been refined through discussions with sponsors and medical professionals involved in the clinical trials of drugs. In India, other medical services were identified, such as the cost per laboratory test,

Table 4: Cost methodology and scope of medical services in the NRUC studies

| Country | Cost methodology | Scope of medical services | Cost component scope of medical services |
|-------------|---|---|--|
| Canada | Four methods 1. Top-down costing. 2. Bottom-up or micro-costing. 3. Activity-based costing. 4. To use prices, charges, or rates as an approximation of the costs of services. | Inpatient hospital. Outpatient hospital services (outpatient surgery, emergency care, outpatient clinics). Home care. Nursing home. Physician services. Outpatient diagnostic services. | N/A |
| Netherlands | Three methods 1. Top-down costing. 2. Bottom-up or micro-costing. 3. Allocation methods. | Direct, inside health care. Indirect, outside healthcare. Indirect, inside health care. Direct outside recommended self-report. In 2009, the replacement costs amounted to €12.50 per hour. | Inpatient days. Laboratory tests. GP visits. Hours of home care. Travel expenses, Time costs. Productivity costs. Special education. Juridical costs. |
| The UK | Mixed approach (bottom-up and top-down) | N/A | N/A |
| Australia | N/A | Six categories of health care are classified into: admitted patient services and non-admitted patient services | N/A |
| India | Three methods 1. Standard costing method. 2. Simultaneous equation method. 3. Average cost method. | Unit cost of OPD visit, stay, emergency room visit, IPD, and surgery. Costs of some other medical services for individual hospitals. | Human resources costs. Capital costs. Materials costs. |
| Thailand | Three methods 1. Development of standard RVUs of health services. 2. Unit cost analysis of hospital medical services. 3. Direct non-medical costs for outpatients. | 3091 items in 12 groups. | Labor. Materials. Capital costs but excluding pharmacy costs. |
| Philippines | Two methods 1. Top-down or step-down costing. 2. Bottom-up or resource costing. | Unit cost of bed-day, discharge, outpatient visit, and ancillary services of hospitals. | Capital cost. Cost of personnel services. Drugs/medicines and medical supplies costs. Other recurrent costs. |

The UK: The United Kingdom, N/A: Not available. NRUC: National reference unit cost, OPD: Outpatient department, IPD: inpatient department

cost per admission or bed-day at the intensive care unit, cost per surgery in the orthopedic, ophthalmic, and gynecology operating theaters, and cost per visit to the physiotherapy, and other units. The 12 categories identified in Thailand are routine services at outpatient and inpatient departments, blood transfusion services, diagnostic and clinical pathology

services, diagnostic and therapeutic radiology services, special investigations, medical supplies and services, medical procedures and anesthesia, nursing care services, dentistry services, physical therapy and medical rehabilitation, acupuncture and other alternative medicine, and health promotion and disease prevention and control.

The cost component scope of medical services consisted of the capital cost, materials cost, and labor cost. In general, the various cost components are carefully calculated (e.g. in the Netherlands, India, Thailand, and the Philippines). Based on the provider's perspective, the capital costs are frequently estimated, while variable costs such as drugs and medical supply costs only appear when assessing the unit cost of the medical service in the Philippines. Yet, the Netherlands is the country that has the largest range of costs, including direct costs (e.g. inpatient days, laboratory tests, and general practitioner visits) and non-direct costs (e.g. travel expense and hours of home care). These medical costs, which are both usually calculated based on the perspective of the payer, are also present in other countries, such as Thailand and the Philippines.

Very few countries mentioned the discount rate in their studies. The discount rate, as recommended by the WHO guide,^[21] was 3% for a base case. However, the Netherlands used 1.5% based on the assumption that the value of health gains increases over time, while this increasing value is not accounted for in economic evaluations. This explains why the discount rate is not an important variable and has little effect on the results of the economic evaluations in countries such as Canada, the UK, Australia, India, and the Philippines. The results and limitations of each study were showed in Table 5.

DISCUSSION

Costing methodology

There exist a variety of approaches to resource measurement, and the choice of approach may be determined by the problem needing to be decided on, the perspective of the study, and the availability of data. Based on the main methodological issues identified in costing health-care services by the University of York, there are five general costing approaches found in almost all projects: Direct measurement (including top-down [gross-costing] and bottom-up [micro-costing or activity-based] costing); using standard unit costs; using cost accounting methods; use of fees; and market prices and estimates based on information derived from previous studies.^[22] Applying direct measurement at a study site to ascertain the unit cost is appropriate when the results are to be used for organizational management, while the standard unit cost is used when the results are needed for national-level management.

In Thailand, the majority of studies have used the accounting-based approach due to its relative simplicity. It ignores the concept of opportunity cost and costs in time difference. The notion of the "effect of costing methods on unit cost of hospital medical services" argues that the capital cost of buildings and capital items as calculated using the accounting-based

Table 5: The outcomes of the NRUC studies

| Countries | Results | Limitations |
|--------------------------------|--|--|
| Canada | The classification of patient care by diagnosis and procedure as well as the assignment of first principal diagnosis. Both provinces use the CIHI DPG classification system and weights. Both Alberta and Manitoba use fees to place a value on nursing home care, which can be consolidated into a cross-provincial fee rate. | While Alberta and Manitoba were the first provinces to develop formal cost lists, it is desirable to develop cost lists for other provinces as well, since the current lists do not represent health-care expenditures in all of Canada. A truly representative national cost list for Canada would have to include data from both Quebec and Ontario. |
| Netherlands | N/A | Lacked topics on (1) medical costs in life-years gained, (2) the database of the DBC Casemix System, (3) reference prices for the mental health-care sector, and (4) the costs borne by informal caregivers. New insights and developments necessitated the updating of existing topics, such as (5) the friction cost method to account for absence from paid work, (6) discounting future effects, and (7) options for transferring cost results from international studies to the Dutch situation |
| The UK, Australia, Philippines | N/A | N/A |

(Contd...)

Table 5: (Continued)

| Countries | Results | Limitations |
|-----------|--|--|
| India | <p>The tertiary care hospital had the highest caseload (average of 1045 visits per day), and the charitable hospital, the lowest (average 84 visits per day). One of the efficiency indicators of hospitals is the bed occupancy rate. The major cost component for the district and tertiary care hospitals was human resources, while for the charitable and private hospitals it was the capital cost, but for the private teaching hospital, it was the materials cost.</p> <p>The land cost was the largest component for the charitable hospital, the equipment and building costs shared almost the same percentages for the district hospital, the equipment cost was the biggest item for both teaching hospitals, and the building cost was the highest component for the private hospital.</p> <p>The human resources cost was the main component of the total operating cost for the government hospitals, but the materials cost became the main component for all the other hospitals when the land cost was excluded. Within an individual cost center, human resources accounted for the highest cost share, followed by the materials cost, in both the district and tertiary care hospitals.</p> | <p>As the tertiary care hospital was unable to indicate the distribution of drugs and medical supplies among its cost centers, we used the number of visits and admissions to distribute this cost. Based on the hospital physicians' opinions, we assumed that patients in the wards consumed 3 times more drugs and medical supplies than patients seen at the OPD or emergency room. Although expert opinion is an accepted method for resource allocation, the resulting figures are not exact. Hence, the unit costs of different departments at the tertiary care hospital might be either under- or over-estimated.</p> <p>As we did not have access to price data for certain equipment and instruments in the ophthalmic operating theater of the tertiary care hospital, the equipment cost of this department is an estimate. This might affect the unit cost estimate of the ophthalmic department of this hospital.</p> <p>Donated items have not been considered in the cost calculation. Shepard <i>et al.</i> argued for the inclusion of donated items in cost analyses, since hospitals or wards with more donated items may appear more efficient than their peers, even though their actual efficiency may be the same. Such items can account for a substantial share of hospital resources.^[4]</p> <p>However, as the study hospitals did not keep any record of donated items, we excluded them from our calculation, although the unit cost estimates of the study hospitals would have been different had they been included.</p> <p>The quality of services could clearly explain some of the variations in costs, but it was beyond the scope of this study.</p> <p>Using duty rosters to allocate nursing and ground level staff time provides only estimates of time allocation. However, it was impossible to obtain exact time allocations for these staff categories.</p> <p>As one goal of this study was to determine the feasibility of conducting cost estimates in the Indian health-care sector, we chose five hospitals of different types whose administrators would agree to cooperate and provide data. Given the diversity of hospitals in India, our study hospitals might not be representative.</p> |
| Thailand | <p>The costs per RVU for regional/provincial hospitals and district hospitals were found to be 134.95 THB and 128.67 THB, respectively.</p> <p>The cost to charge ratios is 1.63 and 1.45 for regional/provincial hospitals and district hospitals, respectively.</p> | <p>The CSMBS reimbursement rate used for the standard RVU development was established several years ago, which may mean that some of the methods may be slightly out of date.</p> <p>The small sample size of health facilities used for the calculation.</p> <p>Did not include services at a super tertiary level or at a university hospital level.</p> |

The UK: The United Kingdom, N/A: Not available. DTC: Diagnosis treatment combination, OPD: Outpatient department, CIHI: Canadian Institute for Health Information, RVU: Relative value unit

approach was 13% lower than that calculated using the economic-based approach. If the results were used for price setting or financial planning, then the hospital would lose approximately US\$24,596 per year. These results reflect the WHO's guidelines, which state that the economic-based approach is appropriate for calculating the capital costs of hospital cost analysis.^[23]

Prior studies have shown that the top-down approach is simple, transparent, and able to tackle regional or institutional variability. Due to the lack of detailed data, it is often the only feasible option. Moreover, it is retrospective, and standard costs cannot be calculated this way. The managers of health-care institutions frequently use the top-down approach to calculate hospital treatment costs in several countries, including Australia, Belgium, Sweden, the UK, and the USA.^[24-26] The results of the bottom-up approach are more reliable and precise although such an approach can prove expensive, may not always be practical, and requires a very detailed service delivery process.^[27]

In Thailand, a special form of the bottom-up approach known as the relative value unit (RVU) system is used to establish the standard unit cost based on existing prices lists. The RVU system is a weighted procedure method calculated based on the detail of the consumption of supplies, equipment, or personnel as cost drivers. A study from Thailand argued that the RVU method is suitable for calculating the unit costs if the standard relative weight units have already been established.^[2]

In practice, analysts prefer a mixed approach in their studies, for instance, the NHS Costing Manual guidelines and the situation in the Netherlands (which uses a step-down approach, that is, a special form of mixed approach). The mixed model allowed analysts to tailor the cost measurement to the particular study objectives and decide when they will rely on direct cost measurement (micro-costing) and when they will use computer-based databases (macro-costing).^[27-29]

Perspectives

The unit cost perspective is different in every country. While the costing perspective in the Netherlands focuses on society, in India, it focuses on the provider. The determination of the perspective could affect the question/decision problem to be addressed, the inclusion and exclusion of resource items (costs), the methodology selected, the statistical analysis completed, and a decision or recommendation. Analysts should, therefore, be clear and explicit about whether the costing exercise is performed from a: (a) patient (first party), (b) provider (second party), (c) purchaser (payer, third party), (d) employer or other sponsor (fourth party), (e) government, or (f) societal perspective.

The perspective determines the types of costs that should be taken into account. For instance, it can have an impact

on whether direct non-medical costs (e.g., travel) should be taken into account as well as whether or not they should be reimbursed. Further challenges include the partial inclusion or exclusion of multidisciplinary care costs (e.g., early intervention for schizophrenia). In addition, the perspective will determine whether productivity costs should or should not be taken into account, as well as whether (service providers') overheads should be added to the direct medical costs.^[27,30,31]

In Africa, the costs were calculated from the perspective of the health-care facility, while in Australia, the financial analysis in a submission prepared according to subsections E.2–E.4 of the PBAC Guidelines adopts the perspective of the PBS/Repatriation Pharmaceutical Benefits Scheme (RPBS). This means that cost components borne by payers other than the Australian Government are excluded from the financial analysis. In practice, this means that non-PBS/RPBS drugs, over-the-counter drugs, or drug delivery systems are excluded from the financial analysis because they incur no direct financial cost to the PBS/RPBS. This also means that the range of patient copayments is subtracted from each PBS/RPBS drug's unit cost.

In summary, the perspective of an economic evaluation study is the objective of the individual study as deemed appropriate for each country. It is crucial in relation to both the definition of the costs and the criteria for inclusion in the study.

Discount rate

Discounting is the process of converting future costs into their present value to reflect the fact that, in general, individuals and society have a positive rate of time preference for consumption now over consumption in the future. The allocation of overhead costs is a common problem when estimating the unit cost, especially in multi-cost centers. Moreover, health economic methodological guidelines frequently fail to provide sufficient details regarding the recommended cost allocation methods.^[32] Analysts should be aware of the value of the fixed asset, the working life of each particular asset, and either the acquisition costs or the replacement costs of the assets.

The discount rate, as recommended by the WHO guidelines,^[21] was 3% for a base case and 6% for a sensitivity analysis. The sensitivity analysis of the discount rate was tested using a 6% discount rate in the calculation rather than the 3% of the base case. This resulted in an increase in the total annualized capital cost of 4.76%.

The discount rate in Thailand and India is determined to be 3%, while in the Netherlands it is 1.5%. The latter is based on the assumption that the value of health gains increases over time, while this increasing value is not accounted for in economic evaluations.^[33]

Scope of services - sample size

The hospital data from Canada were collected in two hospitals from two provinces though they combined lost of terms of services. The study from the Philippines included data from eight hospitals, while the studies from India and Thailand were both conducted in five hospitals. India exported the unit costs of inpatient and outpatient care (One of the most popular approaches), emergency visits, surgery, for instance, Canada, and the Philippines. While Thailand classified 3,091 services into 12 groups.

CONCLUSION

This first systematic review of studies concerning the NRUC for medical services clearly showed that based on the current situation, the international methodological guidelines for conducting and reporting the NRUC of health-care services should be amended and developed as soon as possible.

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Socioeconomic Burden of Community-acquired Pneumonia Associated Hospitalizations among Vietnamese Patients: A Prospective, Incidence-based Study

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Abstract

Context: Community-acquired pneumonia (CAP) is a leading cause of morbidity and mortality. **Aims:** This paper presents a study that was conducted to assess the socioeconomic effects of a CAP episode to help policymakers to create effective prevention and control measures. **Settings and Design:** This study used an incidence-based approach from a societal perspective. **Materials and Methods:** The sample comprised 255 hospitalized patients at the Respiratory Department at Trung Vuong General Hospital during a 12-week period in 2017. Payment data were also collected. **Results:** Overall, there were 148 (58.0%) men and 107 (42.0%) female with a mean age of 66 ± 16 years. More than half 158 (62.0%) were older than 65. The current study showed the mean treatment cost to be approximately \$629 for CAP inpatients; this included direct and indirect costs. The average informal cost of treating one CAP patient was estimated at \$297. On average, the biggest expenses were those related to direct medical costs - 76.6% (\$481). The mean CAP-related direct non-medical and indirect costs accounted for 19.3% and 4.1%, valued at \$121 and \$26, respectively. The results of the study also showed a significant relationship between length of stay and average cost of treatment per CAP episode. **Conclusions:** The results of this study can be used to improve the allocation of resources for CAP control in Vietnam and to provide a foundation for future analyses of the cost-effectiveness of pneumococcal vaccines or other methods for controlling CAP.

Key words: Community-acquired pneumonia, direct cost, indirect cost, treatment cost, Vietnam

INTRODUCTION

Community-acquired pneumonia (CAP), as distinguished from hospital-acquired (nosocomial) pneumonia, is an acute infection of the pulmonary parenchyma in a patient who has acquired the infection in the community.^[1,2] There are an estimated 920,000 cases annually, accounting for 16% of deaths among children younger than 5 years old.^[2] Lozano *et al.* found that from 1990 to 2010, CAP was ranked as the fourth highest cause of deaths in adults: 1.9 million people over the age of 15 die from CAP each year.^[3] Special attention must be paid to CAP in Southeast Asia, where the incidence rate was reported to range between 988 and 4,205 for every 100,000 people in 2016.^[4] Indeed, the annual incidence

rate of reported infections in Vietnam has been estimated to be between 2.6 and 16.8 cases per 1,000 people annually, with mortality rates of 2–30% for CAP inpatients.^[1] In addition, with high morbidity and mortality rates, CAP is considered a growing public health concern because of the accompanying

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significant socioeconomic burden, which includes both direct and indirect costs.^[5]

The highest burden comes from hospitalized patients. CAP inpatient care costs accounted for 80–95% of total treatment costs, with the average length of stay (LOS) estimated to be about 9–10 working days.^[6] About 8,500 hospitalizations related to CAP annually, at the cost of more than \$40 million, were estimated to be in Alberta.^[7] Thomas File *et al.* reported that in 2010, the overall economic burden of CAP was estimated to be \$9.3 billion for 4 million outpatient cases in the United States (US).^[8] Recently, Sato *et al.* estimated the economic burden of CAP to be \$11,148–\$51,219 per case with an average of 31.8 treatment days. The Chinese Ministry of health reported the average hospitalization costs of CAP as \$575.30–\$1,137.40 in 2005.^[9,10] Results from studies on Singapore suggest that the inpatient costs for treating CAP varied from \$1,294 for 6.4 treatment days to \$3,456 for 10 treatment days.^[11] In the Philippines, the economic burden associated with CAP was estimated at \$852–\$5,885 per case.^[12]

Studies on Vietnam have described CAP in terms of the clinical picture, diagnosis, treatment, and prevention. However, few studies have assessed the economic burden of CAP, and even fewer have done so for adult inpatients. Estimates of the average treatment cost have varied widely - from \$180 to \$318 per case in 2014.^[13] The lack of data on treatment costs for adult inpatients makes it difficult to evaluate the economic burden of CAP. In this study, the burden of CAP in Vietnam was assessed from a social point of view. In addition, incremental factors related to cost of illness for CAP hospitalized patients were evaluated. Evidence regarding the societal costs of the disease could help policymakers to set priorities, especially in the context of rising health-care costs and to assess a potential effective vaccine.

SUBJECTS AND METHODS

Study design and hospital

From March to May 2017, a cross-sectional study that included a cost-of-illness analysis using a prospective approach and incidence-based measures was conducted on patients who were treated for CAP in the Respiratory Department of Trung Vuong General Hospital in Ho Chi Minh City.^[14,15] The focus was the societal perspective. Based on the findings of a study conducted at Bach Mai Hospital in Vietnam in 2016, the sample size was calculated. The mean treatment costs of pneumonia were approximately \$318 (SD = 181, CV = 0.5) for 1,000 patients.^[13] We used a sample size formula recommended by the World Health Organization in 2005. It had a precision of 5% and assumed a non-response rate of 5% for a sample of 184 pneumonia patients. During three months of data collection, we were able to collect information and analyzed data for 255 patients.^[16]

Trung Vuong General Hospital, located in downtown Ho Chi Minh City, is classified as a central level hospital (second highest

hospital rank in Vietnam) with 700 beds.^[17] Over a 50-year period, Trung Vuong General Hospital had become one of the biggest general hospitals in Ho Chi Minh City by 2014, with a staff of 964 in 27 departments and the capacity for the diagnostic testing and treatment of 1,500–2,000 patients per day.^[17] The total number of outpatients and inpatients is more than about 500,000 and 40,000, respectively (unpublished data).

CAP population

Within the framework of the cost-of-illness study, the study cohort comprised all CAP inpatients, identified by enrolment criteria, receiving medical care in the Respiratory Department at Trung Vuong General Hospital from March to May 2017. During the 3 months, the total number of inpatients in the Respiratory Department was 768, and those patients' medical records were reviewed by researchers using the enrolment criteria for the study to determine CAP patients. The study protocol is described in Figure 1. Of the total 768 hospitalized patients who were screened for CAP, 513 were excluded from this study because either they did not meet the enrolment criteria ($n = 481$) or their approval could not be obtained ($n = 32$).

Enrolment criteria

At first, the study included patients who had a primary diagnosis of pneumonia, as defined in the World Health Organization's International Classification of Disease, Tenth Revision (ICD-10th) codes J10-J18. The list of ICD-10 codes included influenza resulting from an identified influenza virus (J10.0, J10.1, and J10.8); influenza, virus not identified (J11.0, J11.1, and J11.8); viral pneumonia, not elsewhere classified (J12.0, J12.1, J12.2, J12.3, J12.8, and J12.9); pneumonia resulting from *Streptococcus pneumoniae* (J13); pneumonia resulting from *Haemophilus influenzae* (J14); bacterial pneumonia, not elsewhere classified (J15.0, J15.1, J15.2, J15.3, J15.4, J15.5, J15.6, J15.7, J15.8, and J15.9); pneumonia resulting from other infectious organisms, not elsewhere classified (J16 and J16.8); pneumonia in disease, classified elsewhere (J17.0, J17.1, J17.2, J17.3, and J17.8); pneumonia, and organism unspecified (J18.0, J18.1, J18.2, J18.8, and J18.9).

If a patient developed the disease 48 hours after admission, he or she was classified as having hospital-acquired pneumonia and was excluded. To ensure the integrity of the study, patients who were arbitrarily discharged from hospital (before full recovery) or moved from another hospital to the study site were excluded. The study also eliminated patients who refused to provide their personal information. The payment data related to enrolled patients were collected from the hospital's electronic database after direct interviewing of the patients. These criteria were based on those used in previous studies of CAP and were modified for the local setting.^[4]

The enrolment process resulted in a final sample of 255 participants who had CAP during the study period for analysis

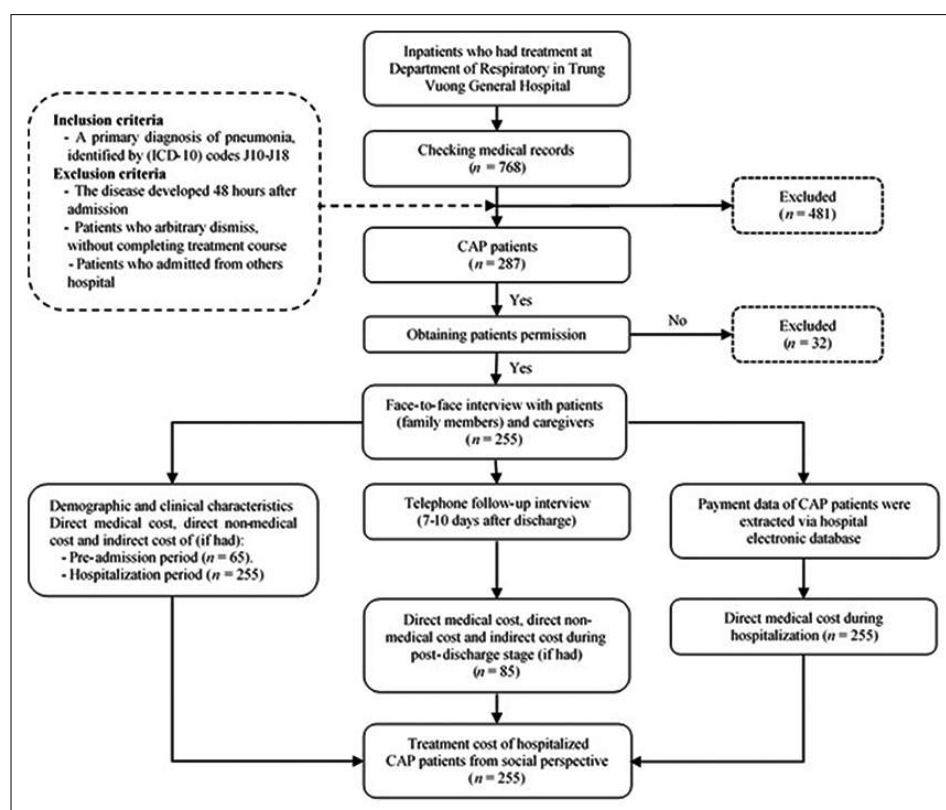


Figure 1: Flowchart of the patients enrolled in this study

of the economic burden of the disease. For the 255 qualified patients, general information and overall treatment costs, including direct medical costs (DMCs), direct non-medical costs (DNMCs), and indirect costs (IDCs), were collected through the following three steps:

Step 1. Questionnaire survey

The survey was conducted at the time of the patient's full recovery from the illness episode by direct interview of the patient using a standardized questionnaire.^[18] The survey instrument permitted the collection of demographic information and treatment costs. The general information collected about the participants included age, gender, living place, monthly income, education level, occupation, health insurance status, pneumococcal vaccinations, and LOS. LOS was calculated as number of days between admission and discharge. Clinical symptoms were recorded on admission. They included cough, high fever, shortness of breath, fatigue, headache, and vomiting. The comorbidity of CAP inpatients included pulmonary diseases, cardiovascular diseases, renal diseases, diabetes, digestive system diseases, and cerebrovascular diseases. The examined cost-of-illness data were the DMCs, DNMCs, and IDCs during pre-hospitalization and the DNMCs and IDCs during hospitalization.

Step 2. Extraction direct medical cost data

Payment data were extracted from the hospital electronic data to estimate the DMCs during hospitalization. DMCs included the cost of a bed for each day, diagnostic tests (imaging and laboratory tests), medication, medical supplies, and any surgeries.

Step 3. Telephone follow-up survey

For each case, within 7–10 days after discharge, the interviewers contacted the patient or any family member who had a good knowledge about the CAP illness and the related expenses to ascertain the follow-up costs. The telephone interview (7–10 days after discharge) tended to obtain data, including DMCs, DNMCs, and IDCs, related to the post-discharge period.

In summary, the cohort study required 255 CAP patients to complete two interviews - a face-to-face inpatient interview and a telephone follow-up interview.

Costs associated with CAP

Cost-of-illness in this study refers to the costs incurred from the three stages of treating one CAP episode - cost of treatment pre-hospitalization, hospitalization, and post-discharge. In each stage, treatment costs considered all costs which were estimated from a societal perspective. The costs consisted of direct costs (including DMCs and DNMCs) and IDCs.^[19]

Direct cost component

$$\left(\frac{CPI_{2017}}{CPI_{2014}} = 1.549 \right)$$

Direct costs consisted of DMCs and DNMCs. Details on resources used were collected from medical records during

hospitalization. These included the cost of diagnostic tests, laboratory tests, bed-days, medication, surgeries, medical supplies, and blood transfusions or infusions. To standardize the reporting of the DMCs, the study based the unit cost of medical services in Vietnam on that in the study by Vo *et al.* The unit cost of medical services was adjusted for inflation in 2017.^[20]

Because of the lack of pre-hospitalization and post-discharge DMCs, the current study focused only on the total DMCs in these stages rather than a detailed analysis of the DMCs. Self-reported

illness-related cost items such as meals, transportation, accommodation, as well as informal care costs reported by patients and their family members were considered DNMCs. In addition, the study collected DCs for all three CAP treatment stages - pre-hospitalization, hospitalization, and post-discharge.

Indirect cost component

Indirect costs represent expenses for loss of productivity of patients resulting from hospitalization. This information

Table 1: Demographic and clinical characteristics of CAP inpatients (*n*=255)

| Characteristics | Value (%) | Characteristics | Value (%) |
|---------------------------------|------------|--------------------------------|------------|
| Age group (years old) | | ICD-10 code | |
| Mean±SD | 66±16 | J15 | 121 (47.5) |
| Median (IQR) | 69 (56–78) | J15.1, J15.2, J15.6 | 15 (5.9) |
| Range | 25–93 | J15.9 | 109 (42.7) |
| 18–44 | 22 (8.6) | J18 | 10 (3.9) |
| 45–64 | 75 (29.4) | Vaccination | |
| 65–74 | 59 (23.1) | Yes | 13 (5.1) |
| 75–84 | 78 (30.6) | No | 242 (94.9) |
| ≥ 85 | 21 (8.3) | Health insurance (%) | |
| Gender | | 0 ^a | 32 (12.5) |
| Male | 148 (58.0) | 48 | 14 (5.5) |
| Female | 107 (42.0) | 60 | 11 (4.3) |
| Length of stay (days) | | 80 | 153 (60.1) |
| Mean±SD | 10.3 (5.4) | 95 | 9 (3.5) |
| Median (IQR) | 10 (7–12) | 100 | 36 (14.1) |
| Range | 2–32 | Comorbidity | |
| Living places | | Pulmonary diseases | 108 (42.4) |
| Urban | 227 (89.0) | Cardiovascular diseases | 176 (69.0) |
| Rural | 28 (11.0) | Renal diseases | 17 (6.7) |
| Education level | | Diabetes | 56 (22.0) |
| Illiteracy | 23 (9.0) | Digestive system diseases | 115 (45.1) |
| Elementary school | 67 (26.3) | Cerebrovascular diseases | 11 (4.3) |
| Secondary school | 60 (23.5) | Other diseases (gout, etc.) | 24 (9.4) |
| High school | 68 (26.7) | Hospitalization Symptoms | |
| College (2–3 years training) | 8 (3.1) | High fever | 97 (38.0) |
| University (4–6 years training) | 29 (11.4) | Cough | 140 (54.9) |
| Occupation | | Shortness of breath | 102 (40.0) |
| Worker/Labor | 32 (12.5) | Fatigue | 43 (16.9) |
| Trader/Businessman | 27 (10.6) | Others (headache, vomit, etc.) | 66 (25.9) |
| Housewife | 8 (3.1) | History of getting CAP | |
| Retirement | 179 (70.3) | Yes | 78 (30.6) |
| Others ^b | 9 (3.5) | No | 177 (69.4) |

CAP: Community-acquired pneumonia, ICD-10: International Statistical Classification of Diseases and Related Health Problems 10th Revision. ^aOut of pocket, ^bStudent, Farmer, Teacher, etc., SD: Standard deviation, IQR: Interquartile range

was obtained during patient interviews. The estimation was based on the number of working days (calculated as 30 per month) lost and the reported monthly income of patients and caregivers. Each working day was assumed to be eight hours. The IDC was calculated by multiplying the mean monthly income by the number of lost working days. In this study, people older than 65 were considered as having low (almost zero) IDCs. Moreover, the reported IDCs in the current study were those for patients. The IDCs to caregivers were combined with the DMCs and DNMCs to caregivers and reported as caregiver costs.

Analytical approaches

The demographic data were analyzed and expressed by frequency, proportion, and mean using Microsoft Excel 2016. The cases were divided into two age groups - adults under 65 and adults (elderly people) over 65. The study estimated the standard deviations (SDs) for the average treatment cost for each age group for each period (pre-hospitalization, hospitalization, and post-discharge) and for each component (DMC, DNMC, IDC, and informal cost). Moreover, the study also assessed differences in treatment costs between the two age groups using a *t*-test assuming unequal variances. In

the overall group, cost was calculated and described as the mean with SD, range (with a 95% confidence interval) and proportion (compared with total average cost of treatment). The results for costs were presented in 2017 US dollars (\$1 USD = 422,433).^[21] Descriptive statistics were used to compare the average treatment cost along various dimensions (e.g., gender and living place). Differences in treatment cost per patient were estimated using a *t*-test and ANOVA single factor, as appropriate, through Microsoft Excel 2016. *P* < 0.05 was considered significant in all statistical analyses.

Ethics statement

To avoid any violation of the principles for using human participants set forth in the Declaration of Helsinki, the ethical review committees of Trung Vuong General Hospital reviewed and approved the study protocol, the questionnaire, and the information letter for participants. Case investigations could not reveal the patients' personal information. The patient's privacy and other rights and interests were not violated. All patients or family members who had information about expenses during the disease period (in the case of patients unable to participate in a direct interview), and caregivers participating in this study provided written informed consent.

Table 2: Average expenses divided by pre-hospitalization, hospitalization, and post-discharge periods (USD 2017; *n*=255)

| Age (years) | <65 | ≥ 65 | <i>P</i> value ^a | All ages | <i>P</i> value ^b |
|-------------------------|-------------|-------------|-----------------------------|-------------|-----------------------------|
| Pre-hospitalization | | | | | <0.01 |
| Direct medical cost | 26.3±27.4 | 50.1±81.7 | 0.520 | 37.3±57.5 | |
| Direct non-medical cost | 51.5±60.0 | 60.8±79.9 | 0.818 | 10.6±28.2 | |
| Indirect cost | 12.5±12.6 | - | 0.039 | 6.7±11.0 | |
| Total cost | 40.2±18.4 | 71.5±122.1 | 0.560 | 54.7±81.5 | |
| Hospitalization | | | | | 0.711 |
| Direct medical cost | 407.4±458.2 | 502.2±264.0 | 0.409 | 465.0±351.8 | |
| Direct non-medical cost | 108.4±152.7 | 120.4±91.6 | 0.755 | 115.7±118.1 | |
| Indirect cost | 42.9±52.3 | - | 0.002 | 16.8±38.6 | |
| Total cost | 558.8±573.6 | 622.6±301.1 | 0.651 | 597.5±424.7 | |
| Post-discharge | | | | | <0.01 |
| Direct medical cost | 27.1±56.1 | 13.9±15.1 | 0.537 | 20.1±39.2 | |
| Direct non-medical cost | 5.7±5.8 | 12.1±9.9 | 0.128 | 9.1±8.7 | |
| Indirect cost | 5.7±5.8 | - | 0.027 | 22.1±44.6 | |
| Total cost | 79.8±84.4 | 26.0±19.5 | 0.116 | 51.3±63.9 | |
| Total | | | | | <0.01 |
| Direct medical cost | 427.5±455.4 | 515.9±259.0 | 0.436 | 481.2±347.8 | |
| Direct non-medical cost | 111.2±154.1 | 128.0±95.2 | 0.655 | 121.4±120.5 | |
| Indirect cost | 66.1±82.9 | - | 0.002 | 25.9±60.6 | |
| Total cost | 604.8±571.0 | 643.9±297.2 | 0.779 | 628.6±421.1 | |

^aComparison of mean cost using *t*-test two-sample assuming unequal variances; ^bComparison of mean cost among three periods of treating CAP (pre-hospitalization, hospitalization, and post-discharge) using ANOVA single factor. CAP: Community-acquired pneumonia, USD: US dollars

Table 3: Estimated average DMCs per CAP case by component (USD 2017; *n*=255)

| Cost components | Total cost (%) | Mean±SD | 95% CI |
|--------------------------------|--------------------------|--------------------|--------------------|
| Direct medical cost | | | |
| Medical care cost ^a | 827.1 (0.4) | 16.2±40.7 | 5.0–27.4 |
| Imaging technique | 8,373.7 (3.9) | 32.8±16.4 | 27.8–37.8 |
| Radiograph | 4,789.6 (2.2) | 18.8±17.9 | 13.8–22.9 |
| CT scanner | 2,158.5 (1.0) | 54.2±14.7 | 44.2–64.2 |
| Ultrasonic | 1,425.6 (0.7) | 7.6±5.0 | 6.0–9.2 |
| Laboratory test | 11,950.6 (5.6) | 46.9±11.0 | 43.9–49.9 |
| Serum biochemistry tests | 1,602.1 (0.8) | 6.3±1.3 | 5.9–6.7 |
| Urine biochemistry tests | 691.0 (0.3) | 2.7±1.1 | 2.4–3.0 |
| Microbiological tests | 8,816.4 (4.1) | 42±23.1 | 35.0–49.0 |
| Other tests | 841.0 (0.4) | 3.3±3.2 | 2.4–4.2 |
| Bed-day | 24,042.7 (11.3) | 94.3±54.0 | 79.5–109.1 |
| Pharmaceutical | 66,124.8 (31.0) | 259.3±45.4 | 246.8–271.8 |
| Antibiotics | 48,702.1 (22.8) | 191.0±74.3 | 170.6–211.4 |
| Respiratory affected drug | 2,967.1 (1.4) | 11.6±6.6 | 9.6–13.6 |
| Analgesic drug | 3,112.5 (1.5) | 12.2±8.6 | 9.7–14.7 |
| Other medicines | 11,343.1 (5.3) | 44.5±22.8 | 38.2–50.8 |
| Operation | 4,411.9 (2.1) | 126.1±77.5 | 68.7–183.5 |
| Medical supplies | 2,185.5 (1.0) | 8.6±2.9 | 7.8–3.7 |
| Others | 1,491.1 (0.7) | 5.8±10.9 | 2.8–8.8 |
| Direct non-medical cost | | | |
| Transport | 629.1 (0.3) | 12.3±14.6 | 8.3–16.3 |
| Meal | 1,723.8 (0.8) | 33.8±29.8 | 25.6–42.0 |
| Caregiver | 3,738.0 (1.8) | 73.3±94.9 | 47.3–99.3 |
| Indirect cost | | | |
| Productivity lost | 1322.5 (0.6) | 25.9±60.6 | 9.3–42.6 |
| Total | 213,269.8 (100.0) | 628.6±421.1 | 513.0–744.0 |

^aDirect medical costs for pre-hospitalization and post-discharge periods. SD: Standard deviation, CI: Confidence interval, DMCs: Direct medical costs, CAP: Community-acquired pneumonia, USD: US dollars

RESULTS

Demographic data and clinical presentation

The study comprised 255 patients hospitalized for CAP. Their demographic characteristics, comorbidity, and admission symptoms are reported in Table 1. Fifty-eight percent of all patients were male, and the median age was 69 (ranging from 25 to 93). Sixty-two percent of all patients were elderly people over 65, and 38.9% were over 75. In terms of comorbidity, 69.0% had cardiovascular diseases, 45.1% had digestive system diseases, and 41.4% had pulmonary diseases. A majority of the symptoms on admission were cough (54.9%) and shortness of breath (40.0%).

Cost results

According to the data in Table 2, the total average cost per case was \$628.60 ± \$421.10. The average cost per case of

patients ≥65 years old was higher than for patients <65 years old but not significant (\$643.9 ± \$297.2 and \$604.8 ± \$571.0, respectively; *P* = 0.779). The average DMCs, DNMCs, and IDCs per episode were estimated to be \$481.20 ± \$347.80, \$121.40 ± \$120.50, and \$25.90 ± \$60.60, respectively.

The detailed DMCs during hospitalization are described in Table 3 and Figure 2. As can be seen in Figure 2, medications accounted for the highest proportion of the cost (55.8%), 1,191 with the largest proportion (nearly three-quarters (73.6%)) attributed to antibiotics.

According to the data in Table 4, the total average informal cost per case was \$297 ± \$255.30. There was a difference in informal costs between patients under and over 65, but statistical significance was not reached (*P* = 0.798). On the other hand, the study showed that there were differences in terms of indirect, transportation, and meal costs among patients and caregivers (*P* < 0.05). The average CAP treatment costs according to

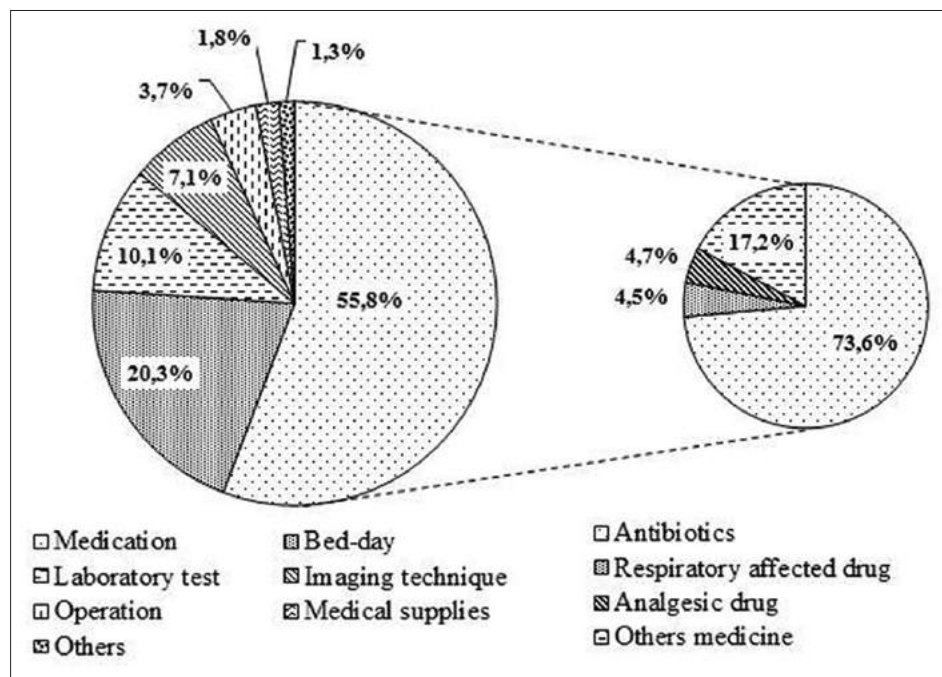


Figure 2: Distribution of direct medical costs during hospitalization

Table 4: Detail of informal costs by patients age (USD 2017; *n*=255)

| Age (years) | <65 | ≥ 65 | <i>P</i> value ^a | All ages | <i>P</i> value ^b |
|--------------------------------------|----------------------|----------------------|-----------------------------|----------------------|-----------------------------|
| Indirect cost | | | | | |
| Caregivers time cost | 85.2 (116.2) | 46.0 (57.8) | 0.287 | 58.3 (81.3) | 0.043 |
| Patients time cost | 66.1 (82.9) | - | 0.002 | 25.9 (60.6) | |
| OOP^c payments | | | | | |
| Transportation for patients | 7.1 (8.1) | 15.7 (16.8) | 0.018 | 12.3 (14.6) | 0.001 |
| Transportation for caregivers | 2.5 (2.8) | 5.6 (10.6) | 0.124 | 4.4 (8.5) | |
| Food for patients | 34.1 (40.6) | 33.6 (20.9) | 0.953 | 33.8 (29.8) | 0.036 |
| Food for caregivers | 14.3 (21.7) | 27.3 (26.7) | 0.063 | 22.2 (25.4) | |
| Lodging for caregivers | 2.0 (5.0) | 4.0 (3.6) | 0.130 | 3.2 (4.3) | |
| Out of health insurance ^d | 131.2 (124.7) | 164.9 (184.9) | 0.440 | 151.7 (163.4) | |
| Total | 308.5 (249.9) | 289.6 (262.6) | 0.798 | 297.0 (255.3) | |

Data were presented as mean (SD) cost in USD. ^aComparison of mean cost using *t*-test two-sample assuming unequal variances;

^bComparison of mean cost for three periods of treating CAP (pre-hospitalization, hospitalization, and post-discharge) using ANOVA single factor; ^cOut of pocket (expenses, which were unbudgeted and paid for in cash, relating to DNMC and DMC); ^dPatient's expenses for medical care that were not reimbursed by insurance (including deductibles, coinsurance, and copayments for covered services plus all costs for services that were not covered). SD: Standard deviation, DMCs: Direct medical costs, CAP: Community-acquired pneumonia, UDS: US dollars, DNMC: Direct non-medical costs

patient age, gender, history of CAP, \pm living place, LOS, and comorbidities are described and compared in Table 5. A positive correlation was found between LOS and total cost of illness, i.e., the longer the LOS and the greater the cost. The mean cost of treatment for patients whose LOS was <7 days, 7–14 days, and more than 14 days was \$325, \$652, and \$1,191, respectively.

DISCUSSION

The current study found that the average age of patients was 66 ± 16 and that a majority of patients (62.0%) were over

65. This figure was, in fact, similar to that in a study recently conducted in Vietnam in which the mean age was 62.5, with patients over 60 accounting for more than half (56.9%).^[22] Another study conducted in Spain in 2007 also obtained similar results, with the mean age being 70 ± 15 , and the incidence of CAP for male patients being higher than that for female patients (58.0% compared to 42.0%).^[5] In a study conducted in Kien An hospital, the number of male patients was higher than that of female patients (65.9% compared to 34.1%), and the number of urban patients was higher than that of rural patients (89.0% compared to 11.0%).^[22] Similar results were also found by Chau *et al.* (55.6% compared to

Table 5: Treatment costs according to patient age, gender, history of CAP, comorbidity, and length of stay (USD 2017; *n*=255)

| Independent variables | Mean±SD (95%CI) ^b | P value ^a |
|--------------------------|------------------------------|----------------------|
| Gender | | |
| Male | 584±319 (466–702) | 0.408 |
| Female | 688±525 (474–902) | |
| Age (years) | | |
| <65 | 607±573 (357–857) | 0.779 |
| ≥65 | 647±298 (542–752) | |
| History of CAP | | |
| Yes | 655±294 (507–803) | 0.762 |
| No | 621±470 (468–774) | |
| Resident | | |
| Urban | 622±418 (502–742) | 0.717 |
| Rural | 713±513 (265–1,161) | |
| ICD-10 ^c code | | |
| J15 | 584±316 (462–705) | 0.284 |
| J15.1; J15.2; J15.6 | 974±299 (635–1,312) | |
| J15.9 | 670±537 (434–905) | |
| J18 | 284±184 (29–538) | |
| Comorbidity | | |
| Pulmonary disease | 578±281 (461–695) | 0.205 |
| Cardiovascular disease | 609±447 (463–755) | |
| Renal disease | 439±169 (249–629) | |
| Diabetes | 495±172 (383–607) | |
| Digestive system disease | 728±543 (511–945) | |
| Cerebrovascular disease | 377±182 (125–629) | |
| Other diseases | 1158±1116 (68–2,248) | |
| Number of comorbidities | | |
| None | 546±263 (315–777) | 0.632 |
| One | 613±439 (365–861) | |
| Two | 666±200 (568–764) | |
| Three | 682±600 (388–976) | |
| Four or more | 200±66 (108–292) | |
| LOS (days) | | |
| <7 | 325±208 (189–461) | <0.01 |
| 7–14 | 652±174 (594–710) | |
| >14 | 1191±857 (553–1,829) | |

^at-test two-sample assuming unequal variances/ANOVA single factor; ^bConfidence interval; ^cInternational Statistical Classification of Diseases and Related Health Problems 10th Revision. CAP, community-acquired pneumonia, LOS: Length of stay, SD: Standard deviation, CI: Confidence intervals, USD: US dollars

44.4%) and Reyes *et al.* (59.4% compared to 40.6%).^[5,23]

In the current study, pulmonary and cardiovascular diseases were the most frequent comorbidities in CAP patients, and this phenomenon was described by Soraya Azmi *et al.*^[4] The current study obtained similar results to those in a study by Reyes *et al.* in which the rate of cardiovascular disease accounted for the highest proportion (32.8%) with regard to comorbidities.^[5] In terms of CAP symptoms, this study showed that cough, shortness of breath, and high fever had the highest rates in all patients - 54.9%, 40.0%, and 38.0%, respectively. This is similar to previous reports for Vietnam, i.e. cough, shortness of breath, and high fever accounted for a high proportion of comorbidities: 65.3%, 51.4%, and 62.3%, respectively.^[22]

Similarly, LOS per episode was estimated in this study to be 10.3 days, which was identical to other results (7–14 days) obtained in Vietnam.^[22] The average LOS in this study was much higher than was previously reported in Malaysia, Indonesia, and the Philippines (6.1–8.6 days) in 2016 and was similar (4–12 days) to that of a study conducted in North America in 2010.^[4,8]

This prospective incidence-based study, conducted from March to May 2017 at Trung Vuong General Hospital, resulted in the successfully calculated treatment cost of CAP. The average social cost of treating one hospitalized patient with CAP was \$628.6 ± \$421.1, which was very similar to results from other studies in the Philippines (\$852–\$2,678)^[12] and lower than those in rural Thailand, where the mean treatment cost ranged between \$490 and \$628.^[24] In Europe, the average treatment cost was much higher. In 2002, the median cost for patients hospitalized with CAP in Spain was estimated to be €1,210, €1,553, or €1,683 (€1,291–€2,471).^[5,25,26] The direct costs were €1,333 in Germany and €2,550–€7,650 in the United Kingdom.^[27,28] The mean treatment cost per episode LOS <7 days (\$325) and >14 days (\$1,191) was lower when compared with the average treatment cost in Singapore, which was \$1,294 for a hospital stay of 6.4 days and \$3,456 for a hospital stay of 10 days.^[11] The current study also found the average direct cost per case to be \$602.60, which was much lower than that for North America (\$3000–\$13,000).^[8] Gender, CAP history, living place, and comorbidities were examined but were not significantly related to the unequal mean treatment cost. A study conducted in Spain yielded similar results where age, gender, and comorbidities were not significantly associated with a high cost for CAP.^[5] The study showed that the mean informal cost per case was \$297 ± \$255.30. There was a difference in informal costs between patients under and over 65 who needed more care, but statistical significance was not reached (*P* = 0.798). The ANOVA single factor test was conducted to distinguish between these groups to determine whether significant differences in cost of treatment existed.

There were several limitations to the current study. First, the sample comprised only adult patients because of the characteristics of the selected hospital; consequently, this

study showed the treatment cost of adults only and lacked the data for fully assessing the economic impact of CAP. A larger and more accurate sample in a future study would allow decision makers to better account for CAP costs, particularly for the poor, when balancing the benefits of introducing a potentially effective CAP vaccine. Second, the study depended on physician decisions regarding the diagnosis of CAP, based on the ICD-10 codes assigned at admission. Misdiagnoses could have caused inaccuracies in sample selection. Finally, the calculation of the unit cost was based on that used in a study by Vo *et al.*, the data in which could have contained some biases, although this was not critical.^[29]

CONCLUSION

This cost-of-care study of adult inpatients suggests that a considerable socioeconomic burden is caused by CAP, which is a preventable disease. To reduce the overall burden of CAP, a pneumococcal vaccine needs to be developed; hence, several vaccine candidates are currently on the market. To perform an analysis of the cost-effectiveness of the potential use of pneumococcal vaccines and other control methods, a more accurate evaluation of CAP and the costs to the public and private sectors in Vietnam for hospitalized and non-hospitalized cases is needed urgently. Such results can be the foundation for formulating investment plans and allocating funds for the treatment and control of this disease.

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Mental Disorders among College Students in Vietnam: Evidence for Improving Coping Strategies

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Abstract

Context: Mental disorders are highly prevalent worldwide, especially among university students. **Aims:** This study therefore aimed to explore the association between various demographic characteristics and depression, anxiety disorder, and stress. **Materials and Methods:** A cross-sectional study was conducted from September 2016 to June 2017 among college students in Southern Vietnam. The depression, anxiety, and stress scales (DASS-21) were used to measure the severity of the core symptoms of depression, anxiety, and stress. **Statistical Analysis Used:** The DASS-21 were used to measure the severity of the core symptoms of depression, anxiety, and stress. Results: There were 965 participants included in this study, with the study population comprising 53.6% of medical students and 46.4% of non-medical students. Based on the study findings, 928 students (96.2%) perceived the symptoms of the three disorders (i.e., depression, anxiety, and stress), while 307 students (31.8%) suffered an extremely severe level of the three disorders. In terms of depression, the participants' study plan ($\chi^2 = 10.284$, $P = 0.001$) and internet usage ($\chi^2 = 6.076$, $P = 0.001$) had a significant effect. For anxiety, the participants' study plan ($\chi^2 = 6.091$, $P = 0.013$) and school year ($\chi^2 = 3.629$, $P = 0.046$) were found to have an association. With regard to stress, the participants' field of study ($\chi^2 = 5.900$, $P = 0.015$), school year ($\chi^2 = 5.102$, $P = 0.013$), study plan ($\chi^2 = 6.776$, $P = 0.009$), and internet usage ($\chi^2 = 11.807$, $P = 0.001$) all proved to be influential. **Conclusions:** Coping strategies for psychological problems are hence recommended to focus on the study plans and internet usage of students.

Key words: Anxiety, Depression, Mental, Stress, Student, Vietnam

INTRODUCTION

Mental health is fundamental to general health, and it is recognized by the World Health Organization (WHO) as “a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community.”^[1] This implies that mental health is paramount to personal well-being and human relationships as well as being related to the development of countries. Unfortunately, common conditions such as depression and anxiety have proved difficult to manage and hence have become one of the largest contributors to global disability and death rates. Depressive disorders are increasingly prevalent worldwide. Indeed, they represented the leading cause of the disease burden for women in high-, middle-, and low-income countries in Africa,

Southeast Asia, and the Eastern Mediterranean in 2014.^[2] In 2013, major depression and anxiety disorders, respectively, ranked second and seventh in the top ten causes of the global burden of diseases.^[3] Further, the WHO's Global Burden of Disease Survey estimated that mental health conditions, including stress-related disorders, will be the second leading cause of disabilities by 2020, before moving into first place by 2030.^[4,5]

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Despite the recognized impacts of depression, anxiety, and stress on various facets of life, the budget allocated for mental health around the world remains disproportionate to the associated burden.^[6] As a result, the WHO has reported that between 76% and 85% of people with severe mental health disorders receive no treatment for their conditions. In Vietnam, per 100,000 residents, there are only 0.68 mental health professionals but 1991.^[7] Mental disorder is related to disability-adjusted life years.^[6] Even more concerning, a large-scale study conducted in the United Kingdom involving 16,460 undergraduate students revealed that at no time during university did the participants' psychological distress falls to pre-admission levels.^[8] In Canada, 88.8% of undergraduate students were found to be feeling generally overwhelmed, while 70% of students in Pakistan reported relating to the symptoms of depression, and numerous statistics from China, Hong Kong, Thailand, and other Asian countries have provided an explicit warning about mental disorders in campus environments.^[9-12] The high estimates regarding the prevalence of mental illness among college students may be due to difficulties in adapting to a new environment, taking responsibility for one's private life, achieving personal targets, and solving problems independently, without family support.^[13-15] A large number of prior studies have demonstrated the relationship between mental health and various sociodemographic factors.^[9,16,17]

It must also be recognized that studying at Vietnamese universities is frequently associated with a high level of pressure, high academic demands, and complex emotional changes during the transition to university.^[18] In addition to transitional difficulties, Vietnamese students may suffer from excessive workloads, fear of academic failure, and challenges stemming from relatives' expectations. Therefore, the WHO has recommended that Vietnam combines psychological health within the primary health-care setting in the interests of internal consistency.^[19] The main practical challenge concerns the fact that it is not possible to apply the available strategies used in developed countries in the Vietnamese context due to differences in culture, clinicians' bias and stereotyping, society service settings, and primary care or social misconceptions, which all have huge impacts on mental health.^[20] Therefore, the present study aimed to (a) estimate the prevalence of depression, anxiety, and stress disorders among undergraduate students in Southern Vietnam, (b) analyze the correlation between various demographics and the level of mental illness, and (c) identify the factor(s) most responsible for each disorder and then orientate effective interventions.

MATERIALS AND METHODS

Study design and target population

This research study was designed as a cross-sectional descriptive analysis of mental disorders among college students in Southern Vietnam. The study was conducted from September 2016 to June 2017.

Data collection

Our sampling procedure was designed based on the depression, anxiety, and stress scales (DASS-21), and it was conducted in a two-stage process using a questionnaire administered online through Kwik Surveys. During the first stage (which was considered to be the test stage), 117 undergraduate students were invited to participate in a test group and help to evaluate the intelligibility of the study instrument's language following translation. Their responses formed the basis for any necessary modifications, and they were used to check the reliability and validity of the questionnaire among undergraduate students. Next, the completed questionnaire was launched online in January 2017 and made available to the public for 1 month. The data collection process was carried out after the examination period so that academic stress would not affect the responses given by the students. All college students were eligible to participate in the study, and participation was entirely voluntary and anonymous. Some 1,137 students submitted responses, although only 965 questionnaires were found to be valid for the purposes of this study. Among the 168 excluded questionnaires, 77 replies were incomplete, nine were duplicates, and 73 were in an incorrect format. One advantage of choosing electronic administration was that the scoring was automated and available for the participants immediately after they submitted their responses.

Instruments

Reliability test

Although the reliability of the DASS-21 has been tested in previous studies, none of those studies involved Vietnamese undergraduate students. In this study, internal consistency was examined for each subscale and then measured using Cronbach's alpha coefficient value. The testing process involving 117 volunteer students demonstrated the following results: Depression (Cronbach's $\alpha = 0.90$), anxiety (Cronbach's $\alpha = 0.84$), stress (Cronbach's $\alpha = 0.80$), and the overall report, which included all the items, (Cronbach's $\alpha = 0.93$). The statistical analysis not only indicated good internal consistency between the questions but also proved that no removal of any question could increase the total Cronbach's value. In other words, every item contributed to the general result so that no adjustment was needed. Such a result was completely consistent with the validation test performed in a previous study in Vietnam.^[21] Based on these high estimates, the questionnaire is considered to be both stable and consistent.

Validity test

To date, there are 45 translations available for public download on the official DASS website, including a Vietnamese version translated by Tung Pham *et al.*^[22] In the present study, a validity test was performed on their translated questionnaire to determine whether the target population is

capable of understanding the items and responding to them in an unbiased way. With the 117 participants in the test group, exploratory factor analyses were carried out to identify the dimensionalities of each scale. As shown in Table 1, each subscale presented only one significant dimension, which means that all seven questions associated with depression only contributed to one single factor (considered to be depressive symptoms) rather than presenting for anything else. Similarly, the seven questions associated with anxiety together support anxiety illness, while the stress-related questions only indicate the stress status. Therefore, no adjustments were needed.

Scoring and interpretation of the DASS-21

The DASS-21 requires the students to rate each item based on the frequency of symptoms experienced over the previous week. There are four point levels, namely, “0” for students who did not experience the symptoms at all, “1” for students to whom the symptoms sometimes applied, “2” for those to whom the symptoms often applied, and “3” for the remaining students to whom the symptoms almost always applied.^[23] Each question was initially coded by the letter D (depression), A (anxiety), or S (stress) to indicate which scale it belongs to. The sum of the scores for the identified questions in each scale was multiplied by two and then compared to the scoring scale to identify the level of disorder. Although the DASS-21 can be used by individuals, the interpretation should be made by an appropriately qualified health professional, for example, a clinical psychologist.

Data analysis

The raw data from the online survey were summarized and analyzed using SPSS software (version 22.0). Based on the scoring scale of the DASS-21, the three levels of normal, mild, and moderate were categorized into the

first group, which was referred to as “absent,” while the two remaining levels (severe and extremely severe) were gathered into a second group referred to as “present.” In this study, descriptive statistics were used to summarize the sociodemographic characteristics and mental health status of the 965 participants. They were expressed in frequencies and percentages. Then, the association between the demographic factors and mental health was investigated using Chi-squared tests. Odds ratio (OR) was calculated to show up the prevalence of sick student in each group. Analytical results with a *P* value or significant value of 0.05 or less were considered to be statistically significant. After estimating the influence level of each factor, all significant items were entered into a logistic regression. The equation used in this analysis will be applied with regard to the mental health prognosis of undergraduate students.

Ethical approval

The study protocol was approved by the University of Medicine and Pharmacy at Ho Chi Minh City.

RESULTS

Sociodemographic characteristics

Table 2 presents the seven investigated demographic characteristics, which consisted of three academic-related items and four habitual items. Among the 965 respondents, there were 517 (53.6%) medical students and 448 (46.4%) non-medical students. Of these, 26.4% were in their 1st and 2nd years of study, while the remaining 73.6% were seniors. With regard to study habits, 494 participants (51.2%) reported that they had a weekly study plan, while the others (48.8%) did not make a plan for the week. The duration

Table 1: Factors' loading values in the validity test of the DASS-21

| Depression (KMO=0.88, significant<0.05, FE=4.35) | | Anxiety (KMO=0.73, significant<0.05, FE=3.56) | | Stress (KMO=0.78, significant<0.05, FE=3.21) | |
|--|-----------|---|-----------|--|-----------|
| Question | FL | Question | FL | Question | FL |
| Q3. No positive feeling | 0.81 | Q2. Dry mouth | 0.55 | Q1. Hard to wind down | 0.63 |
| Q5. No initiative | 0.85 | Q4. Breathing difficulty | 0.70 | Q6. Overreact | 0.74 |
| Q10. Expect nothing | 0.76 | Q7. Trembling | 0.69 | Q8. Nervous energy | 0.66 |
| Q13. Downhearted, blue | 0.73 | Q9. Panic, make fool of self | 0.65 | Q11. Agitated | 0.72 |
| Q16. Unable to become enthusiastic | 0.69 | Q15. Close to panic | 0.81 | Q12. Difficult to relax | 0.74 |
| Q17. Not worth much | 0.87 | Q19. Action of heart | 0.76 | Q14. Intolerant of delays | 0.63 |
| Q21. Life meaningless | 0.79 | Q20. Scared without reason | 0.80 | Q18. Touchy | 0.62 |

FE: Factor's eigenvalue, FL: Factor loading

spent using the internet also differed among the students, with 45.4% using it for 5 h or more daily and 54.6% using it for <5 h per day. The number of students living in a dormitory or shared room was 570, accounting for 59.1% of the sample, while 395 reported living in a house, accounting for 40.9%. According to the statistics presented in Table 2, the difference in proportion between the students who did not have a part-time job ($n = 613$, 63.5%) and those who had a part-time job ($n = 352$, 36.5%) was nearly two-fold. The majority of the 965 participants did not drink beer or wine ($n = 696$, 72.1%), with only 269 students (27.9%) reporting that they drank.

Prevalence of mental illness

Table 3 displays the severity distribution of the investigated mental disorders. The five levels of illness were classified into two groups, namely, “absent” and “present,” so that we could easily distinguish students who suffered obvious illness symptoms from others exhibiting vivid signals. Unfortunately, more than 90% of participants expressed symptoms associated with all three disorders, and most of them were at the severe or extremely severe level. More specifically, some 98.6%, 99.4%, and 96.9% of students, respectively, perceived the symptoms of stress, anxiety disorder, and depression. In particular, the number of students suffering an

extremely severe level of anxiety disorder was significantly high ($n = 827$), accounting for some 85.7% of the sample. In addition, the high mean scores for the three mental illnesses represented strong evidence of the poor state of mental health within the university environment.

Independent association between the demographic characteristics and each mental health disorder

Table 4 clearly displays the impact of the demographic characteristics on the students’ mental health. With regard to depression, there were two significant associations observed between the level of the illness’s presence and demographic factors. The first demographic factor was the students’ study plan ($P = 0.001$, $\chi^2 = 10.284$), while the second was the duration time of spent using the internet ($P = 0.014$, $\chi^2 = 6.076$). In more detail, the ratio between depression being perceived and depression not being perceived was 75.9 (98.7/1.3) among the students who did not have a weekly study plan and 19.4 (95.1/4.9) among the students who made a plan for the week. As a result, the OR was 3.9 (obtained by dividing 75.9 by 19.4), which showed that the risk of developing depressive disorder in students without weekly study plans was 4 times higher than that for students with weekly plans. By means of similar calculations, the OR between students using the internet for more than 5 h and students using the internet for <5 h was 2.8, which indicated that depression appeared more frequently in students who spent more time on the internet. The five remaining personal characteristics were found to have no association with mental health.

Table 2: Sociodemographic characteristics of the students ($n=965$, n [%])

| Characteristic | Value (%) |
|--|------------|
| Field of study | |
| Medical student | 517 (53.6) |
| Non-medical student | 448 (46.4) |
| School year | |
| 1 st and 2 nd year | 255 (26.4) |
| Other years | 710 (73.6) |
| Study plan | |
| Weekly plan | 494 (51.2) |
| Monthly annual or no plan | 471 (48.8) |
| Internet usage (hours per day) | |
| <5 | 527 (54.6) |
| ≥5 | 438 (45.4) |
| Living place | |
| House | 395 (40.9) |
| Shared room or dormitory | 570 (59.1) |
| Part-time work | |
| Yes | 352 (36.5) |
| No | 613 (63.5) |
| Drinking beer | |
| Yes | 269 (27.9) |
| No | 696 (72.1) |

When repeating the analysis in terms of stress, the strong correlation between the prevalence of the presence of illness and four demographic factors, namely, the study plan ($P = 0.009$, $\chi^2 = 6.776$) (χ^2 : Chi-square), internet usage ($P = 0.001$, $\chi^2 = 11.807$), field of study ($P = 0.015$, $\chi^2 = 5.900$), and school year ($P = 0.027$, $\chi^2 = 5.102$) was noted. In particular, all the students who used the internet for more than 5 h per day and all the 1st or 2nd year students presented with symptoms of stress disorder. Among the two groups, the χ^2 values were calculated using Fisher’s exact two-tailed test. Both the two OR values of perceived stress between the non-medical students and medical students and between the students with weekly plans and those without weekly plans were considerably high (5.3 and 5.8, respectively). These numbers convincingly indicated a more severe risk of suffering stress among the respondents who were non-medical, junior, did not have a weekly study plan and used the internet for more than 5 h daily. The other individual factors appeared to not be relevant to psychological disorders. Finally, considering anxiety, only one sociodemographic factor proved to be statistically significantly associated with the prevalence of the presence of illness. That factor was the study plan, with $\chi^2 = 6.091$, $P = 0.021$, and OR = 8.7.

In brief, the demographic factors seen to influence the students’ psychiatric health were study plans (impact on three

Table 3: Severity levels of the stress, anxiety, and depression scores ($n=965$, n [%])

| Severity level | Stress | Anxiety | Depression |
|------------------------|----------------|------------------|----------------|
| | Value (%) | Value (%) | Value (%) |
| Absent | 14 (1.4) | 10 (1.0) | 30 (3.1) |
| Normal | 7 (0.7) | 4 (0.4) | 30 (3.1) |
| Mild | 7 (0.7) | 6 (0.6) | 0 (0.0) |
| Present | 951 (98.6) | 955 (99.4) | 935 (96.9) |
| Moderate | 77 (8.0) | 17 (1.8) | 204 (21.1) |
| Severe | 353 (36.6) | 111 (11.5) | 303 (31.4) |
| Extremely severe | 521 (54.0) | 827 (85.7) | 428 (44.4) |
| Mean score (\pm SD) | 16.8 (3.4) | 13.5 (3.8) | 13.6 (4.7) |
| Level of mean score | Severe or more | Extremely severe | Severe or more |

Table 4: Impact of sociodemographic characteristics on mental disorders

| Variable | Depression | | | | Anxiety | | | | Stress | | | |
|--------------------------------|-----------------|----------------|-----------|-------|-----------------|----------------|-----------|-------|-----------------|----------------|-----------|-------|
| | Present n (%) | Absent n (%) | P value | OR** | Present n (%) | Absent n (%) | P value | OR** | Present n (%) | Absent n (%) | P value | OR** |
| Field of study | | | | | | | | | | | | |
| Medical students | 496 (95.9) | 21 (4.1) | 0.067 | 2.065 | 509 (98.5) | 8 (1.5) | 0.117 | 3.505 | 505 (97.7) | 12 (2.3) | 0.015 | 5.299 |
| Non-medical students | 448 (98.0) | 9 (2.0) | | | 446 (99.6) | 2 (0.4) | | | 446 (99.6) | 2 (0.4) | | |
| School year | | | | | | | | | | | | |
| First and second year | 251 (98.4) | 4 (1.6) | 0.099 | 0.419 | 255 (100) | 0 (0.0) | 0.071 | | 255 (100.0) | 0 (0.0) | 0.027 | |
| Other years | 684 (96.3) | 26 (3.7) | | | 700 (98.6) | 10 (1.4) | | | 696 (98.0) | 14 (2.0) | | |
| Study plan | | | | | | | | | | | | |
| Weekly plan | 470 (95.1) | 24 (4.9) | 0.001 | 3.957 | 485 (98.2) | 9 (1.8) | 0.021 | 8.722 | 482 (97.6) | 12 (2.4) | 0.009 | 5.838 |
| Monthly or annual plan | 465 (98.7) | 6 (1.3) | | | 470 (99.8) | 1 (0.2) | | | 469 (99.6) | 2 (0.4) | | |
| Living place | | | | | | | | | | | | |
| House | 282 (97.9) | 6 (2.1) | 0.231 | 0.579 | 286 (99.3) | 2 (0.7) | 0.732 | 0.585 | 286 (99.3) | 2 (0.7) | 0.251 | 0.388 |
| Shared room or dormitory | 653 (96.5) | 24 (3.5) | | | 669 (98.8) | 8 (1.2) | | | 665 (98.2) | 12 (1.8) | | |
| Part-time work | | | | | | | | | | | | |
| Yes | 337 (95.7) | 15 (4.3) | 0.118 | 1.774 | 347 (98.6) | 5 (1.4) | 0.510 | 1.752 | 345 (98.0) | 7 (2.0) | 0.290 | 1.757 |
| No | 598 (97.6) | 15 (2.4) | | | 608 (99.2) | 5 (0.8) | | | 606 (98.9) | 7 (1.1) | | |
| Drinking beer or wine | | | | | | | | | | | | |
| Yes | 264 (98.1) | 5 (1.9) | 0.164 | 0.508 | 267 (99.3) | 2 (0.7) | 0.735 | 0.644 | 266 (98.9) | 3 (1.1) | 0.768 | 0.702 |
| No | 671 (96.4) | 25 (3.6) | | | 688 (98.9) | 8 (1.1) | | | 685 (98.4) | 11 (1.6) | | |
| Internet usage (hours per day) | | | | | | | | | | | | |
| 5 | 504 (95.6) | 23 (4.4) | 0.014 | 2.809 | 519 (98.5) | 8 (1.5) | 0.123 | 3.356 | 513 (97.3) | 14 (2.7) | 0.001 | |
| ≥ 5 | 431 (98.4) | 7 (1.6) | | | 436 (99.5) | 2 (0.5) | | | 438 (100.0) | 0 (0.0) | | |

P^* : Fisher's exact two-tailed test, $**OR = \frac{P_{\text{present2}}}{P_{\text{absent2}}} \div \frac{P_{\text{present1}}}{P_{\text{absent1}}}$

disorders), internet usage (impact on depression and stress), and field of study and school year (impact on stress), whereas

the remaining factors did not have an impact on the students' mental status.

Combination of remarkable factors

It became clear that individual variables were separately associated with each disorder, which meant that we continued to investigate the relationship between the four identified characteristics and the prevalence of developing the three disorders at an extremely severe level. According to the statistics, some 521 students (54.0%) suffered extremely severe stress. Further, 497 of the 521 (95.4%) had extreme anxiety disorder and 307 of the 497 (61.8%) had extremely severe depression. Consequently, among the 965 undergraduate participants in this study, 307 students (31.8%) suffered from three extremely severe disorders. Such a poor health status was found to be significantly associated with the students' study plans ($\chi^2 = 9.388$, $P = 0.002$), school year ($\chi^2 = 11.758$, $P = 0.001$), and internet usage ($\chi^2 = 12.687$, $P = 0.000$), as shown in Table 5. Finally, these three variables were entered into a logistic regression model to establish a predictive equation. The study-related variables, namely, school year ($P = 0.001$), study plan ($P = 0.016$), and internet usage ($P = 0.002$) were found to be independent risk factors for the investigated outcome. The equation can be given as follows:

$$\ln\left(\frac{p}{1-p}\right) = 0.507 - 0.514 \times \text{School year} + 0.343 \times \text{Study plan} + 0.442 \times \text{Internet usage}$$

Where P is the probability of not suffering from the three mental health disorders at an extremely severe level [Table 6].

DISCUSSION

The unequal distribution of mental disorders

The prevalence of stress, anxiety, and depression symptoms among college students in Vietnam was found to be more than 90%. This result is much higher than the results found in other countries. In fact, the percentage of participants in previous health surveys found to be suffering from mental illness symptoms is unequal between continents, ranging from 20% among the America to 40% in Europe and 70% in Asia. More specifically, the lowest identified percentage was 25% in the United States and Canada,^[24] which increased to 43% in Central and Eastern European^[25] and finally rose to 70% in Pakistan.^[9] This uneven occurrence of mental illness might be explained by the different distributions of resources between regions. According to the WHO report, the budget for mental health in Southeast Asia was 66.7%, compared to 92.6% in the America and 80% in the Eastern Mediterranean. The availability of treatment facilities for severe mental disorders in the primary care system of Southeast Asia was 44%, which was the lowest level of availability seen worldwide, being much lower than the primary care sources available in the America (66.7%) and Europe (65.3%).^[26] In addition, one remarkable point

concerns the fact that the data utilized in this study were mainly collected from students in Ho Chi Minh City, one of the most competitive and populous cities in Vietnam, which suggests that the prevalence of depression was found to be higher than in other areas. Indeed, previous reports have presented concerning statistics about the mental health of students in Ho Chi Minh City, for example, 73.1% of students were found to suffer from mental disorders due to stringent study programs, while 69.2% blamed their mental disorders on examination preparations.^[27]

Understanding the significant associations of stress, anxiety, and depression

Many types of stressors can contribute to the disordered state of individual students, including economic conditions, sociodemographic characteristics such as age, gender, marriage status, and social network, as well as academic factors such as school year, examinations, point average, and competitive rate in skills training.^[28] However, university-related causes are more likely to adjust and eventually offer support for students. In this study, the higher rate of mental disorder found to exist among 1st- and 2nd-year students could be explained by various changes and unpredictable occurrences during the initial period of life as an undergraduate student. Adaptation processes take place when students enter university living accommodation, encounter financial difficulties, and separate from familial support, all of which mean taking responsibility for their own decisions.^[29] Such external pressures can subject freshmen to mental strain or even cause severe damage to students' spiritual life. Based on prior studies, time management among students is particularly poor; therefore, using weekly plans is believed to help construct good study habits for students and support them in diminishing stress and anxiety.^[30] Moreover, the association between study plans and mental disorders is consistent between this study and a previous study conducted in Vietnam, which illustrated the important impact of study plans on students over a 6-year period.^[19] Finally, the duration of internet usage also exhibited a significant relation to psychological health. Students who use the internet for more than 5 h per day have a higher risk of becoming internet dependent or even additive internet users. Many prior studies have shown that excessive use of the internet will reduce the time spent with family, friends, and face-to-face appointments, which narrows both one's social network and communication.^[31] As a result, a disruption to normal life might occur and cause depressive disorder or interpersonal sensitivity, which decreases one's ability to control life. The three remarkable mental disorders frequently observed among college students are depression, anxiety, and stress.^[32] Hence, it is clear that the duration of internet usage is significantly associated with the prevalence of such mental disorders.

Pressure among fields of study

Many prior studies have presented results indicating that medical students experience more pressure than other

Table 5: Associations between the demographic factors and the rate of developing three extremely severe disorders (*n*=386)

| Variable | Present <i>n</i> (%) | Absent <i>n</i> (%) | χ^2 value | <i>P</i> value |
|--|----------------------|---------------------|----------------|----------------|
| Field of study | | | | |
| Medical students | 160 (30.9) | 357 (69.1) | 0.385 | 0.535 |
| Non-medical students | 147 (32.8) | 301 (67.2) | | |
| School year | | | | |
| 1 st and 2 nd year | 103 (40.4) | 152 (59.6) | 11.758 | 0.001 |
| Other years | 204 (28.7) | 506 (71.3) | | |
| Study plan | | | | |
| Weekly plan | 135 (27.3) | 359 (72.7) | 9.388 | 0.002 |
| Monthly or annual plan | 172 (36.5) | 299 (63.5) | | |
| Internet usage (hours per day) | | | | |
| <5 | 142 (26.9) | 385 (73.1) | 12.687 | 0.000 |
| ≥5 h daily | 165 (37.7) | 273 (62.3) | | |

Table 6: Logistic regression analysis (*n*=386)

| Variables | B | <i>P</i> value | Adjusted OR | 95% Confidence interval |
|----------------|--------|----------------|-------------|-------------------------|
| School year | -0.514 | 0.001 | 0.598 | 0.442–0.808 |
| Study plan | 0.343 | 0.016 | 1.409 | 1.066–1.862 |
| Internet usage | 0.442 | 0.002 | 1.556 | 1.178–2.056 |
| Constant | 0.507 | 0.000 | | |

students. This is because of the large amount of information input and pressure directly related to human life.^[24,33] Moreover, a lack of social network relationships and the high risk of debt after graduation represent significant worries for numerous medical students, especially those who have a humble financial status.^[34] In Spain, the prevalence of medical students suffering from emotional disturbances was 30%, which was higher than that found for other fields of study.^[35] On the contrary, this research study found no differences in terms of experiencing mental disorders between medical students and students in other fields. Such a result could be explained by the fact that the level of academic pressure was unequal among colleges in the same field, which meant that students studying for the same major might suffer different levels of stress and anxiety. In addition, the health-care provision in private universities has more resources and exhibits more concern than that in public colleges, which provides students with more convenient and effective access to primary health treatment. As a result, the data collected from both types of colleges eliminated all the differences among the different fields of the study.

Role of the logistic regression model

In this study, both the dependent variables (prevalence of perceiving stress, anxiety, and depression) and three independent variables (school year, study plan, and internet

usage) were identified as binary categorical variables. They were entered into a logistic regression analysis and then used to estimate the probability of a binary response based on the presence of certain factors. In addition, logistic regression was also regarded as a tool for establishing a predictive equation.^[36,37] In this study, the predictors (school year, study plan, and internet usage) only had two values, “0” and “1,” which represent the two groups of predictors. In terms of the school year, “1” was used for 1st- and 2nd-year participants and “0” for the others. Concerning the study plan, “1” inferred that the students had weekly plans, while “0” indicated the others. Likewise, students who used the internet for <5 h daily were regarded as “1,” whereas “0” was used for the others. The predictive equation offered a percentage of correct answers of approximately 70%; therefore, health-care workers can use it to estimate the risk of mental illness among students. For instance, if a student is in the 1st year (school year = 1), does not have a weekly study plan (study plan = 0), and uses the internet for more than 5 h daily (internet usage = 0), the probability of suffering three extremely severe illnesses (1-p) is 50.2%. However, if that student is in the final year (school year = 0), has a weekly study plan (study plan = 1), and uses the internet for <5 h daily (internet usage = 1), then the probability of suffering three extremely severe illnesses (1-p) is 21.6%. In this way, the predictive equation can support careers counselors or lecturers in achieving an early diagnosis as well as assist in the primary risk estimation of students’ mental illness.

LIMITATIONS

This study had a number of limitations. First, the data collection process was launched online and lasted for only 1 month, which meant that this study could not reach all colleges students. It also resulted in some challenges when verifying information provided by the participants. Second, the study concentrated on just seven demographic characteristics, consisting of both academic factors and habitual elements; hence, the predictive equation is not totally accurate.

CONCLUSION

The prevalence of college students in Vietnam who suffer from mental disorders was found to be approximately 90%. Such an alarming finding strongly indicates an urgent need for the implementation of an intensified and enhanced psychological management program. The school year, study plan, and duration of internet usage were all significantly associated with stress, anxiety, and depression. Hence, these three factors need to be thoroughly considered during the initial diagnostic process. The recommended means of avoiding poor mental health status are making weekly study plans, limiting the amount of time spent on the internet, and confiding in friends, family, or counselors about any challenges faced.

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Pharmacy Students' Perceptions of Generic Medicines in Southern Vietnam

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Abstract

Context: Various studies concerning the knowledge of pharmacy students regarding generic medicines have been conducted worldwide although this issue has not previously been investigated in Vietnam. **Aims:** The present study therefore aims to assess the knowledge of pharmacy students regarding generic medicines in Southern Vietnam. **Materials and Methods:** A cross-sectional survey study was conducted between January and April 2017. A total of 608 undergraduate pharmacy students from various universities in Southern Vietnam were questioned using a 22-item questionnaire. **Statistical Analysis used:** The Chi-square, t-test, and analysis of variance were manipulated to calculate the association between the study variables. **Results:** Some 800 forms were initially distributed, which led to an effective response rate of 76.0% when 608 forms were returned by 306 students from private universities and 302 students from public universities. The numbers of participants who had previously heard of the brand name and generic medicines were 93.3% and 90.6%, respectively. The major sources of students' knowledge included textbooks (72.7%) and lectures (82.6%). Almost 90% of students exhibited the ability to distinguish generic and brand name medicines. Of the ten questions investigating participants' knowledge of generic medicines, the average score of the 608 students was 5.19 ± 2.43 . In this regard, the public university students scored higher with 5.65 ± 2.61 than the private students with 4.73 ± 2.15 ($t = -4.770$, $P < 0.001$). **Conclusions:** In general, the lack of awareness among pharmacy students varied between universities so that both the education system and the government should pay a greater attention to the education of future pharmacists.

Key words: Generic, knowledge, perception, pharmacy, students, Vietnam

INTRODUCTION

Medicine is an important product that serves to reduce morbidity and mortality as well as improve quality of life although only one-third of the global population can access adequate medical care. More than half of the population of certain developing countries in Asia and Africa has no access to essential medicines.^[1] Yet, generic medicines appear to offer the potential to overcome the biggest barrier to access to medical care, that is, the price of drugs.^[2]

The World Health Organization defines a generic product as a pharmaceutical product that has the same utility as an innovative product but is produced without a license from the company that created it following the expiration of the patent.^[3] The price of generic medicine is cheaper than that of brand name drugs. For instance, the Congressional Budget Office (CBO) has found that generic medicines are 75%

cheaper than brand name medicines, and hence, they saved 93 billion US dollars for the health-care system in 2010.^[4] A research program of the CBO conducted with senior citizens with disabilities showed that the cost for medical plans or the pharmacies will be reduced by about 55% if generic medicines are used instead of the brand name medicines.^[4] The savings made on the use of generic medicines can help the government to focus its financial resources on developing new services for patients as an urgent goal.^[5]

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Pharmacists now play a very important role in reducing medical expenses since it has been found that patients more commonly attend pharmacies (at a rate of 42%) than hospitals and clinics in Malaysia.^[6] In Australia, Hassali *et al.* noted that brand-name drugs on prescription can be substituted for generic medicines following advice from the pharmacist and assurances of efficacy.^[7,8] Another study by Hassali *et al.* conducted in eight countries (the US, United Kingdom, Finland, Sweden, Australia, Japan, Malaysia, and Thailand) in 2013, as well as the study by Babar *et al.* conducted in Malaysia in 2010, suggest that pharmacists are generally in favor of promoting the use of generic medicines to their clients.^[9,10]

One reason for this lack of knowledge on the part of doctors could be the limited scope of college programs concerning the concept of generic medicines, which may need to be supplemented by additional education to enhance the future use of generic medicines.^[11] Both pharmacists and doctors acknowledge that there is insufficient knowledge about the quality, safety, and efficacy of generic medicines.^[12,13] A study conducted in Bangladesh found that students' perspectives with regard to generic medicines were moderate (63.29%), while there was a difference between the perspectives of medical students and pharmacists, with about 85% of students having heard of the concept of generic and brand name drugs.^[14] Pharmacy students are the practitioners of the future, and their knowledge and perspectives will thus play an important role in promoting the use of high-quality medications.^[15] Othman and Abdulghani (2015) found that more than 70% of students believed that the generic medicine was lower quality and less effective than the brand-name medicine. That results needed for distinctiveness and prevention pre-registrants to contribute inappropriately to generic medicine use.^[16]

To determine the extent to which future practitioners are aware of generic prescriptions and generic substitutes, and in light of the fact that studies on the impact of pharmacy students on the use of generic medicines in Vietnam are limited, the current study aims to assess the knowledge and perspectives of pharmacy students in Southern Vietnam regarding generic medicines.

MATERIALS AND METHODS

Study design and study sample

This cross-sectional survey study was conducted with sophomore to senior students attending various universities between February and April 2017. The study sample was achieved through convenience sampling. The University of Medicine and Pharmacy at Ho Chi Minh City and Can Tho University of Medicine and Pharmacy are two public universities with full facilities and experienced teachers to train pharmacists, with their numbers of students per year

being about 300 and 150, respectively. In contrast, Hong Bang International University and Nguyen Tat Thanh University are two private universities that in recent years have trained larger number of pharmacists (400 and 950 students per year, respectively).

This study used the Raosoft online tool to determine the sample size.^[17] The estimated enrolment for the relevant university courses was approximately 5450 students (which was calculated according to the average indicator training multiplied by the number of years of relevant training). The minimum sample size for the study was 359, which was estimated using an online sample size calculator (Raosoft) with a confidence level of 95% and 5% margin of error. However, a larger sample size was then obtained by doubling the result of the formula and eliminating the sampling error. The total response rate was 81.5% ($n = 652$) after 800 questionnaires had been distributed and voluntarily completed by the students. After excluding the inadequate forms, 608 questionnaires were selected for the final analysis, which gave an effective response rate of 76.0%. The information obtained from the survey was secure in terms of the participants' privacy and confidentiality.

Data collection

A 22-item questionnaire based on that used in the study by Siam *et al.* was reviewed and modified so as to match the conditions in Vietnam to achieve the objectives of the present study.^[14] The questionnaire was validated with a sample of 30 randomly selected students. The feedback received from those students helped to adjust the questionnaire before the survey being conducted. To ensure the consistency of the questions, a confidence scale was applied. Indeed, Cronbach's alpha value for this research tool was 0.806, while the KMO (Kaiser-Meyer-Olkin) was 0.673.

The questionnaire consists of three main parts. The first part contains questions intended to elicit general information about the students, including their age, gender, and university, while four questions were added to this part to assess the students' knowledge of generic medicines. The first question sought to determine whether the students have ever worked in a pharmacy or hospital. The next two questions used "yes" or "no" options to ask if the students had previously heard about generic or brand name drugs. The final question sought to understand the source(s) of the students' information about brand-name and generic medicines. The four questions that comprise part two of the questionnaire are related to the students' knowledge about generic and brand name drugs and how they distinguish between these two types of drugs. The ten questions in the final section use a five-point Likert scale (5= strongly agree to 1= strongly disagree) to evaluate the students' perceptions of generic medicines.

Data analysis

The collected data were imported into Microsoft Excel for Windows® version 2016. The data were then sorted, grouped, and extracted into the SPSS® version 20.0 (SPSS Inc., Chicago, IL) package to create descriptive statistics. A descriptive statistical analysis, including the frequency and percentage, was used to describe the general information concerning the participating students. Non-parametric statistics (Chi-square) were used to examine the variables reflected in the general information. The data were checked for standard deviations, and the *t*-test and analysis of variance (ANOVA) were used to examine the relationship between the cognitive points and factors. All statistical analyses in this study were set at a 95% confidence level or a $P < 0.05$.

Ethical approval

Ethical approval for this study was received from the University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam. Participation in the study was entirely voluntary, and all collected information was anonymous and used only for research purposes.

RESULTS

General information concerning participants

A total of 608 questionnaires were analyzed in this study (the effective response rate was 76% after 800 forms had been distributed).

Among the students who completed the questionnaire, 302 students from public universities (University of Medicine and Pharmacy at Ho Chi Minh City and Can Tho University of Medicine and Pharmacy) and 306 students from private universities (Hong Bang International University and Nguyen Tat Thanh University) were participated. The percentage of female students who participated in the study is higher than that of the male participants ($n = 383$, 63.0%). The average age of the students was 22.0 ± 2.04 years old. More than two-thirds of students had not undertaken work experience or medicine contact at pharmacies. However, in terms of the students participating in the study who had previously heard about generic medicine and branded medicine, there were very high rates of 93.4% and 90.6%, respectively. The public university students had often received more information about these two types of drugs than the private university students. Table 1 details the general characteristics of the participants.

Knowledge of generic and brand-name medications

The participants' general knowledge regarding the two kinds of medicine is illustrated in Table 2. Generic medicines were

understood by the students to be those medicines produced and distributed without a license ($n = 557$, 91.6%) and those produced by domestic pharmaceutical companies ($n = 541$, 89.0%). Branded medicines were understood to be developed and manufactured by a company that holds the protected copyright ($n = 548$, 90.1%) as well as produced by multinational companies ($n = 532$, 87.5%).

The results of the knowledge survey concerning branded and generic medicines are displayed in Table 3. Nearly two-thirds of participants agreed that generic medicines are bioequivalent to brand-name medicines. More than two-thirds of participants believed that generic and innovator brand products are available in the same dosage form. The number of participants who agreed and disagreed that brand-name drugs are safer than generic medicines was similar at 41.2% and 41.1%, respectively. Approximately 41.8% of students disagreed that the drugs produced by multinational companies are more reliable than those manufactured by the national firms, while about 62.9% of participants expressed that generic medicine is of lower quality than branded medicine. The participants generally disagreed with the idea that generic medicines have more side effects than branded medications.

To quantify the participants' understanding, the scoring of the responses was performed with the mean score being 5.19 ± 2.43 Table 4. A statistical analysis was performed using the *t*-test and ANOVA to detect differences in the subgroup of domains (i.e. university, gender, academic year, work experience, and age). The perceptions of the public universities students were higher than those of the private universities, which was found to be statistically significant ($t = -4.77$, $P < 0.001$).

DISCUSSION

To the best of our knowledge, the current study is the first to evaluate pharmacy students' perceptions in Vietnam. A high proportion of students in Vietnam have heard of the definition of generic and branded medication, which could be explained by the main sources of information (70–80%) that Vietnamese students learn from being textbooks and lectures. This result indicates that Vietnamese education focuses on this issue, which correlates well with the findings of a previous study conducted in Bangladesh. Students attending both public (85.7%) and private (77.4%) universities agreed with the notion that generic medicines are less expensive than brand-name medicines and hence that they help to reduce the cost of treatment. Similar results have been reported in studies conducted in Afghanistan (71.4%), Bangladesh (75.7%), and Pakistan (79.7%) for students in the medical field.^[14,19,20] This result can be explained by the concern of policymakers regarding the content of education programs and the fact that generic drugs are important in terms of reducing medical costs.

Table 1: Participants' demographics and general knowledge about generic medications (n=608, n [%])

| Variable | Public universities ^a (n=302) | Private universities ^b (n=306) | Total (n=608) | P ^c |
|---|--|---|---------------|----------------|
| Age | | | | |
| 19–21 | 61 (20.2) | 226 (73.9) | 327 (53.8) | P<0.001 |
| 22–23 | 194 (64.2) | 18 (5.9) | 212 (34.9) | |
| ≥24 | 47 (15.6) | 22 (7.2) | 69 (11.3) | |
| Mean±SD | 21.8±1.39 | 22.16±2.45 | 22.0±2.04 | |
| Gender | | | | |
| Male | 126 (41.7) | 99 (32.4) | 225 (37.0) | P<0.001 |
| Female | 176 (58.3) | 207 (67.6) | 383 (63.0) | |
| Work experience in hospital or community pharmacy/job experience? | | | | |
| Yes | 109 (36.1) | 79 (25.8) | 188 (30.9) | P<0.001 |
| No | 193 (63.6) | 227 (74.2) | 420 (69.1) | |
| Have you ever heard of generic medicine? | | | | |
| Yes | 289 (95.7) | 278 (90.8) | 568 (93.4) | P<0.001 |
| No | 13 (4.3) | 27 (8.8) | 40 (6.6) | |
| Have you ever heard of branded medicine? | | | | |
| Yes | 290 (96.0) | 261 (85.3) | 551 (90.6) | P<0.001 |
| No | 12 (4.0) | 45 (14.7) | 57 (9.4) | |
| Academic year | | | | |
| 2 nd year | 52 (17.2) | 22 (7.2) | 74 (12.2) | P<0.001 |
| 3 rd year | 104 (34.4) | 271 (88.6) | 375 (61.7) | |
| 4 th year | 74 (24.5) | 13 (4.3) | 87 (14.3) | |
| 5 th year | 72 (23.8) | 0 (0.0) | 72 (11.8) | |
| Source of knowledge | | | | |
| Textbook | 246 (81.5) | 196 (64.1) | 442 (72.7) | P<0.001 |
| Newspaper | 101 (33.4) | 61 (19.9) | 162 (26.6) | |
| Lecturer | 245 (81.1) | 257 (84.0) | 502 (82.6) | |
| Visit to hospitals/clinics | 63 (20.9) | 31 (10.1) | 94 (15.5) | |

^aUniversity of Medicine and Pharmacy at Ho Chi Minh City and Can Tho University of Medicine and Pharmacy, ^bHong Bang International University and Nguyen Tat Thanh University in Ho Chi Minh city, ^cStatistics with the average value and actual value determined using Chi-square test. SD: Standard deviation

The results of this study showed that public university students agreed that generic medicines are bioequivalent and therapeutically equivalent to brand-name drugs by a proportion of 72.2% and 53.3%, respectively, while the figures were 65.3% and 56.1%, respectively, with private university students. However, when asked about the safety, quality, and side effects of generic medicines, the results differed. For the public university students, some 73.6% did not believe or understand that generic medicines are less safe than brand-name drugs. About half of the students considered that generic medicines are of lower quality and have more side effects than the innovator branded product. For the public university students, the results were better, being 58.9%, 30.1%, and 47.7%, respectively. A weak understanding of

bioequivalence and therapeutic equivalence may be associated with negative beliefs regarding generic medicines. This result was found in a study conducted in Afghanistan, where in half of the participants were concerned about the quality, safety, and efficacy of the drugs.^[19] In Australia, a study found that generic medicines were considered to be lower in quality and less effective,^[11] while in New Zealand, 65% of participants felt that innovator branded products are of higher quality than generic products.^[9] In India, there is a widespread distrust of the quality control practiced by manufacturers of generic drugs.^[21] In contrast, the results of a study conducted in the United States found that 68% of participants believed in the safety of the drug.^[22] However, it has been suggested to be common knowledge that generic drugs are of weak quality.^[23]

Table 2: Participants' views about the definitions of generic and branded medication

| Statements about generic and branded medicines | Group | Public universities (n=302, %) | Private universities (n=306, %) | Total (n=608, %) |
|---|-------|-----------------------------------|------------------------------------|---------------------|
| A drug that is produced and distributed without patent protection. The generic drug may still have a patent on the formulation but not on the active ingredients | (i) | 292 (96.7) | 265 (87.7) | 557 (91.6) |
| | (ii) | 10 (3.3) | 41 (13.6) | 51 (8.4) |
| A drug that is the property of the company that manufactures it through research and development and markets it under a patent. No other companies are allowed to produce it until the patent expires | (i) | 16 (5.3) | 44 (14.6) | 60 (9.9) |
| | (ii) | 286 (94.7) | 262 (86.8) | 548 (90.1) |
| Drugs manufactured by local/national pharmaceutical firms are | (i) | 283 (93.7) | 258 (85.4) | 541 (89.0) |
| | (ii) | 19 (6.3) | 48 (15.9) | 67 (11.0) |
| Drugs manufactured by multinational firms under propriety rights are | (i) | 25 (8.3) | 51 (16.9) | 76 (12.5) |
| | (ii) | 277 (91.7) | 255 (84.4) | 532 (87.5) |

(i): Generic medication, (ii): Branded medication

A majority of students from both public and private universities (78.2% - 88.7%) like using generic medicines due to the reduction in the cost of treatment. These results are in agreement with those obtained in research reports from Bangladesh (75.6%), Afghanistan (98.0%), and Pakistan (50.5%).^[14,19,20] Bertoldi *et al.* and Hassali *et al.* found that the majority of participants considered that the affordability of treatment could be improved and reductions in family expenses made if generic medicines were used because they cost less.^[24,25]

Future pharmacists also misunderstand the safety standards associated with the generic products. Some 60.5% of public university students and 70.4% of private university students did not know or understand that generic drugs have higher safety standards. In Bangladesh and Yemen, this rate was found to be 86.4% and 81%, respectively.^[14,16] Due to safety concerns, students tend to prefer brand name drugs over generic drugs when treating life-threatening conditions (45.7% and 64% for public university students and private university students, respectively). The participants' responses may be the result of limitations in the scope and explanation of bioequivalence for generic medicines in the current pharmacy curricula. Therefore, policymakers should pay more attention to the content of education as well as the reception of student knowledge.

The mean scores among the groups showed the public university students to exhibit better perceptions (5.65 ± 2.61) than the private university students (4.72 ± 2.15). This is most likely due to different teaching styles in each

university, which can be attributed to the highly qualified and experienced teaching staff employed in public universities. Contrary to expectations, this study did not find a significant difference between gender and job experience; however, the observed differences between university, academic year, work experience, and group age in this study were significant. The present results are consistent with those of Siam *et al.*, who found that gender did not significantly influence students' perceptions.^[14]

The current research is limited because the data are collected from only certain universities in the south of Vietnam. In addition, the research did not evaluate the factors that influence the perceptions of generic medicines or the impact of current educational programs. Future research studies should therefore be conducted nationwide and further assess the impact of students' perceptions.

CONCLUSION

Research concerning future pharmacists has demonstrated a lack of knowledge among such students, particularly those attending private universities, in relation to the use of generic medications. Although the concept of bioequivalence is known by many students, the number of students who correctly understand the concept remains low. This issue should hence be addressed by pharmacy educators to enhance the knowledge and confidence of students regarding generic medicines.

Table 3: Participants' perceptions of generic medications

| Statement | Public universities (n=302, %) | | | | | Private universities (n=306, %) | | | | | Total (n=608, %) | | | | |
|---|--------------------------------|---------------|--------------|---------------|---------------|---------------------------------|---------------|--------------|---------------|--------------|------------------|---------------|---------------|---------------|---------------|
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| A generic medicine is bioequivalent to a brand name medicine | 14 (4.6) | 48 (15.9) | 22 (7.3) | 138 (45.7) | 80 (26.5) | 18 (5.9) | 57 (18.6) | 52 (17.0) | 145 (47.4) | 34 (11.1) | 32 (5.3) | 105 (17.3) | 74 (12.2) | 283 (46.5) | 114 (18.8) |
| Generic types of a particular medicine are therapeutically equivalent to the innovator branded product | 13 (4.3) | 76 (25.2) | 52 (17.2) | 114 (37.7) | 47 (15.6) | 13 (4.2) | 74 (24.2) | 39 (12.7) | 159 (52.0) | 21 (6.9) | 26 (4.3) | 150 (24.7) | 91 (15.0) | 273 (44.9) | 68 (11.2) |
| Branded medicines are safer than generic medicines because they have been tested through bioequivalence studies | 29 (9.6) | 95 (31.5) | 47 (15.6) | 68 (22.5) | 62 (20.5) | 21 (6.9) | 60 (19.6) | 56 (18.3) | 96 (31.4) | 73 (23.9) | 50 (8.2) | 155 (25.5) | 103 (16.9) | 164 (27.0) | 135 (22.2) |
| Generic medicines are in the same dosage form (e.g., tablet and capsule) as branded medicine | 4 (1.3) | 45 (14.9) | 43 (14.2) | 144 (47.7) | 66 (21.9) | 10 (3.3) | 44 (14.4) | 43 (14.1) | 178 (58.2) | 31 (10.1) | 14 (2.3) | 89 (14.6) | 86 (14.1) | 322 (53.0) | 97 (16.0) |
| Medicines manufactured by multinational companies are more reliable than those manufactured by national firms | 24 (7.9) | 97 (32.1) | 53 (17.5) | 86 (28.5) | 42 (13.9) | 26 (8.5) | 107 (35.0) | 64 (20.9) | 84 (27.5) | 25 (8.2) | 50 (8.2) | 204 (33.6) | 117 (19.2) | 170 (28.0) | 67 (11.0) |
| Branded medicines should be preferred over generic medicine for life-threatening conditions | 35 (11.6) | 92 (30.5) | 37 (12.3) | 76 (25.2) | 62 (20.5) | 19 (6.2) | 47 (15.4) | 43 (14.1) | 110 (35.9) | 86 (28.1) | 54 (8.9) | 139 (22.9) | 80 (13.2) | 186 (30.6) | 148 (24.3) |
| The cost of treatment will be less if generic medicines are used | 6 (2.0) | 12 (4.0) | 25 (8.3) | 113 (37.4) | 146 (48.3) | 8 (2.6) | 27 (8.8) | 34 (11.1) | 158 (51.6) | 79 (25.8) | 14 (2.3) | 39 (6.4) | 59 (9.7) | 271 (44.6) | 225 (37.0) |
| Generic medicines are of inferior quality to brand name drugs, which is why they are less expensive | 80 (26.5) | 131 (43.4) | 37 (12.3) | 40 (13.2) | 14 (4.6) | 36 (11.8) | 135 (44.1) | 54 (17.6) | 66 (21.6) | 15 (4.9) | 116 (19.1) | 266 (43.8) | 91 (15.0) | 106 (17.4) | 29 (4.8) |
| Generic medicines produce more side effects than branded medicines | 49 (16.2) | 109 (36.1) | 92 (30.5) | 44 (14.6) | 8 (2.6) | 24 (7.8) | 106 (34.6) | 77 (25.2) | 83 (27.1) | 16 (5.2) | 73 (12.0) | 215 (35.4) | 169 (27.8) | 127 (20.9) | 24 (3.9) |
| Brand name medicines are required to meet higher safety standards than generic medicines | 29 (9.6) | 89 (29.5) | 40 (13.2) | 81 (26.8) | 62 (20.5) | 12 (3.9) | 48 (15.7) | 51 (16.7) | 115 (37.6) | 80 (26.1) | 41 (6.7) | 137 (22.5) | 91 (15.0) | 196 (32.2) | 142 (23.4) |

1: Strongly disagree, 2: Disagree, 3: Do not know, 4: Agree, 5: Strongly agree

Table 4: Mean score comparison of the perceptions of generic medicines

| Variable | Mean±SD | P |
|---------------------------|-----------|---------------------------|
| Perception score | 5.19±2.43 | |
| Median (IQR) ^a | 5 (3–7) | |
| University | | |
| Public universities | 5.65±2.61 | $t=-4.770^b$ $P<0.001$ |
| Private universities | 4.72±2.15 | |
| Gender | | |
| Male | 4.96±2.43 | $t=-1.756^b$ $P=0.080$ |
| Female | 5.32±2.42 | |
| Academic year | | |
| 2 nd year | 4.12±2.09 | $P<0.001^c$ |
| 3 rd year | 4.83±2.22 | |
| 4 th year | 6.76±2.58 | |
| 5 th year | 6.25±2.44 | |
| Work Experience | | |
| Yes | 5.73±2.38 | $t=3.753^b$ $P<0.001$ |
| No | 4.94±2.42 | |
| Age | | |
| 20–21 | 4.14±2.22 | $P<0.001^c$ |
| 22–23 | 5.88±2.60 | |
| ≥ 24 | 4.61±2.45 | |

SD: Standard deviation. ^aInterquartile range, ^bindependent samples t-test, ^cANOVA: Analysis of variance

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Birth Control Knowledge among Pharmacy Undergraduate Students in Vietnam: A Case Study and Situation Analysis

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Abstract

Aims: The main goal of this study is to define the factors that contribute to the knowledge, awareness, perceptions, and practice of birth control among pharmacy students at Lac Hong University (LHU) in Dong Nai Province. **Subjects and Methods:** A prospective cohort study was conducted among pharmacy students over 4 months from September to December 2017. **Results:** All respondents ($n = 403$) had heard of birth control methods. Nearly 90% of participants indicated that the male condom can protect against sexually transmitted diseases. Condoms are also the most common method of birth control. The mean knowledge and awareness scores of students were 4.52 ± 1.420 and 20.67 ± 4.06 , respectively. The highest birth control knowledge score was 5.64 ± 0.996 . Fifth-year students were the most knowledgeable about contraceptive use and had the highest mean knowledge score (4.82 ± 1.307). A significant association was found between marital status ($P < 0.001$), religion ($P < 0.05$), and mean knowledge of the respondents. **Conclusions:** Overall, the findings reflect that the majority of students at LHU had a poor understanding and awareness of contraception methods. Health education and awareness programs should be initiated for students to provide them with correct knowledge about contraception. The knowledge of these future health-care professionals will play an important role in improving public health.

Key words: Awareness, birth control, knowledge, perception, practice, Vietnam

INTRODUCTION

The planned prevention of pregnancy through the use of diverse devices, sexual practices, drugs, chemicals, or surgical operations is the definition of birth control.^[1] Therefore, barrier methods, emergency contraception, hormonal methods, sterilization, and intrauterine methods that act or interfere with the normal process of ovulation, fertilization, and implantation to prevent pregnancy may be called contraception.^[2] Effective contraception enables individuals and couples of all social backgrounds to enjoy a physical relationship without concerns about undesired pregnancies and provides an opportunity to engage in family planning.^[1] Several goals of contraception are to provide the greatest level of both comfort and protection at the lowest cost and level of side effects. The correct use of male or female condoms, for example, provides the dual advantage of preventing pregnancy and preventing sexually transmitted diseases.^[1]

At present, sex before marriage and cohabitation in Vietnam are frequently perceived as social problems. However, attitudes regarding sexuality are changing among students aged 18–22. Students are increasingly open-minded and also start sexual activity at earlier ages as a result of various social shifts and the modernization of Vietnamese society. After 30 years of economic renovation in Vietnam, the existence and development of foreign media are repeatedly mentioned as a leading cause of premarital or unintended sex in the youth of Vietnam.^[3] The abortion rate among Vietnamese women of

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reproductive age is 83 of every 1000 women, and women have an average of 2.5 abortions over the course of their lifetime. Hence, Vietnam ranks first in Asia and is one of the top five countries in the world in terms of frequency of abortions. About one million abortions per year are performed in Vietnam.

Unplanned pregnancy among students is an important national health problem and represents a major threat to female fertility, especially among adolescents in developing countries. During their studies, students travel far from home and lack parental supervision. Students often begin to experiment sexually, which can lead to undesired pregnancies and a host of other problems.^[4] According to the Survey and Assessment of Vietnamese Youth (SAVY) 2, the average age at first sex among 14–25 years' old is 18.1 years, which decreased in comparison to SAVY 1 (19.6 years).^[5,6] Teenage girls who get pregnant are more likely to drop out of school and rarely have the social and economic means to raise children.^[7] Furthermore, SAVY 2 reported that 9.5% of adolescents had premarital sex. Specifically, 5.2% of women reported having premarital sex, while 13.6% of men reported having premarital sex. Moreover, 8.4% of sexually active women aged 15–24 reported having had an abortion.^[6] Overall, youth and single women in Vietnam receive insufficient education on reproductive physiology, sexuality, and contraception. Those who are sexually active have little access to birth control through either the national family planning program or the private sector. As a consequence, many of these women come to rely on abortions.^[8] In short, unexpected pregnancy in students poses multiple problems for universities and for society in developing countries.

Furthermore, contraception methods are effective in preventing pregnancies when properly used, and some methods have been shown to have health benefits, especially the risk of unwanted pregnancies, ectopic and molar pregnancies, abortion and sexually transmitted infections can be reduced by using contraception.^[9] Birth prevention services and products currently prevent 187 million unwanted pregnancies every year, including 60 million unintended births and 105 million abortions.^[10] Birth control in the United States has led to an 86% decrease in teenage pregnancy over the past 40 years.^[11] Peipert *et al.* indicated that providing free contraception to women considerably reduces unexpected pregnancies and abortion rates by 62–78%.^[12] Several studies on the knowledge and practices of birth control, including attitudes toward birth control, have been carried out in countries such as China,^[13] Malaysia,^[14] and Pakistan.^[15] For example, a cross-sectional study in Wuhan, China, showed that a better understanding of factors associated with birth control use among female students can enable colleges and families to protect students from unintended pregnancies.^[13] Women with higher levels of education generally seek more contraceptive services and have lower rates of fertility compared to women of lesser educational achievement.^[16,17] These examples show that reducing the rate of unplanned pregnancy is key to decreasing abortions around the world.

The present research study investigates the knowledge, awareness, practices, and perception of birth control among pharmacy students in Vietnam considering the demographic characteristics of students. A sufficient sample was considered to provide an informative assessment of using birth control use and to contribute to the National Strategy on Population of Vietnam to reduce unwanted pregnancies and associated abortions. As documented in various research studies, accurate, in-depth knowledge of birth control among pharmacy students tends to be low in developing countries in comparison to developed countries. In Vientiane, Laos, knowledge of emergency contraception pills among young adults is relatively low, and the number of misperceptions is high.^[18] Similar results were found in Addis Ababa, Ethiopia, where a low level of knowledge and practice of emergency contraceptives was found among female university students.^[19] In contrast, 752 student pharmacists in the United States had higher scores of contraceptive knowledge and had more favorable attitudes toward oral emergency contraceptives.^[20] In addition, medical students in Germany correctly answered 50.3% of questions regarding contraceptives.^[21] The main goal of the present study was to determine the factors that contribute toward the knowledge, awareness, practices, and perception (KAPP) of birth control among pharmacy students at a private university, Lac Hong University (LHU), in the Dong Nai Province of Southern Vietnam.

SUBJECTS AND METHODS

Study design and research tool

This cross-sectional study was based on a 4-month survey from September to December 2017 conducted at LHU, Dong Nai Province, to assess the KAPP of contraception among undergraduate pharmacy students. A validated, self-administered questionnaire was used to assess the KAPP of contraception and was based on a literature review of two previous studies.^[14,22] The validity, reliability, and appropriateness of the questionnaire were pre-tested among 30 non-participants who supplied information about their sociodemographic characteristics and their KAPP of contraception.

The questionnaire was comprised of five sections. Section one had eight items that aimed to gather the demographic information of the respondents. The primary focus of section two was to assess general knowledge about contraception. Statements about contraception were rated by respondents using a nominal scale (yes/no) and a three-point Likert scale was provided for respondents. The mean knowledge score was then calculated with respect to the demographic variables of those surveyed [Table 1]. Section three was comprised of seven main items to explore respondents' awareness of birth control use [Table 3]. Section four was

Table 1: Association of mean knowledge scores with demographic variables (*n*=403; *n* (%))

| Characteristics | Number (%) of respondents | Mean±SD of knowledge score | P value* |
|------------------------|---------------------------|----------------------------|----------|
| Gender | | | |
| Male | 174 (43.2) | 4.35±1.45 | 0.384 |
| Female | 229 (56.8) | 4.66±1.38 | |
| Ethnic | | | |
| Vietnamese | 399 (99.0) | 4.53±1.42 | 0.096 |
| Chinese | 4 (1.0) | 4.00±0.82 | |
| Religion | | | |
| Buddhism | 96 (23.8) | 4.92±1.33 | 0.002** |
| Roman Catholicism | 83 (20.6) | 4.19±1.46 | |
| None | 222 (55.1) | 4.49±1.41 | |
| Protestantism | 2 (0.5) | 2.00±0.00 | |
| Marital status | | | |
| Single | 310 (76.9) | 4.22±1.37 | <0.001** |
| Married | 88 (21.8) | 5.64±0.99 | |
| Divorce | 5 (1.2) | 3.80±0.84 | |
| Education program | | | |
| Full-time ¹ | 255 (63.3) | 4.01±1.31 | 0.409 |
| Part-time ² | 148 (36.7) | 5.41±1.15 | |
| Year of study | | | |
| First year | 99 (24.6) | 4.41±1.62 | 0.120** |
| Second year | 93 (23.1) | 4.46±1.40 | |
| Third year | 102 (25.3) | 4.71±1.25 | |
| Fourth year | 58 (14.4) | 4.22±1.43 | |
| Fifth year | 51 (12.7) | 4.82±1.31 | |
| Total | 403 (100.0) | 4.52±1.42 | |

¹Studying in 5 years; ²Studying in 4 years from technician pharmacy. *Calculated by independent sample *t*-tests, **Calculated by one-way ANOVAs. SD: Standard deviation

Table 2: Knowledge of contraception among participants (*n* [%])

| Opening question and statements | Correct responses | Incorrect responses |
|---|-------------------|---------------------|
| 1. Have you heard of contraceptive methods? | 403 (100.0) | - |
| 2. The risk of some types of cancer in women can be reduced by oral contraceptives | 97 (24.1) | 306 (75.9) |
| 3. A woman will not get pregnant within at least 2 months after having stopped taking birth control pills | 202 (50.1) | 201 (49.9) |
| 4. Male condoms can protect against sexually transmitted diseases | 334 (82.9) | 69 (17.1) |
| 5. Common side effects of birth control pills include weight gain and mood swings | 237 (58.8) | 166 (41.2) |
| 6. It is safe to have sex during the period of infertility | 126 (31.3) | 277 (68.7) |
| 7. There is an increased risk of breast cancer in women taking estrogen-containing oral contraceptives | 126 (31.3) | 277 (68.7) |
| 8. To get birth control pills, women are required to have a prescription from a doctor | 298 (73.9) | 105 (26.1) |

comprised of nine items to gather respondents' perception of birth prevention using a 5-point Likert scale [Table 5]. The last section of the study consisted of seven main questions to explore respondents' practice of family planning [Table 7].

Study population and sampling method

LHU was founded in 1997 and represents the first private university in Dong Nai Province in the southern key economic

Table 3: Awareness of contraception among participants (*n* [%])

| Symbol | Question | Participants' responses | | | | |
|--------|--|-------------------------|------------|------------|------------|-------------------|
| | | Strongly agree | Agree | Not sure | Disagree | Strongly disagree |
| A1 | Only women are responsible for using contraceptive methods | 17 (4.2) | 14 (3.5) | 8 (2.0) | 138 (34.2) | 226 (56.1) |
| A2 | Contraceptive methods are more harmful than beneficial to health | 39 (9.7) | 122 (30.3) | 57 (14.1) | 126 (31.3) | 59 (14.6) |
| A3 | Contraceptive methods can protect the health of families and society | 98 (24.3) | 235 (58.3) | 23 (5.7) | 23 (5.7) | 24 (6.0) |
| A4 | The use of contraceptive methods in young people will increase the risk of infertility in the future | 50 (12.4) | 185 (45.9) | 53 (13.2) | 87 (21.6) | 28 (6.9) |
| A5 | Contraceptive pills are not 100% effective in preventing pregnancy | 52 (12.9) | 209 (51.9) | 59 (14.6) | 58 (14.4) | 25 (6.2) |
| A6 | Women's experiences of the side effects of birth control can be diminished by changing to a different or safer form of contraception | 39 (9.7) | 149 (37.0) | 117 (29.0) | 82 (20.3) | 16 (4.0) |
| A7 | Discussing contraception with my partner is embarrassing | 18 (4.5) | 25 (6.2) | 45 (11.2) | 200 (49.6) | 115 (28.5) |

Table 4: Association of contraception awareness with demographic variables

| Question | P value* | | | |
|----------|----------|--------|----------------|------------------|
| | Year | Gender | Marital status | Education system |
| A1 | 0.152 | 0.027 | <0.001 | <0.001 |
| A2 | 0.010 | 0.300 | <0.001 | <0.001 |
| A3 | 0.430 | 0.273 | 0.092 | 0.406 |
| A4 | 0.130 | 0.737 | 0.002 | <0.001 |
| A5 | 0.034 | 0.002 | 0.053 | <0.001 |
| A6 | 0.380 | 0.801 | <0.001 | <0.001 |
| A7 | <0.001 | 0.014 | 0.001 | <0.001 |

*Chi-square test

zone of Vietnam. Specifically, LHU is a multidisciplinary and multilevel educational institution that provides vocational, college, undergraduate, and postgraduate education. The university currently has 9 faculties, 20 branches, and 29 majors with an enrolment of more than 20,000 students. The Faculty of Pharmacy was established in 2012. Students may obtain a bachelor's degree, which includes practical and research training and transmits knowledge and skills for prospective pharmacists. This university generates highly qualified professionals for Dong Nai Province and other regions.

Calculation of sample size and sample assignment

The number of participants were determined using the following formula applicable to survey research that is based on normal to hypergeometric approximation:

Where n = the sample size of pharmacy students at LHU, $p = 0.5$, d = the rate of allowable error, and z = the standard normal deviation at a 95% confidence interval. Based on the aforementioned formula, the obtained sample size should be equal to the following 2:

To eliminate errors related to the survey size, the sample size was increased by a factor of 110% to allow for a lack of follow-up and non-response. All factors were based on expert opinion. Overall, 423 participants were surveyed in this prospective cohort study. The convenience sampling method was used, and questionnaires were self-administered (using paper and pencil). In particular, a 43-item questionnaire was used to assess university students' knowledge of contraceptive.

Data collection

The respondents participating in this survey had different ages, genders, marital status, and educational backgrounds. No specific criteria for inclusion and exclusion were used for this survey. However, respondents who were unwilling to participate were excluded from this study. Verbal consent to participate in this study was provided by all respondents as an ethical requirement.

The original questionnaires were hand-delivered to students in lecture halls. An investigator provided a brief introduction and instructions and later visited the students to collect the completed

Table 5: Perception of contraception among participants (*n* [%])

| Question | Participants' responses | | | | |
|---|-------------------------|------------|------------|------------|-------------------|
| | Strongly agree | Agree | Not sure | Disagree | Strongly disagree |
| It is unnecessary to purchase contraceptives | 6 (1.5) | 25 (6.2) | 22 (5.5) | 190 (47.1) | 160 (39.7) |
| Courage is needed to purchase condoms from pharmacies, conventional shops, or dispensaries | 12 (3.0) | 69 (17.1) | 44 (10.9) | 175 (43.4) | 103 (25.6) |
| Using condoms will generate less sexual pleasure during sexual intercourse | 29 (7.2) | 147 (36.5) | 151 (37.5) | 55 (13.6) | 21 (5.2) |
| Changing attitudes have led males to participate in contraception and to increase the rate of contraception use in some areas | 99 (24.6) | 216 (53.6) | 44 (10.9) | 24 (6.0) | 20 (5.0) |
| Contraception can reduce the fear of unwanted pregnancy and allow women the freedom to enjoy a sexual relationship | 51 (12.7) | 230 (57.1) | 56 (13.9) | 57 (14.1) | 9 (2.2) |
| Contraceptives allow women to pursue higher education by delaying pregnancy and to achieve some measure of economic security | 76 (18.9) | 250 (62.0) | 37 (9.2) | 31 (7.7) | 9 (2.2) |
| The use of contraceptive methods is complicated | 20 (5.0) | 82 (20.3) | 126 (31.3) | 135 (33.5) | 40 (9.9) |
| Sex education, including contraception, should be introduced at an early age | 91 (22.6) | 168 (41.7) | 53 (13.2) | 67 (16.6) | 24 (6.0) |
| Health-care providers should provide counselling on contraceptive methods, their mechanisms of action, their best time to use, and their possible side effects to all women | 168 (41.7) | 189 (46.9) | 22 (5.5) | 9 (2.2) | 15 (3.7) |

questionnaires. Of the 423 questionnaires that were distributed, 9 were not returned, and 11 were incorrectly completed. A total of 403 respondents met the survey requirements.

Data analysis

A descriptive analysis was performed in the Statistical Package for the Social Sciences version 20. Furthermore, to identify the factors affecting the KAPP toward contraceptive medicine, a covariate analysis was applied using gender (reference: Male) and field of education (reference: Non-health science) as the covariates. A significance value of 0.05 was set in the analysis of respondents' responses. Knowledge and attitudes were assessed by a scoring system based on the research of Elkalmi *et al.*^[12]

Ethical clearance

The study design was approved by the LHU. All participants in this study voluntarily participated in answering the questionnaire. The responses were kept private, and the respondents remained anonymous. The results are expressed as numbers and statistics and are discussed without using the names of respondents.

RESULTS

Surveys were distributed to a total of 423 respondents, of which 403 completed the survey, resulting in a response rate of 95.3%. The remaining variables for intergroup comparisons were gender (43.2% of male and 56.8% of female) and ethnicity (99% Kinh and 1% Hoa ethnicity). The majority of participants (76.9%) were single. More than half of respondents (55.1%) were non-religious. Most students (63.3%) were studying full time.

The mean knowledge scores of the respondents were 4.52 ± 1.420 . The highest birth control knowledge score was 5.64 ± 0.996 . The 5-year students were the most knowledgeable about contraceptive use and had the highest average knowledge score (4.82 ± 1.307). A significant association was found between religion ($P < 0.05$), marital status ($P < 0.001$), and the mean knowledge score of the participants.

Of the 403 students that answered the questionnaire, all had heard of contraceptive methods. Nearly 90% of respondents ($n = 403$) indicated that male condoms can protect against sexually transmitted diseases. In addition, more than 70% of

Table 6: Association of perception with demographic variables

| Questions | P value* | | | |
|-----------|----------|--------|----------------|------------------|
| | Year | Gender | Marital status | Education system |
| P1 | 0.006 | 0.189 | 0.153 | 0.001 |
| P2 | 0.042 | 0.510 | <0.001 | <0.001 |
| P3 | 0.002 | 0.001 | <0.001 | <0.001 |
| P4 | 0.011 | 0.032 | <0.001 | <0.001 |
| P5 | 0.011 | 0.810 | 0.096 | 0.001 |
| P6 | 0.014 | 0.445 | 0.048 | <0.001 |
| P7 | 0.033 | 0.037 | 0.001 | <0.001 |
| P8 | 0.032 | 0.064 | <0.001 | <0.001 |
| P9 | 0.001 | 0.178 | 0.001 | <0.001 |

P value was calculated by Mann–Whitney and Kruskal–Wallis test

Table 7: Practice of using contraception among participants (*n* [%])

| Question | Frequency (%) |
|---|---------------|
| Ever used contraception (<i>n</i> =403) | |
| Yes | 168 (41.7) |
| No | 235 (58.3) |
| Type of contraceptive used (<i>n</i> =298) | |
| Contraception pills | 87 (29.2) |
| Condoms | 133 (44.6) |
| Emergency oral contraceptives | 53 (17.8) |
| Coitus interruptus | 2 (0.7) |
| Etonogestrel implants | 2 (0.7) |
| Intrauterine devices | 21 (7.0) |
| Reason for choosing contraceptive method (<i>n</i> =258) | |
| Convenient to use | 132 (51.2) |
| Has no side effects (weight gain, nausea, etc.) | 17 (6.6) |
| Not easy to forget | 27 (10.5) |
| Low cost | 59 (22.9) |
| Long-acting effectiveness | 16 (6.2) |
| Other | 7 (2.7) |
| Reason for using contraceptive method (<i>n</i> =209) | |
| Fear of pregnancy | 139 (66.5) |
| Advised by health worker | 22 (10.5) |
| To avoid sexually transmitted diseases | 14 (6.7) |
| To delay menstrual cycle | 8 (3.8) |
| To treat acne | 6 (2.9) |
| At request of partner | 18 (8.6) |
| Other | 2 (1.0) |

respondents (*n* = 298) correctly affirmed the statement “To get birth control pills, women are required to have a prescription

from a doctor.” In contrast, 75.9% (*n* = 306) of respondents incorrectly answered the statement about whether the risk of certain types of cancer in women can be reduced by birth control pills.

Three hundred and sixty-four respondents (90.3%) disagreed or strongly disagreed that only women are responsible for using contraceptive methods. Similarly, 82.6% of respondents agreed or strongly agreed that contraceptive methods can protect the health of families and society. In contrast, a few students (4.5%) strongly agreed that discussing contraception with their partner is embarrassing. Furthermore, 64.8% of respondents believed that contraceptive pills are not 100% effective in preventing pregnancy. Overall, the mean awareness score of participants was 20.67 ± 4.06 .

Few students (1.5%) strongly agreed that the purchase of contraceptives is unnecessary. No more than half of participants (37.5%) were unsure whether the use of condoms would create less sexual pleasure during sexual intercourse. Most students (88.6%) agreed or strongly agreed that health-care providers should provide counseling on contraceptive methods to all women in addition to information on their mechanism of action, their best time of use, and their possible side effects. In fact, 69.3% of female students agreed or strongly agreed with this statement ($P < 0.001$). Meanwhile, 315 students (78.2%) agreed that male attitudes toward contraceptive methods are changing. Only 20 students (5.0%) strongly agreed that the use of contraceptive methods is complicated.

The practice of contraceptive use among respondents is presented in Table 7. One hundred and sixty-eight (41.7%) students have used contraception, and condoms (51.2%; *n* = 133) are the most common method because of their convenience of use. Other contraceptive methods included vaginal diaphragms, emergency oral contraceptives, vasectomy, spermicides, etonogestrel implants, and intrauterine devices, which were either comparatively uncommon or not used. More than half

of students choose to use birth control because of a fear of pregnancy (66.5%). Other students used birth control following health workers' advice (66.5%) or at their partners' request (8.6%). While most chose birth control that was convenient to use ($n = 132$), some also preferred methods that were not easy to forget (10.5%), low cost (22.9%), and without side effects (6.6%).

DISCUSSION

These findings of this study indicated that the knowledge and awareness of birth control of pharmacy students at LHU were lower than the rates reported in other studies in Malaysia,^[14] Nigeria,^[23,24] and South Africa.^[25] However, increasing levels of awareness can be attributed to the increasing use of social networks/media, which was identified as one of the main sources of knowledge in this study. This finding is consistent with other studies that identified the internet and social media as the greatest sources of health-related information for undergraduate students.^[26] Notably, some studies have demonstrated that high awareness and knowledge of contraceptive methods did not signify that these methods were popular or highly utilized. For instance, the regular usage of family planning among sexually active, single undergraduate students at a tertiary institution in Kano State, Nigeria, was low (15.63%),^[23] and only 38.0% of the University of Venda's (South Africa) male students reported correctly using a method for preventing pregnancy.^[25] This confirms that awareness and knowledge of contraceptive methods do not necessarily translate to the use of contraception.

Slightly less than half of students (41.7%) involved in this study reported having used contraception. Condoms were most frequently used (44.6%), followed by contraception pills (29.2%) and emergency oral contraceptives (17.8%). Other methods such as coitus interruptus and etonogestrel implants were rarely mentioned. Most students (82.9%) were also aware that male condoms can protect against sexually transmitted diseases. The primary motivation for using contraception was to avoid pregnancy. The main reasons for choosing contraceptive methods were related to convenience of use and low cost. In another study, individuals who received a lesson on the human immunodeficiency virus later had higher rates of condom use at last intercourse; therefore, health education can help increase condom use in certain subgroups.^[27] However, in the present study, around 50% of respondents also believed that using condoms would produce less sexual pleasure during sexual intercourse.

Nearly 80% of respondents believed that the risk of some types of cancer in women cannot be reduced by oral contraceptives. The majority women are not exposed to long-term cancer threats using oral contraceptives; instead, many women have effectively lower risks of some cancers for many years after ceasing oral contraceptives.^[28] Furthermore, the pharmacy students did not

believe that oestrogen-containing oral contraceptives were related to a high risk of breast cancer in women (68.7%). However, a research study on African-American women showed that persistent and recent usage of oral contraceptives was associated with a greater risk of breast cancer.^[29] Therefore, pharmacy students should recognize their gaps in knowledge with respect to contraceptives. More than 80% of respondents agreed with the statement that birth control represents an opportunity for women to pursue higher education and higher incomes. Kallner *et al.* demonstrated that women achieved higher knowledge and higher incomes by stopping childbirth.^[9] More than half of our respondents affirmed that sex education, including contraception, should be introduced at an early age.

Pharmacy students should receive training on communicating about birth control in addition to health education. Advance practice lessons could be implemented to provide students with more in-depth knowledge about the correct use of contraception and the selection of an appropriate method. In particular, freshman should have a basic knowledge of birth control. In addition, a website on contraception could be created. Such a website could be easily accessed by students and be continuously updated. Furthermore, real-life scenarios and situations could be presented. Finally, individuals with questions could anonymously contact professional health-care providers through an online message system, keeping individuals' information private.

However, the present study also has some limitations. The research was only carried out at one department of LHU. Hence, the results cannot be generalized to pharmacy students across Vietnam. Further studies are required to establish statistics on contraceptive methods and use at the national level, although the present study can serve as a basis for a nationwide study evaluating the KAPP of pharmacy students in regard to contraception.

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A Cross-sectional Study Exploring the Knowledge, Perceptions, and Factors Influencing Prescriptions of Vietnamese Physicians with regard to Generic Medicines

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Abstract

Context: In Vietnam, which is a developing country, generic medicines have been suggested as a solution that should serve to decrease treatment costs. Physicians play a key role in facilitating and enhancing patients' use of generic medicines. **Aims:** The aim of this study was to assess the knowledge, perceptions, and factors influencing prescriptions of physicians in Vietnam to suggest policies for effectively enhancing the use of generic medicines. **Subjects and Methods:** This cross-sectional research study was conducted using a 27-item questionnaire between January 2017 and April 2017 in a number of Vietnamese hospitals and private clinics. The sample size as calculated by Raosoft website was 383. **Statistical Analysis Used:** The Chi-square, Kruskal–Wallis, and Mann–Whitney U-tests were manipulated to calculate the association between the study variables. **Results:** Of the 405 responses received, 390 were eligible for inclusion in the study, which led to a response rate of 84.78%. In terms of the scoring of the physicians' knowledge, 141 physicians (37.2%) gave the right number of answers, which was fewer than two. The percentages of the various levels of agreement with the notion that “generic medicines can be interchanged with brand name medicines” were independent of the physicians' knowledge ($P < 0.001$). The age variable was strongly associated with the level of the physicians' consensus (Spearman's rho = 0.986, $P < 0.001$). **Conclusions:** Some policies based on the analyzed perception results are therefore suggested to enhance the efficacy of generic medication use as well as the quality of local generic medicines.

Key words: Generic, knowledge, perception, physician, Vietnam

INTRODUCTION

Several global organizations have provided useful definitions of generic medicines. For instance, the World Health Organization defines generic medicines as “those produced without a license from the innovator company when the patent or other market exclusivity rights on the innovator product have expired.”^[1] According to the US Food and Drug Administration, a generic drug is meant to be “identical or bioequivalent to a brand name drug in dosage form, safety, strength, route of administration, quality, performance characteristics, and intended use.”^[2] A generic

medicine must be proven to be of sufficient quality when compared to the previously approved medicine.^[2,3] However,

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generic products may have a different appearance to the reference products.

Generic medicines are of considerable interest because they are cheaper than brand-name medicines, which means that the use of generic medicines could possibly serve to reduce the economic burden of healthcare, since the cost of illness is closely related to the medication cost.^[4] Calculating the savings that could result from the use of generic products is considered to be an attractive topic because generic products offer the benefit of decreasing the therapeutic cost.^[3-8] Cameron *et al.* showed that using generic medicines instead of the previously approved versions of products, for instance, the total potential cost saving per capita for Malaysia and the Philippines would be almost 16 million United State Dollar (USD) and 38 million USD, respectively.^[8] According to a report by the Generic Pharmaceutical Association in 2015,^[9] some 88% of prescriptions are for generic drugs, although their cost still accounts for only a small percentage of the total drugs cost (28%).

It has been claimed that in low- and middle-income countries, the cost of various essential pharmaceuticals is too expensive for a large proportion of the population, although the support offered by insurance companies is now being expanded.^[4,8] Increasing the use of generic medicines could help to increase the number of patients who can access necessary medicines, thereby helping to achieve national health-related goals.^[8,10] Therefore, the use of generic drugs has become increasingly popular worldwide,^[11] especially in developing countries. Vietnam is a lower middle-income country with a gross domestic product of 2,052.32 USD per capita,^[12] but according to the Joint Annual Health Review, it has a significant health-care budget. Indeed, the average drug expenditure per capita was 34.48 USD in 2014, having increased gradually year by year from 22.25 USD in 2010.^[13] Therefore, it is extremely important to formulate effective policies for encouraging the use of generic medicines in Vietnam.

Physicians played an vital role in patients' medication usage in community clinics.^[14] Therefore, the consumption of generics can be said to be contingent on physicians. They significantly influence both patients' understanding and use of generic products. Hence, numerous studies have been designed to explore the knowledge and perceptions of physicians regarding generic products in various countries over the past decade.^[10,14-25]

Generic medicines should play a key role in the health-care sector of a developing country such as Vietnam. The government has recognized the benefits of using generic products, although difficulties have been encountered in relation to implementation.^[13] One of the remarkable problems faced when attempting to increase the use of generic medicines concerns perceptions regarding the quality, effectiveness, and safety of such medicines, especially local generic medicines.^[13] In Vietnam, there were a few studies conducted with the same design.^[26] The aim of this study is therefore to explore the knowledge, perceptions, and factors influencing prescriptions of Vietnamese physicians regarding generic medicines to suggest some policies for improving the usage of generic medicines.

SUBJECTS AND METHODS

This cross-sectional research study was conducted among Vietnamese physicians between January 2017 and April 2017. A Vietnamese language questionnaire was developed based on two prior studies^[14,21] conducted in Pakistan and Malaysia. These two countries share some similar characteristics with Vietnam, including economic, social, and cultural characteristics. The participants in the study had to be Vietnamese physicians who work in a hospital or private clinic in Vietnam.

The sample size was computed to be 383 by Raosoft website based on an overall population size of 72,869.03 (7.8 physicians/10,000 people),^[27,28] with a 5% margin of error and 95% confidence level. To ensure that an adequate number of questionnaires were distributed and returned, the sample size was increased by 20% to 460.

Data collection

Some 460 self-administered anonymous questionnaires were sent directly to various hospitals and private clinics from January 2017 to April 2017.

Thirty physicians were chosen to take part in a pilot test of the questionnaire. Following the pilot test, some changes were made to improve the clarity and quality of the questionnaire. Cronbach's alpha and the intraclass correlation were calculated to test the reliability of the research instrument. As can be seen in Table 1, the internal consistency of each domain was good. More specifically, the Cronbach's alpha values for the

Table 1: Reliability of the questionnaire (pilot test, $n=30$)

| Domain | Cronbach's alpha | ICC value | 95% CI | P value |
|---|------------------|-----------|-------------|---------|
| Knowledge | 0.775 | 0.463 | 0.279–0.653 | <0.001 |
| Perceptions of generic medicines | 0.874 | 0.635 | 0.405–0.741 | <0.001 |
| Perceptions of Vietnamese generic medicines | 0.822 | 0.536 | 0.357–0.709 | <0.001 |
| Factors influencing prescriptions | 0.849 | 0.585 | 0.334–0.693 | <0.001 |
| Sources of medicine information | 0.831 | 0.552 | 0.374–0.721 | <0.001 |

CI: Confidence interval, ICC: Intraclass correlation

knowledge, perceptions of generic medicines, Vietnamese generic medicines, factors influencing prescriptions, and sources of medication information parts were 0.775, 0.874, 0.822, 0.849, and 0.831, respectively.

The final questionnaire comprised 27 questions divided into five parts. The first part was intended to collect general information about the participants. The second part was focused on an appraisal of the physicians' knowledge regarding the distinction between generic and brand-name medicines. The third part was used to statistically assess the physicians' perceptions of generic medicines in general and local generic medicines in particular. The fourth and fifth parts were, respectively, intended to discover which factors influence prescriptions and determine which sources of medication information were favored by physicians. There were four questions in each part of the questionnaire, except for the first part, which comprised six items. The knowledge domain had three options for respondents to choose from, namely, "Yes," "No," and "I do not know." A 5-point Likert scale was used in the remaining domain, with "1" indicating "strongly disagree" and "5" indicating "strongly agree." The scale was intended to show the increase in agreement in the perception part of the questionnaire as well as the increment of priority in the final two parts.

Data analysis

The Statistical Package for the Social Sciences version 20.0 was used to record the answers given by the survey participants. The demographic characteristics were calculated using a descriptive statistics tool. Each correct knowledge answer was scored one point. There was no point awarded for the answer "I do not know." The total points scored by every

physician were summarized. If the physicians' knowledge score was equal to or more than two, it was suggested to be in the "good" range; otherwise, it was considered to be in the "not good" range. Moreover, the Chi-square test was manipulated to report the association between the physicians' knowledge range and their demographic characteristics, while the Kruskal–Wallis and Mann–Whitney U-tests were conducted to analyze the last three domains. To determine whether the level of satisfaction would increase or decrease if the rank of age rose, Spearman's rank correlation coefficient was used.

Ethical considerations

Ethical approval for this study was granted by the University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam. The participants were informed that participation was entirely voluntary and their anonymity would be guaranteed. All the information collected was solely used for research purposes.

RESULTS

Of the 405 questionnaires that were returned, 15 were rejected due to being incomplete. Hence, a total of 390 replies were eligible for inclusion in this study, which gave a response rate of 84.78%.

Demographic characteristics

Table 2 summarizes the demographic characteristics of the 390 participating physicians. A large majority of participants were male ($n = 264$, 67.7%), while 70% of the physicians

Table 2: Demographic characteristics ($n=390$)

| Characteristic | n (%) | Characteristic | n (%) |
|----------------------------|------------|----------------------------|------------|
| Age | | Years of experience | |
| ≤25 | 54 (13.8) | 1–5 | 180 (46.2) |
| 25–29 | 93 (23.8) | 6–10 | 105 (26.9) |
| 30–34 | 99 (25.4) | 11–15 | 45 (11.5) |
| 35–39 | 60 (15.4) | 16–20 | 30 (7.7) |
| 40–49 | 60 (15.4) | >20 | 30 (7.7) |
| ≥50 | 24 (6.2) | Locality | |
| Gender | | Urban | 330 (84.6) |
| Male | 264 (67.7) | Rural | 60 (15.4) |
| Female | 126 (32.3) | Number of patients per day | |
| Geographical region | | <25 | 147 (37.7) |
| North and central | 117 (30.0) | 25–50 | 159 (40.8) |
| South | 273 (70.0) | 51–100 | 60 (15.4) |
| Highest qualification | | >100 | 24 (6.2) |
| Bachelor's degree | 204 (47.7) | | |
| Postgraduate qualification | 186 (52.3) | | |

were in the South of Vietnam. There was a considerable difference between the number of physicians working in urban areas ($n = 330$, 84.6%) and those working in rural areas ($n = 60$, 15.4%). Around 80% of the physicians met <50 patients per day.

Knowledge and perceptions of physicians regarding generic medicines

Table 3 summarizes the data concerning the physicians' knowledge of generic medicines. While more than 65% of physicians gave correct answers to questions KQ2 and KQ4, the proportion of incorrect answers given to questions KQ1 and KQ3 was around 50%. The proportion of correct answers given to each question was independent of the physicians' age, gender, geographical region, and years of experience ($P < 0.05$). Based on the scores, some 249 physicians (63.8%) could be classed as being in the "good" range in terms of their knowledge. The percentages seen at the high qualification rank ($P = 0.370$) and locality rank ($P = 0.500$) were the same for the distinct values of the knowledge range.

Based on the data presented in Table 4, the majority of physicians considered that consumers should be notified that low-cost drugs are of lower quality. More than 120 physicians strongly agreed that "there should be many conferences for doctors concerning medicine information" and "if GPs and pharmacists work together, the use of generic medicines among Vietnamese consumers would be more effective." When the physicians were asked about interchanging brand-name medicines for generic medicines, the proportions of the different assent levels were independent of their knowledge range ($P < 0.001$) [Table 5].

Perceptions of physicians regarding Vietnamese generic medicines

Table 6 displays the physicians' perceptions regarding local generic medicines. This issue involved four aspects, namely, the manufacturing process, safety, reputation, and quality, which were intended to assess the discernment of the physicians. It was noteworthy that none of these four aspects of Vietnamese generic medicines were appreciated well by more than 30% of physicians. Twenty-four physicians (6.2%) considered that local medicines had a good reputation, while the physicians' age was strongly associated with their level of agreement (Spearman's Rho = 0.986, $P < 0.001$).

Factors influencing prescriptions and medication information sources

According to Table 4, some 141 physicians believed considering patients' economic and social characteristics to be an issue of extreme priority. When looking at the factors of medication cost, patients' characteristics, physicians' experience, and patients' requirements in Table 5, the figures

Table 3: Physicians' knowledge of generic medicines ($n=390$)

| Knowledge question | n (%) | | Age | Gender | Geographical region | High qualification | Years of experience | Locality | Average number of patients per day |
|---|--------------------|------------------------|---------|---------|---------------------|--------------------|---------------------|----------|------------------------------------|
| | Correct | Incorrect | | | | | | | |
| Generic medicines | | | | | | | | | |
| KQ1 Are less safe than brand name medicines | 114 (29.2) | 276 (70.8) | 0.016* | 0.002* | 0.008* | 0.453 | 0.003* | 0.887 | 0.059 |
| KQ2 Are lower quality than brand name medications | 261 (66.9) | 129 (33.1) | <0.001* | 0.001* | <0.001* | 0.75 | 0.001* | 0.033* | 0.017* |
| KQ3 Produce more side effects than brand name medicines | 192 (49.2) | 198 (50.8) | 0.001* | 0.031* | 0.001* | 0.006* | 0.005* | 0.07 | 0.068 |
| KQ4 Are not required to meet as high safety standards as brand name medicines | 276 (70.8) | 114 (29.2) | <0.001* | 0.002* | 0.009* | 0.156 | <0.001* | 0.046* | 0.679 |
| Knowledge range | Good 249 (63.8) | Not good 141 (37.2) | <0.001* | <0.001* | <0.001* | 0.370 | 0.002* | 0.500 | 0.040* |

*Chi-square was used to calculate P value

Table 4: Physicians' perceptions of generic drugs and factors influencing prescriptions ($n=390$, [n , %])

| Perceptions of generic medicines | | "Strongly disagree" | "Disagree" | "Neutral" | "Agree" | "Strongly agree" |
|---|--|----------------------------------|-------------------|------------------|----------------|-------------------------|
| Statements | | 1 | 2 | 3 | 4 | 5 |
| PQ1 | Generic medicines can be interchanged with brand-name medicines | 9 (2.3) | 45 (11.5) | 57 (14.6) | 201 (51.5) | 78 (20.0) |
| PQ2 | There should be more conferences for doctors concerning drug information | 6 (1.5) | 18 (4.6) | 60 (15.4) | 186 (47.7) | 120 (30.8) |
| PQ3 | The generic medicine usage of consumers would be more effective if both physicians and pharmacists worked together | 9 (2.3) | 12 (3.1) | 57 (14.6) | 186 (47.7) | 126 (32.3) |
| PQ4 | It should be explained to consumers that low-cost drugs are not necessarily of lower quality | 12 (3.1) | 21 (5.4) | 39 (10.0) | 216 (55.4) | 102 (26.2) |
| Factors | | The increment of priority | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| Factors influencing perceptions | | | | | | |
| F1 | Medicine cost | 15 (3.8) | 36 (9.2) | 90 (23.1) | 177 (45.4) | 72 (18.5) |
| F2 | Patients' economic and social characteristics | 6 (1.5) | 15 (3.8) | 60 (1.4) | 168 (43.1) | 141 (36.2) |
| F3 | Physicians' experience | 3 (0.8) | 6 (1.5) | 33 (8.5) | 249 (63.8) | 99 (25.4) |
| F4 | Patients' requirements | 18 (4.6) | 69 (17.7) | 150 (38.5) | 117 (30.0) | 36 (9.2) |
| Source of medication information | | | | | | |
| F5 | Pharmaceutical representatives | 36 (9.2) | 102 (26.2) | 138 (35.4) | 90 (23.1) | 24 (6.2) |
| F6 | The internet | 18 (4.6) | 21 (5.4) | 132 (33.8) | 177 (45.4) | 42 (10.8) |
| F7 | Conferences | 6 (1.5) | 12 (3.1) | 60 (15.4) | 207 (53.1) | 105 (26.9) |
| F8 | Scientific articles | 9 (2.3) | 9 (2.3) | 48 (12.3) | 162 (41.5) | 162 (41.5) |

showing the extent of the effect on the prescriptions made by physicians can be seen to be distributed differently in the different years of experience groups ($P < 0.05$). A large majority of physicians do not usually obtain details about new medicines from pharmaceutical representatives. The distribution of the incremental precedence ranks of the usage of the internet, scientific articles, and attending conferences to access pharmacy information for the "good" and "not good" knowledge groups was not equal ($P < 0.001$).

DISCUSSION

Based on the knowledge results, there are some gaps in the physicians' comprehension of generic medicines that must be corrected. This is extremely important because physicians are contact directly with patients. Moreover, some 348 of the 390 eligible physicians prescribed based on their experience. The internet, scientific articles, and conferences are all suggested to be practical tools for disseminating information since more than 60% of physicians reported using such information

sources. However, there were differences in relation to the use of these sources between the "good" and "not good" physicians. Therefore, physicians should be strongly urged to seek out new and accurate information from trusted and beneficial sources.

Nowadays, several foreign companies have invested in the Vietnamese pharmaceutical market, which poses a threat to domestic drug producers.^[29] As mentioned above, an increasing level of satisfaction with many aspects of generic products was associated with the increment of age, which suggests that younger physicians do not sufficiently appreciate local medicines. This could become a significant obstacle to encourage the wider use of generic products to reduce medical costs.

The perception results showed that the physicians expressed an active decision to substitute generic medicines for brand-name medicines. Nevertheless, the proportions of the agreement levels were independent of the physicians' knowledge, which could influence attempts to increase the

Table 5: Physicians' perceptions of generic drugs and factors influencing prescriptions by demographic characteristics

| Question | Knowledge | Gender | Geographical region | High qualification | Locality | Age | Years of experience | Average number of patients per day |
|-----------------------------------|-----------|---------|---------------------|--------------------|----------|---------|---------------------|------------------------------------|
| Perceptions of generic medicines | | | | | | | | |
| PQ1 | <0.001* | <0.001* | <0.001* | 0.049* | 0.002* | 0.498 | 0.573 | 0.035* |
| PQ2 | 0.031* | 0.695 | <0.001* | 0.040* | <0.001* | 0.001* | <0.001* | 0.039* |
| PQ3 | 0.626 | 0.736 | <0.001* | 0.783 | 0.002* | 0.246 | 0.053 | 0.055 |
| PQ4 | 0.043* | 0.193 | <0.001* | 0.526 | <0.001* | 0.041* | 0.437 | 0.295 |
| Factors influencing prescriptions | | | | | | | | |
| F1 | 0.691 | 0.636 | 0.996 | 0.143 | 0.677 | 0.132 | 0.024* | 0.003* |
| F2 | 0.921 | 0.034* | 0.400 | 0.252 | 0.414 | 0.001* | <0.001* | 0.010* |
| F3 | 0.360 | 0.046* | 0.014* | 0.951 | 0.777 | 0.036* | 0.026* | 0.042* |
| F4 | 0.038* | 0.397 | 0.360 | 0.208 | 0.321 | <0.001* | <0.001* | 0.043* |
| Source of medication information | | | | | | | | |
| F5 | 0.345 | 0.971 | 0.180 | 0.207 | 0.649 | 0.114 | 0.084 | 0.008* |
| F6 | <0.001* | 0.017* | 0.701 | 0.013* | 0.157 | 0.002* | 0.470 | 0.720 |
| F7 | <0.001* | 0.240 | <0.001* | 0.807 | 0.020* | 0.008* | 0.009 | 0.025* |
| F8 | 0.035* | 0.067* | <0.001* | 0.123 | <0.001* | 0.040* | 0.030* | 0.005* |

* $P < 0.05$. Mann–Whitney and Kruskal–Wallis tests were used to compute P value

Table 6: Vietnamese physicians' perceptions regarding domestic generic medicines by age ($n=390$)

| Statement | Aspect | Good n (%) | Spearman's rho | P value |
|---|-----------------------|--------------|----------------|-----------|
| Local generic medicines do not follow the GMP guidelines | Manufacturing process | 99 (25.4) | 0.257 | 0.623 |
| Locally manufactured generic medicines are less safe than multinational companies' products | Safety | 102 (26.2) | 0.143 | 0.787 |
| Local companies have reputable generic medicines | Reputation | 24 (6.2) | 0.986 | <0.001* |
| There is a lack of quality checks for local companies' products | Quality | 105 (26.9) | 0.600 | 0.208 |

* $P < 0.05$. GMP: Good manufacturing practice

use of generic products to reduce the burden of healthcare. To enhance physicians' understanding of generic products, more conferences should be held so that physicians can obtain accurate and up-to-date information about pharmaceuticals. As more than 60% of physicians agreed that the use of generic medicines among Vietnamese consumers would be more effective if both physicians and pharmacists worked together. Collaboration between these two professions should be promoted in relation to prescribing and guiding drug use for patients. In terms of allocating medicines to patients, physicians should explain that low-cost pharmaceuticals are not synonym with low quality.

Many prior studies have investigated a similar subject to the present study, although they have been conducted in other

locations and using various methodologies. Popular study designs used in this area include a web survey,^[15] postal survey,^[17,21] interview,^[23,25] or questionnaire, as in the present study.^[14,18] Among the seven publications mentioned, four studies^[14,17,21,25] appraised the participants' knowledge. When comparing this study to previously published reports, it must be acknowledged that this study failed to test the physicians' understanding with regard to bioequivalence^[21,25] and therapeutic equivalence.^[14] These represent useful aspects for future studies to investigate.

With regard to the perception domain, Shank *et al.*^[15] noted that older physicians exhibited 3–7.5 times more negative discernment than young physicians, while the results of Tsiantou *et al.*^[18] showed that older physicians were more

likely to prescribe generic medicines than brand-name medicines, which was the same result as found in this study. Moreover, Chua *et al.*^[21] reported that 86.2% of physicians agreed that patients should be provided with adequate information by physicians. Similarly, our study found the physicians to consider that patients should be provided with information about generic medicines. Perceptions regarding local generic medicines were investigated by Jamshed *et al.*^[14] who found that Pakistani physicians did not appreciate the manufacturing process (82.5%) and quality (59.7%) of generic products.

A few prior publications have considered the medicine-related information that physicians have accessed^[14,18] and the factors associated with prescriptions.^[14,21] A large majority of Pakistani and Malaysian physicians reported considering the socioeconomic characteristics of patients when choosing medications.^[14,21] According to Tsiantou *et al.*^[18] and Jamshed *et al.*,^[14] pharmaceutical representatives are an essential source of up-to-date information on medicines in Greece and Karachi, respectively, while our study demonstrated that Vietnamese physicians did not prioritize information given by representatives to the same extent.

It must be noted that this study did have a number of limitations. The majority of participants were male, from urban areas, and experienced physicians. Physicians from the north and central Vietnam were less likely to participate in the survey. As this is the first time, this questionnaire has been used, minor mistakes may exist, and some features of this problem could potentially not be discussed. Furthermore, we were unable to approach most of the hospitals or private clinics in Vietnam and so were unable to determine if there is any bias in our results.

CONCLUSION

The physicians' knowledge was associated with some aspects of their perceptions, which could affect attempts to enhance the use of generic medicines. It is necessary to increase the number and quality of conferences concerning medications, as well as to provide more information about generic medicines for physicians through the internet or scientific articles to improve their knowledge. Vietnamese pharmaceutical companies should employ more policy initiatives to improve their products, especially in terms of their reputation.

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Medical Students' Knowledge, Awareness, Perceptions, and Practice Regarding Contraceptive Use in Vietnam

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Abstract

Context: The danger of unintended pregnancies and the difficulties associated with abortions remain high due to the inefficiency in terms of contraceptive use that results from a lack of general knowledge and awareness coupled with misconceptions on the part of health-care providers. **Aims:** This study, therefore, aimed to explore the knowledge, awareness, perceptions, and practice regarding contraceptive use among Vietnamese medical students. **Settings and Design:** A cross-sectional study was conducted among 695 medical students, including 311 students attending public universities and 384 students attending private universities, in Vietnam between January 2017 and April 2017. **Materials and Methods:** The utilized questionnaire was divided into five parts, namely, the students' demographic data as well as their knowledge, attitudes, perceptions, and practice regarding contraception. **Results:** Among the 695 participating medical students, there were 225 (32.4%) males and 470 (67.6%) females. Some 585 (84.5%) students were studying at the bachelor's level, while only 110 (15.8%) were studying at the diploma level. The contraceptive-related knowledge was comparatively higher among the 5th-year students ($P < 0.001$), the students studying at the bachelor's level ($P < 0.001$), and the students attending public universities ($P < 0.001$) when compared to their respective counterparts. The mean knowledge score was 5.18 ± 1.30 , while the average awareness score was 19.55 ± 3.51 . A large proportion of participants agreed or strongly agreed (86.6%) that healthcare providers should provide counseling concerning contraceptive methods. More than half of the students (55%) agreed that there had been a general change in the male attitude toward using contraceptives, while only 66 (9.5%) agreed that using contraceptive methods is complicated. Further, 177 (25.5%) students had previously used contraception, with condoms (132) being the most commonly used method. **Conclusions:** Overall, it was observed that the majority of Vietnamese medical students exhibited great knowledge, perceptions, awareness, and practice regarding contraception. This study, hence, suggests that future studies should be conducted in different medical schools nationwide to bolster the present findings.

Key words: Awareness, contraception, knowledge, medical student, perception, practice, Vietnam

INTRODUCTION

Contraception impacts on the bodily processes of ovulation, fertilization, and implantation to prevent pregnancy.^[1] The various available contraceptive methods act at different points during the process, and hence they can be grouped according to how they work, including barrier methods, hormonal methods, emergency contraception, intrauterine methods, and sterilization. Each method has its own associated side effects and risks.^[2] The selection of appropriate contraceptive methods depends on the patient's health, age, frequency of sexual activity, desired timing of having

babies, and the need to prevent sexually transmitted infections (STIs).^[2]

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The risk of unintended pregnancies, ectopic and molar pregnancies, as well as STIs, can be reduced by using contraception.^[3] Although the availability of contraceptives is increasing, unintended pregnancies remain a global problem, accounting for up to 30% of all known pregnancies.^[4] In developing countries, there are approximately 74 million unwanted pregnancies each year, with contraceptive failure being responsible for a significant proportion (30%) of all unwanted pregnancies.^[5] Unintended pregnancies (excluding miscarriages) often result in abortion. Recently, Sedgh *et al.* reported that among 85 million unintended pregnancies worldwide, up to 50% ended in abortion.^[6] Another study by Sedgh *et al.* estimated that for every 1000 women aged 15–44 worldwide, there were 35 cases of abortion during the period 2010–2014.^[7] The World Health Organization (WHO) has estimated that 22 million unsafe abortions take place annually, with a large proportion of them occurring in developing countries.^[8] Vietnam is a developing country situated in Southeast Asia. In 2016, it had a population of 90 million.^[9] In 2012, the number of abortions conducted in Vietnam was the highest of any country in Southeast Asia, with a rate of 18 cases per 100 live births.^[10] Unsafe abortions have contributed significantly to the global rate of maternal mortality, which has also been the case in Vietnam. According to the WHO, the maternal mortality rate in Vietnam is around 690/100,000 live births, with complications stemming from unsafe abortions being one of the major causes of maternal deaths.^[8]

One of the barriers that prevent access to contraception is health-care workers who are not sufficiently trained, insufficient in number, and ineffectively managed.^[11] Indeed, the absence of knowledge and awareness, coupled with the false perceptions of health-care workers, could contribute toward the ineffective and insufficient use of contraception in society. Furthermore, medical students will be health-care workers in the future; thus, the knowledge regarding contraception that they gain while at university is vital. However, Hogmark *et al.* noted that medical students in Maharashtra, India, commonly exhibit misconceptions about modern methods of contraception.^[12] Likewise, the research conducted by Sychareun *et al.* reported that the level of knowledge regarding emergency contraceptive pills among young adults in Vientiane, Lao, was relatively low, while the number of misperceptions was high.^[13] A study conducted in Malaysia by Elkalmi *et al.* showed that the knowledge, awareness, and perceptions of pharmacy students were subpar since they lacked in-depth knowledge concerning the importance and effectiveness of contraceptive measures.^[14] Reducing the number of unintended pregnancies and abortions as well as improving young people's sexual and reproductive health are targets of the National Strategy on Population and Reproductive Care 2011–2020 launched by the Vietnamese government.^[15] To achieve these targets, the role of health-care workers in providing counseling concerning contraception as well as medical students who

will be health-care workers in the future is important. This study, therefore, explores the knowledge, awareness, perceptions, and practice (KAPP) of using contraception among medical students in Vietnam.

MATERIAL AND METHODS

Study setting

A cross-sectional study was conducted among 695 medical students, including 311 students attending public universities and 384 students attending private universities, in Vietnam during the 4-month period from January 2017 to April 2017. The objective of the study was to determine the level of KAPP regarding contraception among medical students in Vietnam. In addition, the study sought to evaluate the relationship between the KAPP regarding contraception and the sample characteristics of medical students in Vietnam. Based on the study's findings, solutions will be suggested for improving the KAPP regarding contraception among Vietnamese medical students.

Instruments

The questionnaire used in the present study was developed based on those used in the earlier studies of Elkalmi *et al.*^[14] and Somba *et al.*^[16] after they had been translated into Vietnamese and modified. An online survey questionnaire was designed using Google Forms. The pretesting of the questionnaire was conducted with 15 students from different medical universities to recognize any problems and edit the questionnaire. The students who participated in the pretest were not included in the main research. Some edits were made to certain statements in the awareness and perception sections so as to help the participants better understand them. The questionnaire comprised five sections, namely, personal information, KAPP. Section 1 explored the participants' sociodemographic characteristics including their age, gender, place of birth, year of education, and religion. Section 2 included true/false statements concerning contraceptives. Section 3 and section 4 included statements intended to evaluate the participants' awareness and perceptions, respectively. Section 5 included questions about the practice of using contraceptive methods.

Data collection

A simple random sampling method was used to select the study sample. Medical students were invited to complete a web-based questionnaire. The link to the questionnaire was shared in the Facebook groups of Vietnamese medical universities. All the participants filled out and submitted

their responses regarding their KAPP of using contraception through a web-based questionnaire. Their knowledge and attitudes were assessed on a scale based on the research of Elkalmi *et al.*^[14] In terms of knowledge, one point was given for the correct answer and zero for an incorrect answer. The scale measured knowledge from a maximum of nine to a minimum of zero. A score of ≥ 5 was taken to indicate a good level of knowledge, while a score of < 5 was considered to indicate a poor level of knowledge. With regard to attitudes, a score of one was assigned to “strongly disagree,” two to “disagree,” three to “not sure,” four to “agree,” and five to “strongly agree.” Reverse coding was performed for negatively worded questions. The scale measured the participants' attitudes from a maximum of 35 to a minimum of seven. Scores < 25 were taken to indicate low awareness, while scores ≥ 25 were considered to indicate high awareness.

Statistical analysis

All data were analyzed using Microsoft Excel 2013. A descriptive statistical analysis was used to describe the participants' sociodemographic characteristics as well as their KAPP of using contraceptive methods. Student's *t*-test was used to compare the means between the groups for the normally distributed continuous variables. The Chi-square test was used to determine the association between the sociodemographic variables and the participants' awareness as well as their perceptions of using contraception.

Ethical considerations

Knowledge of the participants ($P < 0.001$) with regard to the level of education, the mean contraceptive knowledge score of the students studying at the bachelor's level was higher than that of those studying at the diploma level (5.26 and 4.74, respectively). Similarly, the mean contraceptive knowledge score of the students attending public universities was higher than that of those attending private universities (5.50 and 4.92, respectively). The 5th-year students were found to be the most knowledgeable regarding contraceptive use among all the students, with a mean knowledge score of 5.75. All the participants had previously heard of certain contraceptive methods, with condoms being known by 100% of the students. Nearly 90% of participants ($n = 602$) believed that male condoms could protect against STIs and hence gave the correct answer. However, for the statement “In order to get birth control pills, a woman must undergo a pelvic exam,” more than 90% ($n = 620$) of participants gave an incorrect answer. In terms of the question regarding whether or not the risk of getting certain types of cancer is due to the sensitivity of this study, the students who participated did so entirely voluntarily. They were not required to provide their name on the questionnaire; therefore, their information was treated with the highest level of confidentiality. The responses given

by the participants were only used for the research purposes of the present study.

RESULTS

Over the 4-month study period, responses were collected from a total of 695 participants. There were 470 female participants (67.6%) and 225 male participants (32.4%). The majority of participants were of Kinh ethnicity (94.5%, $n = 657$) and followed no religion (66.8%). More than 90% of participants were single. The majority of the students were studying at the bachelor's level (84.2%). The percentages of students who attended public universities and private universities were nearly equal, being 44.7% and 55.3%, respectively. Some 267 participants were 3rd-year students, which accounted for the highest proportion of students (38.4%). The participants' demographic characteristics are presented in Table 1.

Table 1 also indicated the association between the mean knowledge scores and the participants' demographic variables. The mean knowledge score of all the participants was 5.18 ± 1.30 . There was a significant association between the level of education, type of university, year of study, and women can be reduced using birth control pills, only 159 participants (23.2%) gave the correct answer. The responses given by the participants in relation to their knowledge of contraception were detailed in Table 2.

Tables 3 and 4 reflected the awareness of the participants regarding contraceptive use. Some 434 participants (62.4%) strongly disagreed that only women are responsible for using contraceptive methods, of which more female students strongly disagreed than male students (73.3% females and 26.7% males, $P < 0.001$). Similarly, 60.9% of participants disagreed or strongly disagreed that contraceptive methods cause more damage than benefits to health, with 53.3% of students attending public universities and 44.7% of students attending private universities either disagreeing or strongly disagreeing ($P < 0.001$). Some 167 3rd-year students (50.2%) agreed or strongly agreed that the use of contraceptive methods among young people will increase the risk of infertility in the future as compared to their counterparts ($P < 0.001$). A large proportion (80.3%) of participants disagreed or strongly disagreed that discussion about contraception with a spouse is embarrassing, with it being more common for students who were single than for those who were married ($P < 0.001$). In general, the mean awareness score of the participants was 19.55 ± 3.51 .

Tables 5 and 6 summarized the perceptions of the participants regarding contraception. More than half of participants (53.2%) were not sure whether using condoms would create less sexual pleasure during sexual intercourse although the female students expressed greater doubt in

Table 1: Association between the mean knowledge scores and the demographic variables (*n* [%])

| Characteristics | Number (%) of participants | Mean (SD) of the knowledge score | P value* |
|--------------------------------------|----------------------------|----------------------------------|----------|
| Gender | | | |
| Male | 225 (32.4) | 5.19 (1.27) | 0.429 |
| Female | 470 (67.6) | 5.17 (1.32) | |
| Ethnicity | | | |
| Kinh | 657 (94.5) | 5.14 (1.28) | 0.101 |
| Other (Tay, Hoa, Nung) | 38 (5.5) | 5.79 (1.61) | |
| Religion | | | |
| Buddhism | 143 (20.6) | 5.04 (1.39) | 0.280** |
| Roman Catholicism | 75 (10.8) | 5.24 (1.09) | |
| None | 464 (66.8) | 5.20 (1.29) | |
| Other (Tin Lanh, Cao Dai, Ba La Mon) | 13 (1.9) | 5.69 (1.80) | |
| Marital status | | | |
| Single | 670 (96.4) | 5.18 (1.29) | 0.330 |
| Married | 25 (3.6) | 5.04 (1.59) | |
| Education level | | | |
| Bachelor | 585 (84.2) | 5.26 (1.32) | <0.001 |
| Diploma | 110 (15.8) | 4.74 (1.14) | |
| Type of university | | | |
| Public | 311 (44.7) | 5.50 (1.32) | <0.001 |
| Private | 384 (55.3) | 4.92 (1.23) | |
| Year of study | | | |
| 1 | 18 (2.6) | 4.56 (1.42) | <0.001** |
| 2 | 128 (18.4) | 4.90 (1.15) | |
| 3 rd | 267 (38.4) | 4.88 (1.28) | |
| 4 th | 162 (23.3) | 5.60 (1.25) | |
| 5 th | 81 (11.7) | 5.75 (1.32) | |
| 6 th | 39 (5.6) | 5.46 (1.19) | |
| Total | 695 | 5.18 (1.30) | |

*Calculated using the *t*-test: Two-sample assuming unequal variances, **calculated using an ANOVA: Single factor

this regard than the male students (77.9% females and 22.1% males, $P < 0.001$). The majority of students (86.6%) agreed or strongly agreed that health-care providers should provide counseling concerning contraceptive methods, the mechanism of action, the best time for use, and possible side effects to all women, with 69.3% of female students agreeing or strongly agreeing with the statement ($P < 0.001$). Some 382 students (55%) agreed that changes in male attitudes toward using contraceptive methods may increase the use of contraception in some areas, while only 66 (9.5%) agreed that using contraceptive methods is complicated.

The practice of using contraception among the participants was detailed in Table 7. Some 177 (25.5%) students had previously used contraception, with condoms ($n = 132$) being the most commonly used method. The other contraception methods used included vaginal diaphragm, emergency oral

contraceptive, vasectomy, spermicides, etonogestrel implant, and intrauterine device (IUD). In terms of choosing a method of contraception, among the students who had previously used contraception, the main reason for choosing a particular method was convenience of use ($n = 166$), followed by no side effects ($n = 94$), difficult to forget ($n = 59$), low cost ($n = 67$), and long-lasting effectiveness ($n = 23$). The most common reasons for using a contraceptive method were fear of pregnancy ($n = 161$) and a desire to avoid STIs ($n = 111$).

DISCUSSION

The aim of this study was to explore the KAPP of using contraception among medical students in Vietnam. A large number of the participants in this study had prior knowledge regarding contraception. We also found that gender, ethnicity,

Table 2: Knowledge of contraception among participants (n=695)

| Statements | Correct responses | Incorrect responses |
|---|-------------------|---------------------|
| Have you ever heard of contraceptive methods? | 695 (100.0) | - |
| The risk of some types of cancer in women can be reduced using oral contraceptives | 159 (23.2) | 526 (76.8) |
| A woman will not get pregnant within at least 2 months after having ceased taking birth control pills | 395 (57.7) | 290 (42.3) |
| Male condoms can protect against sexually transmitted diseases | 602 (87.9) | 83 (12.1) |
| Common side effects of birth control pills include weight gain and mood swings | 419 (61.2) | 266 (38.8) |
| It is safe to have sex during the period of infertility | 314 (45.8) | 371 (54.2) |
| There is an increased risk of breast cancer in women taking estrogen-containing oral contraceptives | 263 (38.4) | 422 (61.6) |
| To get birth control pills, a woman must undergo a pelvic examination | 65 (9.5) | 620 (90.5) |

Data are presented as the number (%) of participants

Table 3: Awareness of contraception among participants (n=695)

| Symbol | Question | Participants' response | | | | |
|--------|--|------------------------|------------|------------|------------|-------------------|
| | | Strongly agree | Agree | Not sure | Disagree | Strongly disagree |
| A1 | Only women take responsibility for using contraceptive methods | 8 (1.2) | 3 (0.4) | 13 (1.9) | 237 (34.1) | 434 (62.4) |
| A2 | Contraceptive methods are more harmful than beneficial to health | 38 (5.5) | 138 (19.8) | 96 (13.8) | 321 (46.2) | 102 (14.7) |
| A3 | Contraceptive methods can protect the health of family and society | 147 (21.2) | 372 (53.5) | 53 (7.6) | 61 (8.8) | 62 (8.9) |
| A4 | The use of contraceptive methods among young people will increase the risk of infertility in the future | 69 (9.9) | 264 (38.0) | 128 (18.4) | 162 (23.3) | 72 (10.4) |
| A5 | Contraceptive pills do not 100% guarantee the avoidance of pregnancy | 174 (25.0) | 324 (46.6) | 73 (10.5) | 72 (10.4) | 52 (7.5) |
| A6 | Women experience side effects related to changes in the usage of contraception that is changing to a safer form of contraceptive | 31 (4.5) | 264 (38.0) | 207 (29.8) | 135 (19.4) | 58 (8.3) |
| A7 | Discussion about contraception with a spouse is embarrassing | 13 (1.9) | 32 (4.6) | 73 (10.5) | 339 (48.8) | 238 (34.2) |

Data are presented as the number (%) of participants

religion, and marital status were all independently associated with knowledge of contraception. The contraception-related knowledge was found to be highest among students studying at the bachelor's level, 5th-year students, and those attending public universities.

Some 100% of participants had previously heard of contraceptive methods, with condoms being the most commonly known method. In Vietnam, condoms are easy to access, since they are sold in many places, such as

drugstores, supermarkets, and convenience stores and they are distributed for free in sex education programs. Yet, for medical students, it is not only important to know about condoms but also to learn about other effective and popular methods of contraception, including IUD, oral contraceptive pills, and so on. Olugbenga *et al.* noted that condoms represent one of the most effective methods of protection against STIs.^[17] In this study, the majority of participants gave the correct answer in relation to this statement. However, most participants answered wrongly in relation to the statement

Table 4: Association between awareness and the demographic variables

| Questions | P value* | | | |
|-----------|----------|--------|----------------|--------------------|
| | Year | Gender | Marital status | Type of university |
| P1 | 0.025 | 0.435 | 0.120 | 0.016 |
| P2 | 0.792 | 0.008 | 0.218 | 0.690 |
| P3 | 0.017 | <0.001 | 0.005 | 0.035 |
| P4 | 0.191 | 0.036 | 0.401 | 0.012 |
| P5 | 0.153 | 0.023 | 0.338 | 0.045 |
| P6 | 0.624 | 0.153 | 0.288 | 0.005 |
| P7 | 0.014 | 0.017 | 0.227 | 0.047 |
| P8 | 0.240 | 0.172 | 0.296 | 0.080 |
| P9 | 0.286 | <0.001 | 0.198 | 0.023 |

Data are presented as the number (%) of participants

Table 5: Perceptions of contraception among participants (n=695)

| Question | P value* | | | |
|----------|----------|--------|----------------|--------------------|
| | Year | Gender | Marital status | Type of university |
| A1 | 0.849 | <0.001 | 0.124 | 0.123 |
| A2 | <0.001 | 0.648 | 0.572 | <0.001 |
| A3 | 0.598 | 0.049 | 0.548 | 0.231 |
| A4 | <0.001 | 0.029 | 0.372 | <0.001 |
| A5 | 0.017 | 0.884 | 0.041 | 0.059 |
| A6 | 0.429 | 0.141 | 0.891 | 0.132 |
| A7 | 0.106 | 0.027 | <0.001 | 0.588 |

*Calculated using the Chi-square test.

“In order to get birth control pills, a woman must undergo a pelvic exam.” The American College of Obstetricians and Gynecologists states that the first visit for oral contraceptives does not have to include a pelvic exam if the patient prefers to postpone it, while Planned Parenthood states that a pelvic exam may be postponed for up to 13 months after starting taking birth control pills.^[18] Fewer students knew about this statement because there is hardly any research on this issue. There is an increased risk of breast cancer among women taking estrogen-containing oral contraceptives, which was corroborated by the research of Beaber *et al.*, who suggested that recent use of contemporary oral contraceptives is associated with an increased breast cancer risk among women aged 20–49 years.^[19] The participants in this study showed relatively poor knowledge in this regard, with 61.6% of participants wrongly answering this question.

The awareness of the participants in this study concerning contraception was relatively low (19.55 ± 3.51), lower than the level of 23.88 ± 3.06 found in the study by Elkalmi *et al.* conducted among pharmacy students in Malaysia.^[14] Nsubuga *et al.* noted that 6% of participants believed that

contraceptives were only for females.^[20] This result is similar to the finding of the present study, which reported that nearly 100% of respondents disagreed or strongly disagreed with this statement. Approximately half of the participants believed that contraceptive use leads to infertility in the future. This rate contrasts with that found in the study by Hagan *et al.*, who indicated that only 18% of participants supported such a statement,^[21] although it is similar to that found in a study conducted in Nigeria, which reported that a high proportion of students perceived contraceptive use to cause infertility.^[22] The surprising finding in this study is that the majority of participants (83%) did not consider discussing contraception with a partner to be embarrassing. This statement was also supported by the majority of participants in the study of Elkalmi *et al.*^[14] A report by Planned Parenthood stated that the pill is 99% effective if used properly, but in reality, the pill is about 91% effective because it can be hard to follow the perfect procedure.^[23] More than half of the students in this study exhibited a good level of awareness of this statement.

The study conducted by Kallner *et al.* indicated that when women postpone childbirth, they achieve higher levels of education and higher incomes.^[3] The result in this regard was relatively similar in the present study since more than half of all participants agreed with this statement. A study by Free *et al.* conducted among young women reported that women can freely enjoy a sexual relationship by means of using contraception.^[24] Approximately one-third of participants in the present study disagreed or strongly disagreed with this statement. The majority of our participants agreed with the significance of introducing sex education, including contraception, at an early age as well as the significance of health-care providers providing counseling services concerning contraception. This finding was also supported by Ramathuba *et al.*^[25] in their study. Binh *et al.* noted that using condoms can reduce the pleasure experienced when having sex,^[26] although nearly 53% of students in the present study expressed great doubt in this regard.

Among the 695 participants, only a quarter had previously used contraception, which is a lower rate than that reported in the study of Somba *et al.*^[16] The findings of this study revealed that the most commonly used method of contraception was condoms. This result is the same as the outcome noted in the study by Hoque *et al.*^[27] although a study conducted in Ethiopia indicated that the most commonly used contraceptive method was the pill.^[28] There are many reasons for choosing a particular contraceptive method, with convenience being the most common reason given by participants in the present study. Yet, among undergraduate female students in China, the primary consideration when choosing contraception was the safety of the method.^[29] Our study found that the main reason for using contraception was to avoid pregnancy, followed by a desire to avoid sexually transmitted diseases. This finding

Table 6: Association between perceptions and the demographic variables

| Symbol | Question | Participants' response | | | | |
|--------|--|------------------------|------------|------------|------------|-------------------|
| | | Strongly agree | Agree | Not sure | Disagree | Strongly disagree |
| P1 | It is unnecessary to purchase contraceptives | 31 (4.5) | 154 (22.2) | 370 (53.2) | 102 (14.7) | 38 (5.5) |
| P2 | Courage is needed to purchase condoms from pharmacies, conventional shops, or dispensaries | 18 (2.6) | 119 (17.1) | 135 (19.4) | 296 (42.6) | 127 (18.3) |
| P3 | Using condoms will generate less sexual pleasure during sexual intercourse | 31 (4.5) | 154 (22.2) | 370 (53.2) | 102 (14.7) | 38 (5.5) |
| P4 | Changes in male attitudes mean that participation in contraception may increase in some areas | 212 (30.5) | 382 (55.0) | 46 (6.6) | 7 (1.0) | 48 (6.9) |
| P5 | Contraceptive can reduce the fear of unwanted pregnancy and afford woman the freedom to enjoy a sexual relationship | 75 (10.8) | 270 (38.8) | 124 (17.8) | 160 (23.0) | 66 (9.5) |
| P6 | Contraceptives allow women to pursue higher education by delaying pregnancy and hence to achieve some measure of economic security | 95 (13.7) | 435 (62.6) | 73 (10.5) | 51 (7.3) | 41 (5.9) |
| P7 | It is complicated to apply contraceptive methods | 8 (1.2) | 66 (9.5) | 130 (18.7) | 436 (62.7) | 55 (7.9) |
| P8 | Sex education, including contraception, should be introduced at an early age | 149 (21.4) | 277 (39.9) | 58 (8.3) | 166 (23.9) | 45 (6.5) |
| P9 | Health-care providers must provide counseling concerning contraceptive methods, the mechanism of action, the best time for use, and possible side effects to all women | 313 (45.0) | 289 (41.6) | 31 (4.5) | 10 (1.4) | 52 (7.5) |

*Calculated using the Chi-square test

is supported by previous studies conducted in Tanzania^[16] and Madagascar.^[30]

It must be acknowledged that this study had a number of limitations. The research was conducted in a number of medical universities, but not all the medical universities in Vietnam. In addition, due to the small sample size, the findings of this study may not be representative of all medical students throughout Vietnam. Hence, this study contributes a significant understanding of the KAPP regarding contraception among medical students. Further research should be conducted in the future to confirm and expand our findings.

CONCLUSION

This study underscores that the KAPP of Vietnamese medical students regarding contraception were below

average. They exhibited some knowledge concerning the importance and effectiveness of contraceptive methods although that knowledge was inadequate and lacked depth. This study could form the basis for a nationwide study investigating the KAPP of all medical students regarding contraception. Advanced contraceptive education in medical universities is necessary to ensure the provision of the best counseling for patients by future health-care workers.

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Table 7: Practice of using contraception among participants (n, [%])

| Question | Frequency (%) |
|--|---------------|
| Ever used contraception (n=695) | |
| Yes | 177 (25.5) |
| No | 518 (74.5) |
| Type of contraceptive used (n=177) | |
| Condom | 132 (74.6) |
| Vaginal diaphragm | 63 (35.6) |
| Emergency oral contraceptive | 55 (31.1) |
| Vasectomy | 16 (9.0) |
| Spermicides | 4 (2.3) |
| Etonogestrel implant | 5 (2.8) |
| IUD | 6 (3.4) |
| Reason for choosing contraception (n=177) | |
| Convenient to use | 166 (93.8) |
| It has no side effects (weight gain, nausea, etc.) | 94 (53.1) |
| Difficult to forget | 59 (33.3) |
| Low cost | 67 (37.9) |
| Long-lasting effectiveness | 23 (13.0) |
| Other | 3 (1.7) |
| Reason for using contraceptive method (n=177) | |
| Fear of pregnancy | 161 (91.0) |
| Health worker advised | 19 (10.7) |
| Avoid sexually transmitted diseases | 111 (62.7) |
| Delaying menstrual cycle | 7 (4.0) |
| Treat acne | 9 (5.1) |
| Followed partner's advice | 10 (5.6) |
| Other | 3 (1.7) |

IUD: Intrauterine device

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Knowledge, Perceptions, and Attitudes Toward Contraceptive Medicine among Undergraduate Students in Southern Vietnam

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Abstract

Aims: This study examined the knowledge, attitudes, and perceptions of Vietnamese university students regarding various contraceptive methods. **Materials and Methods:** The cross-sectional descriptive study was conducted from March 2017 to May 2017. A pre-tested self-administered questionnaire was used to collect the necessary data, including general information as well as the participants' knowledge, awareness, perceptions, and intention regarding contraceptives. **Statistical Analysis used:** The Chi-square, Kruskal–Wallis, and Mann–Whitney U-tests were manipulated to calculate the association between the study variables. **Results:** Of the 1,107 respondents, 100% had previously heard about different contraceptive methods. The results showed that the contraceptive-related knowledge of medical students was higher than that of non-medical students ($P < 0.001$). The majority of participants exhibited a good level of awareness and positive perceptions regarding contraceptives. Some 60% of participants revealed that they would use contraceptives in the future if needed, which indicated a positive attitude and a strong tendency to use contraceptive methods in the future. However, the findings show that the majority of students had inadequate knowledge, awareness, and perceptions about contraceptives. It is hence necessary to develop and provide relevant health education to better empower young people. **Conclusions:** Both the knowledge and awareness of contraceptives among Vietnamese university students are low, while the number of misperceptions is high. This study will contribute to efforts focusing on providing reproductive health education and counseling, as well as demonstrating the importance of using reliable means of communication.

Key words: Attitude, contraceptives, knowledge, perceptions, students, Vietnam

INTRODUCTION

Uncontrollable population increases represent a burden to the economy, resources, labor, and other assets of many developing countries. Worldwide, some 83% of people live in low-development countries characterized by a high fertility rate and a high infant mortality rate as well as low life expectancy.^[1] The global population is predicted to increase to 2.4 billion within 34 years, moving from 7.4 billion at present to 9.8 billion in 2050.^[1] A gap between births not only decreases fertility but also improves mothers' health. The main reasons for morality among females of reproductive age stem from complications arising during pregnancy and childbirth. Mothers' mortality remains unallowable high. Indeed, approximately 830 women die from the complications of pregnancy

or childbirth worldwide each day. In 2015, it was found that roughly 303,000 women died during and after pregnancy and childbirth, with most of the deaths being preventable. In Sub-Saharan Africa, many countries have halved their levels of maternal mortality since 1990. In other areas, including North

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Africa and Asia, even better advances have been made. During the 25-year period from 1990 to 2015, the global maternal mortality rate (i.e., the number of maternal deaths per 100,000 live births) decreased to only 2.3% per year. However, in some countries, the annual decrease in maternal mortality from 2000 to 2010 was over 5.5%.^[2]

According to the World Population Datasheet 2016, the current population of Vietnam is 92.7 million, with the infant mortality rate and total fertility rate being 15 and 2.1, respectively. Further, some 76% of married women aged 15–49 reported using contraception, of which 57% used a modern method.^[1] A 2014 investigation by the General Statistics Office of Vietnam showed that the fertility rate among adolescents for the 3 years between 2010 and 2013 was 45 children per 1000 women aged 15–49, while 6.3% of women aged 15–19 reported having given birth.^[3] Moreover, 75.7% of women who are currently married or living together as husband and wife reported using contraceptive methods.^[3] The most commonly used method is an intrauterine device, which accounts for 28.2% of contraceptive use.^[3]

The use of contraception has increased in many regions worldwide, especially in Latin America and Asia, although it remains low in Sub-Saharan Africa. In general, the use of modern contraception has slightly increased, rising from 54% in 1990 to 57.4% in 2015. In Africa, it has increased from 23.6% to 28.5%. In Asia, it has slightly increased from 60.9% to 61.8%, while in Latin America and the Caribbean, it has remained steady at around 66.7%.^[4] Yet, the unmet need for access to adequate contraception remains too high. This injustice is enhanced by both population explosions and a lack of family planning education. In Latin America and the Caribbean as well as in Asia, the rates of unmet requirements are 10.7% and 10.2%, respectively. In addition, almost 24% of African women who are of reproductive age do not have access to modern contraceptives.^[4]

The present study aimed to assess the knowledge, attitudes, and perceptions regarding contraceptives among university students in Vietnam as well as to analyze the relationship and factors that affect the knowledge, attitudes, and perceptions concerning contraception among this population.

MATERIALS AND METHODS

Study design and data collection

A cross-sectional survey was conducted over a 3-month period from March 2017 to May 2017, with a descriptive and exploratory approach being adopted to assess the knowledge and perceptions of Vietnamese university students toward contraceptive use. Data relevant to the study's objectives and research questions were collected using a self-administered questionnaire. The questionnaire was developed based on various prior studies,^[5–7] and it was divided into four sections,

namely, Section (1), the sociodemographic characteristics of the participants; Section (2), an evaluation of their knowledge regarding contraceptive methods; Section (3), statements about the participants' awareness regarding contraception; and Section (4), their perceptions and behavior in relation to contraceptives. The pretesting of the questionnaire was performed with 15 students to ensure that the participants understood all the questions as well as to examine the reliability and validity of the scales used in our survey. The responses given by these 15 students were not used in the final data analysis.

The participants were asked to respond to individual statements using either “yes,” “no,” or “not sure” for the knowledge assessment. The participants were awarded one point for a correct answer and no points for a wrong or unsure choice. The scale used to measure the participants' knowledge ranged from a maximum of nine points to a minimum of zero points. A score of ≥ 5 points was categorized as indicating a good level of knowledge, while a score of < 5 was interpreted as indicating a bad level of knowledge.^[5]

The participants' awareness was assessed using a five-point Likert scale. The scale ranged from 1 = strongly disagree, 2 = disagree, 3 = not sure, 4 = agree, to 5 = fully agree. Reverse coding was performed for negatively worded questions. The scale used to assess the participants' awareness ranged from a maximum of 35 points to a minimum of seven points. Participants with a score of ≥ 25 were considered to exhibit a high level of awareness, while those with a score of < 25 were considered to exhibit low awareness.^[5] The perception and behavior areas assessed included willingness to pay for contraception, a feeling of embarrassment when seeking contraception, attitudes regarding the use of contraceptive, the safety and convenience of using condoms, and sexual education for teenagers and women.^[6,7]

Data analysis

Data derived from the questionnaire were entered into Microsoft Excel 2016. Descriptive statistics were used in all the sections of the questionnaire, numbers and proportions were calculated, and cross-tabulations with intergroup comparisons were assembled for participants with different sociodemographic information. We applied Student's *t*-test and one-way analysis of variance to compare the means when analyzing the participants' knowledge among the different groups in the study sample. A Chi-square test was performed to determine the association between the independent and dependent variables when the expected cells were five or more in the contingency table.

Ethical considerations

Ethical approval for this study was obtained from the University of Medicine and Pharmacy at Ho Chi Minh City.

Written informed consent was obtained from all participants before completing the questionnaire survey. The collected data were kept confidential using an anonymous voluntary questionnaire that did not record the participants' names. The data were only used for research purposes. The participants were informed about their right to withdraw from the study at any time without incurring any penalty in terms of their healthcare or sexual consultations.

RESULTS

Participation rate

1,200 students were approached and all agreed to participate in the study, which led to a total participation rate of 100%. However, the results presented the responses of just 1,101 participants, since 93 of them gave a lot of item non-responses.

Sociodemographic characteristics

Information regarding the sociodemographic characteristics of the study participants was summarized in Table 1, including the participants' gender, religion, ethnic group, marital status, and level at university. The study population was comprised of 67.9% males and 32.1% females. The majority of participants were from the Kinh ethnic group (94.5%), and most (97.3%) were single. The participants' level at university ranged between the 1st and 6th year.

Knowledge was assessed by awarding one point for the right answer and zero points for a wrong or unsure choice. The scale measured knowledge from a maximum of nine to a minimum of zero. A score of ≥ 5 was interpreted as indicating a good level of knowledge, while a score of < 5 was taken as indicating a poor level of knowledge. The mean knowledge score of the medical students was 5.39 ± 1.37 , which was significantly higher than the non-medical students' mean score of 4.31 ± 1.20 ($P < 0.001$). Overall, the mean knowledge of the study participants was 4.83 ± 1.38 . The P -value* was calculated using the independent samples t -test, while the P -value** was calculated using a one-way analysis of variance.

Contraceptive education and knowledge

Of the 1,107 study participants, 100% indicated that they had previously heard of different contraceptive methods, including condoms (96.4%), emergency oral contraceptive (63.8%), vaginal diaphragm (63.7%), intrauterine device (67.8%), spermicide (36.9%), and Norplant implants (31.5%). The major sources of information were audio-visual media such as TV broadcasts, books, radio, and the internet (68.7%). In addition, 61.8% of participants obtained

information about contraception from school, 49.1% from their friends, and 45.2% from their family.

Table 1 also presented the mean knowledge scores for each demographic group. The mean knowledge score for all the participants was 4.83 ± 1.38 . As expected, the students studying medicine and health care exhibited better knowledge regarding different contraceptive methods than the students studying other disciplines. The medical students' group had a mean score of 5.39 ± 1.37 , which was higher than that of the non-medical students' group at 4.31 ± 1.20 ($P < 0.001$). The participants' level at university was significantly associated with their level of knowledge ($P < 0.001$), as shown in Table 1, while there was no significant difference found between either males and females or single and married students in terms of their knowledge of contraception. Over 46% of participants ($n = 514$) believed that a woman would not be able to get pregnant for at least 2 months after she stopped taking birth control pills. Yet, for the question regarding whether there is an increased risk of breast cancer in women taking estrogen-containing oral contraceptive, only 31.6% ($n = 350$) of participants gave the correct answer. The complete responses of participants to the knowledge questions are presented in Table 2. It can be seen that the proportion of medical students who gave correct answers was always higher than that for the non-medical group for all questions in the knowledge section.

Awareness was evaluated by awarding one point for strongly disagree, two for disagree, three for not sure, four for agree, and five for strongly agree. Reverse coding was performed for negatively worded questions. The scale measured awareness from a maximum of 35 to a minimum of seven. Scores < 25 were taken to indicate low awareness, while scores ≥ 25 were considered to indicate high awareness. The mean awareness score was 19.43 ± 3.56 . The P -value* was calculated using the Chi-square test.

Table 3 showed the participants' responses to the questions regarding their awareness of contraceptive methods. The majority of participants from both the medical and non-medical student groups agreed or completely agreed (74.7% and 71.9%, respectively) that contraceptive methods can protect the health of family and society. Likewise, only 36.2% and 24.7% of medical and non-medical student participants, respectively, disagreed or completely disagreed that the use of contraceptive methods among young people will increase the risk of infertility in the future. Nevertheless, the medical students agreed with this statement to a greater extent when compared to the non-medical students ($P = 0.079$). Moreover, 84.8% and 69.8% of medical and non-medical student participants, respectively, reported that a discussion about contraception with a spouse is not embarrassing, while others saw no need to discuss contraceptives with their parents or partners and actually felt uncomfortable raising the issue. Overall, the mean awareness score of the study participants was 19.43 ± 3.56 .

Table 1: Correlation between knowledge and sociodemographic variables (n=1107)

| General knowledge | Medical students (n=513) | | | Non-medical students (n=594) | | | Total (n=1107) | | |
|---------------------|--------------------------|-----------|----------|------------------------------|-----------|----------|----------------|-----------|----------|
| | n (%) | Mean±SD | P | n (%) | Mean±SD | P | n (%) | Mean±SD | P |
| Gender | | | | | | | | | |
| Male | 165 (32.2) | 5.38±1.36 | <0.001* | 190 (32.0) | 4.47±1.28 | <0.001* | 355 (32.1) | 4.90±1.39 | 0.083* |
| Female | 348 (67.8) | 5.39±1.38 | | 404 (68.0) | 4.24±1.16 | | 752 (67.9) | 4.77±1.39 | |
| Ethnic | | | | | | | | | |
| Kinh | 479 (93.4) | 5.34±1.35 | <0.001* | 567 (95.5) | 4.33±1.19 | 0.010* | 1046 (94.5) | 4.79±1.36 | 0.085* |
| Other | 34 (6.6) | 6.00±1.56 | | 27 (4.5) | 4.00±1.39 | | 61 (5.5) | 5.11±1.78 | |
| Religion | | | | | | | | | |
| Buddhism | 112 (21.8) | 5.20±1.46 | 0.290** | 119 (20.0) | 4.24±1.30 | 0.798* | 231 (20.9) | 4.70±1.46 | 0.568** |
| Catholic-ism | 46 (9.0) | 5.43±1.22 | | 78 (13.1) | 4.38±1.15 | | 124 (11.2) | 4.77±1.28 | |
| Other | 12 (2.3) | 5.83±1.80 | | 7 (1.2) | 4.37±1.13 | | 19 (1.7) | 4.84±1.35 | |
| None | 343 (66.9) | 5.43±1.35 | | 390 (65.7) | 4.33±1.19 | | 733 (66.2) | 4.84±1.38 | |
| Marital status | | | | | | | | | |
| Single | 497 (96.9) | 5.39±1.35 | 0.050* | 580 (97.6) | 4.32±1.20 | 0.020* | 1077 (97.3) | 4.81±1.38 | 0.403* |
| Married | 16 (3.1) | 5.25±1.95 | | 14 (2.4) | 4.14±1.35 | | 30 (2.7) | 4.73±1.76 | |
| Level at university | | | | | | | | | |
| 1 st | 14 (2.7) | 4.57±1.55 | <0.001** | 83 (14.0) | 4.14±1.25 | <0.001** | 97 (8.8) | 4.21±1.30 | <0.001** |
| 2 nd | 79 (15.4) | 5.33±1.15 | | 116 (19.5) | 4.17±1.08 | | 195 (17.6) | 4.64±1.25 | |
| 3 rd | 180 (35.1) | 4.99±1.46 | | 218 (36.7) | 4.39±1.12 | | 398 (36.0) | 4.66±1.32 | |
| 4 th | 131 (25.5) | 5.76±1.25 | | 148 (24.9) | 4.30±1.34 | | 279 (25.2) | 4.99±1.49 | |
| 5 th | 76 (14.8) | 5.84±1.30 | | 19 (3.2) | 4.84±1.34 | | 95 (8.6) | 5.64±1.36 | |
| 6 th | 33 (6.4) | 5.48±1.23 | | 10 (1.7) | 4.90±1.20 | | 43 (3.9) | 5.35±1.23 | |
| Total | 5.39±1.37 | | | 4.31±1.20 | | | 4.83±1.38 | | <0.001* |

*P<0.05, **P<0.01. SD: Standard deviation

Table 2: Participants' knowledge correction regarding contraceptives (n [%])

| Statement - knowledge | Medical students (n=513) | Non-medical students (n=594) | Total (n=1107) |
|--|--------------------------|------------------------------|----------------|
| Have you ever heard of contraceptive methods? | 513 (100) | 594 (100.0) | 1107 (100.0) |
| The risk of some types of cancer in women can be reduced using oral contraceptives | 141 (27.5) | 80 (13.5) | 221 (20.0) |
| A woman will not get pregnant within at least 2 months after having stopped taking birth control pills | 307 (59.8) | 207 (34.8) | 514 (46.4) |
| Male condoms can protect against STDs | 452 (88.1) | 476 (80.1) | 928 (83.8) |
| The common unwanted effects of birth control pills are weight gain and mood swings | 323 (63.0) | 254 (42.8) | 577 (52.1) |
| It is safe to have sex during the period of infertility | 250 (48.7) | 209 (35.2) | 459 (41.5) |
| The risk of breast cancer is increased in women taking estrogen-containing oral contraceptives | 219 (42.7) | 131 (22.1) | 350 (31.6) |
| To get birth control pills, a woman must undergo a pelvic examination | 53 (10.3) | 28 (4.7) | 81 (7.3) |

STDs: Sexually transmitted diseases

Perceptions of contraceptives

Approximately 90% of participants strongly disagreed with the statement “it is unnecessary to purchase contraceptives”.

However, more than a quarter of the students (25.9%) stated that they needed courage to purchase condoms from pharmacies, conventional shops, or dispensaries. It was further reported that 51.1% of medical students agreed that

Table 3: Participants' awareness regarding contraceptives

| Awareness | Strongly agree | | Agree | | Not sure | | Disagree | | Strongly disagree | | P* |
|--|----------------|------------|------------|------------|------------|------------|------------|------------|-------------------|------------|-------|
| | (a) | (b) | (a) | (b) | (a) | (b) | (a) | (b) | (a) | (b) | |
| Only women take responsibility for using contraceptive methods | 311 (60.6) | 390 (65.7) | 181 (35.3) | 180 (30.3) | 10 (1.9) | 10 (1.7) | 3 (0.6) | 7 (1.2) | 8 (1.6) | 7 (1.2) | 0.796 |
| Contraceptive methods are more harmful than beneficial to health | 80 (15.6) | 65 (10.9) | 253 (49.3) | 200 (33.7) | 65 (12.7) | 117 (19.7) | 90 (17.5) | 155 (26.1) | 25 (4.9) | 57 (9.6) | 0.002 |
| Contraceptive methods can protect the health of family and society | 50 (9.7) | 41 (6.9) | 43 (8.4) | 63 (10.6) | 37 (7.2) | 63 (10.6) | 276 (53.8) | 313 (52.7) | 107 (20.9) | 114 (19.2) | 0.576 |
| The use of contraceptive methods in young people will increase the risk of infertility in the future | 55 (10.7) | 47 (7.9) | 131 (25.5) | 100 (16.8) | 102 (19.9) | 118 (19.9) | 179 (34.9) | 245 (41.2) | 46 (9.0) | 84 (14.1) | 0.079 |
| Contraceptive pills do not 100% guarantee avoidance of pregnancy | 40 (7.8) | 35 (5.9) | 58 (11.3) | 59 (9.9) | 55 (10.7) | 139 (23.4) | 236 (46.0) | 263 (44.3) | 124 (24.2) | 98 (16.5) | 0.023 |
| Women's experiences of unwanted effects are related to change to a safer form of contraceptive | 44 (8.6) | 36 (6.1) | 95 (18.5) | 96 (16.2) | 153 (29.8) | 230 (38.7) | 200 (39.0) | 188 (31.6) | 21 (4.1) | 44 (7.4) | 0.158 |
| Discussion about contraception with a spouse is embarrassing | 177 (34.5) | 144 (24.2) | 258 (50.3) | 271 (45.6) | 49 (9.6) | 113 (19.0) | 23 (4.5) | 50 (8.4) | 6 (1.2) | 16 (2.7) | 0.016 |

The P value* was calculated using the Chi-square test. (a): Medical students, (b): Non-medical students

contraceptives allow women to pursue higher education by delaying pregnancy and hence help them to gain some measure of economic security. The non-medical students agreed with this point of view to a lesser extent, although the strength of the difference was only small (46.1%, $P = 0.102$). The participants' perceptions of contraceptives are tabulated in Table 4. Comparisons were made for all the questions in this section using the Chi-square test, which revealed no significant differences between the medical students' and non-medical students' responses.

Attitudes toward contraception use

Only 22.1% ($n = 245$) of participants revealed that they or their partners had previously used contraceptives. Of those who had used them, almost 80% ($n = 195$) had used condoms, 33.5% ($n = 82$) had used emergency oral pills, and 27.8% ($n = 68$) had used vaginal diaphragm. The reported preferences regarding contraceptive methods ranged from 51.4% who preferred condoms due to their convenience and simplicity to 12.7% who preferred contraceptive pills. A large proportion of participants (49.6%) expressed negative perceptions of pills due to the perceived unwanted side effects, including "weight gain" and "mood swings."

Of the 862 participants (77.9%) who had never previously used contraceptives, 67.1% ($n = 578$) reported the reason for this being not having sexual relations or a demand for natural sex. Some 17% felt afraid of the potential side effects when using contraceptive methods. Other reasons for the reported non-usage of contraception were "boyfriend did not allow it" (3.7%, $n = 32$), "religious abstinence" (7.0%, $n = 60$), or perhaps surprisingly, "they wanted to get pregnant" (12.2%, $n = 105$). When asked about their future use of contraception if required, almost 60% ($n = 505$) of participants said that they would use contraceptives, thereby exhibiting a positive attitude that indicates a strong tendency to use contraceptive methods in the future. Those 350 subjects (41.4%), who stated that they would not use contraception in the future or were not sure whether they would, reported being concerned about potential health disadvantages or a lack of effectiveness.

Relationship between attitudes and knowledge

The relationship between the attitudes and knowledge exhibited by the participants was examined using the Mann-Whitney U-test. Knowledge was considered to be a categorical variable (good and poor), while each question concerning attitude was assessed by awarding five points to "strongly agree" and one point to "strongly disagree." Reverse coding was performed for negatively worded questions. The maximum overall score for each participant was 35, while the minimum was seven. There was a statistically significant association between the participants' knowledge and attitudes regarding contraceptives. This suggested that students with a good level of knowledge generally showed

Table 4: Participants' perceptions toward contraceptives (n [%])

| Perception | Strongly agree | | Agree | | Not sure | | Disagree | | Strongly disagree | | P* |
|---|----------------|------------|------------|------------|------------|------------|------------|------------|-------------------|------------|-------|
| | (a) | (b) | (a) | (b) | (a) | (b) | (a) | (b) | (a) | (b) | |
| It is unnecessary to purchase contraceptives | 206 (40.2) | 209 (35.2) | 269 (52.4) | 319 (53.7) | 19 (3.7) | 29 (4.9) | 15 (2.9) | 25 (4.2) | 4 (0.8) | 12 (2.0) | 0.704 |
| It is embarrassing to ask for condoms from pharmacies, conventional shops, or dispensaries | 102 (19.9) | 71 (12.0) | 216 (42.1) | 214 (36.0) | 97 (18.9) | 133 (22.4) | 88 (17.2) | 141 (23.7) | 10 (1.9) | 35 (5.9) | 0.023 |
| Using condoms will generate less sexual pleasure during intercourse | 32 (6.2) | 17 (2.9) | 81 (15.8) | 60 (10.1) | 265 (51.7) | 357 (60.1) | 114 (22.2) | 130 (21.9) | 21 (4.1) | 30 (5.1) | 0.073 |
| Changes in male attitudes mean that increased participation in contraception may increase the usage rate of contraception in some areas | 37 (7.2) | 33 (5.6) | 5 (1.0) | 10 (1.7) | 37 (7.2) | 57 (9.6) | 273 (53.2) | 329 (55.4) | 161 (31.4) | 165 (27.8) | 0.747 |
| Contraceptives can reduce the fear of unwanted pregnancy and afford woman the freedom to enjoy a sexual relationship | 51 (9.9) | 52 (8.8) | 122 (23.8) | 114 (19.2) | 78 (15.2) | 150 (25.3) | 207 (40.4) | 222 (37.4) | 55 (10.7) | 56 (9.4) | 0.225 |
| Contraceptives allow women to pursue higher education by delaying pregnancy and therefore help them to achieve some measure of economic security | 35 (6.8) | 20 (3.4) | 39 (7.6) | 60 (10.1) | 51 (9.9) | 97 (16.3) | 315 (61.4) | 352 (59.3) | 73 (14.2) | 65 (10.9) | 0.102 |
| It is complicated to apply contraceptive methods | 43 (8.4) | 34 (5.7) | 318 (62.0) | 291 (49.0) | 91 (17.7) | 190 (32.0) | 58 (11.3) | 66 (11.1) | 3 (0.6) | 13 (2.2) | 0.016 |
| Sex education, including contraception, should be introduced at an early age | 30 (5.8) | 45 (7.6) | 123 (24.0) | 126 (21.2) | 43 (8.4) | 53 (8.9) | 206 (40.2) | 231 (38.9) | 111 (21.6) | 139 (23.4) | 0.916 |
| Health-care providers must provide counseling about contraceptive methods, the mechanism of action, the best time to use them, and possible side effects to all women | 42 (8.2) | 26 (4.4) | 8 (1.6) | 11 (1.9) | 25 (4.9) | 35 (5.9) | 205 (40.0) | 284 (47.8) | 233 (45.4) | 238 (40.1) | 0.236 |

(a): Medical students, (b): Non-medical students. The P value* was calculated using Chi-square test

positive attitudes toward the utilization of contraceptives (Mann–Whitney $U = 131,432.5$, $P = 0.000$).

DISCUSSION

Overall, the participants showed a generally inadequate level of knowledge regarding contraceptive methods as well as misconceptions about the safety of using them. However, the results of this study suggested that university students were knowledgeable about different methods of contraception, including condoms, intrauterine device, emergency oral pills, and vaginal diaphragm. The results were therefore in line with those of other studies, which indicated that condoms were the most commonly used method of contraception due to the perceived advantages, simplicity, and convenience.^[8] Condoms were considered to decrease the risk of sexually transmitted diseases (STDs) such as HIV/AIDS, human papillomavirus, hepatitis B, and genital herpes.^[9,10] However, almost 16% of participants in this study disagreed with this statement. The medical students were better informed regarding the utilization and protection that condoms afford against STDs. We also found that the intention to use condoms and other contraceptives on the part of female students was similar to that of male students, which led to the not surprising outcome that both boys and girls felt responsible for using contraceptives and taking care of their reproductive health.

Recent studies have revealed that contraceptive pills containing estrogen might cause breast cancer.^[11,12] The students who participated in this study exhibited a poor level of understanding in this regard, with 68.4% responding wrongly to this question. This was similar to the findings of a study conducted in Malaysia, wherein 68.9% of participants also gave incorrect responses.^[5] However, a cross-sectional survey conducted in India showed contrasting results, with over 70% of participants agreeing with this statement.^[6]

There is significant doubt regarding the correlation between contraception utilization and infertility among young people. Much has previously been written about the effect of contraceptives on the risk of infertility, and the findings of the present study revealed that approximately half of all participants did not know or were confused about whether contraceptives would lead to infertility. These results were more positive than those of a study conducted in Malaysia, in which over two-thirds of participants reported being unsure about this issue,^[5] while only 18% of adolescents in senior high schools in the central region of Ghana exhibited good awareness about this issue.^[13] Surprisingly, a higher number of non-medical students gave correct answers to this question (55.3% vs. 43.9% for non-medical and medical students, respectively). However, $P = 0.079$ suggested that while there did exist a disparity, the statistical difference was not significant. Nevertheless, the safety of emergency oral pills and contraceptive pills

has been approved by the World Health Organization and the US Food and Drug Administration, since there is no evidence of fetal abnormalities or an increased risk of later abnormal fetal development. Despite the reported concerns regarding the safety and effectiveness of contraceptives, the woman in a previous study was willing to use them if necessary because they seemed safer than abortions.^[14] Thus, 30% of participants in this study who stated that they would never use contraceptives in the future due to being afraid of experiencing health disadvantages or a lack of effectiveness suggested the need for awareness programs to acknowledge that contraceptives are safe and effective and that their advantages outweigh their risks in most circumstances.

Two-thirds of the participants in this study believed that oral contraceptive pills did not 100% prevent unwanted pregnancy. These results were also supported by Elkalmi *et al.*^[5] in their study, in which almost 90% of participants agreed with this statement. Based on a report by the US Health and Human Services, five to nine of every 100 women who use birth control pills each year may experience unplanned pregnancies.^[15] A comparison between the medical and non-medical students indicated a difference of opinion regarding the statement “it is uncomfortable and embarrassing to discuss contraception with others.” Fewer students from the medical universities agreed or strongly agreed with this when compared to the non-medical students (5.7% vs. 11.1% for the medical and non-medical students, respectively, $P = 0.016$). This was in line with the findings of previous reports.^[5,6,13] This finding was further supported by Ramathuba *et al.*,^[7] who reported that the adolescents who participated in their study could not discuss contraceptives with their parents or partners.

Contraception has been found to afford women the freedom to engage in sexual intercourse without fear of unintended pregnancies as well as the possibility to attend higher education.^[5] This finding was also supported by the study of Hogmark *et al.*,^[6] who found that sex education encouraged young adults to have sex. The participants' answers in the present study were not particularly different, since about half of them agree or strongly agree with the statement. The majority of study participants believed that using contraceptive methods was very complicated. This finding was supported by the study of Hagan and Buxton,^[13] which indicated that contraceptive pills were considered inconvenient and difficult to use.

A large number of students in this study obtained information about contraceptives from their parents, friends, or siblings, which was in accordance with the findings of previous studies.^[16,17] Unfortunately, these informal networks could prove to be untrustworthy and lead to the spreading of misinformation, while medical and media sources were associated with better and more reliable knowledge. Therefore, it is suggested that there exists a need to provide

sex education and information regarding contraceptives at the primary school level. Further, more programs about this issue should be featured in the media, such as TV, radio, and the internet, while counseling services concerning contraceptives should be offered by health-care providers. This notion was agreed with by the majority of participants in the present study, which was in accordance with the findings of previous studies conducted by Ramathuba *et al.*^[7] and Elkalmi *et al.*^[5]

It must be recognized that this study did have a number of limitations. Firstly, the study was conducted in only selected universities, which might limit the generalizability of the findings to all university students in Vietnam. However, by selecting multiple universities from across the country, we believe that our results are fairly representative of Vietnamese university students in general. Secondly, sexual issues are of a sensitive nature; thus, the participants' free expression and honesty might be constrained. Thirdly, the method of using an anonymous self-administered questionnaire lacks consistency in terms of identifying all misunderstandings in spite of the attendance of a researcher in the field. To minimize this limitation, we ensured the confidentiality and privacy of the participants. Some study assistants attended the classroom to answer any possible questions given by participants while collecting data, and we also confirmed that the questionnaire was as simple and understandable as possible.

CONCLUSION

Despite the acknowledged limitations, this study provides valuable information regarding the knowledge, awareness, perceptions, and attitudes toward contraceptives among Vietnamese university students. Overall, we conclude that both the knowledge and awareness of contraceptives among Vietnamese university students are low, while the number of misperceptions is high. It is our hope that this study will contribute to efforts focusing on providing reproductive health education and counseling, as well as demonstrating the importance of using reliable means of communication such as medical and media sources to spread accurate information, which have previously been found to be associated with good knowledge regarding contraceptives.

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Current Status of Knowledge about and Attitudes Toward the Hepatitis B Virus at A Private University in Southern Vietnam: A Cross-sectional Self-reported Study

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Abstract

Context: Hepatitis B is a common infectious disease and can be life-threatening. The rate of hepatitis B virus (HBV) infection is increasing, especially in developing countries, including Vietnam. Aims: The aim of this study is to explore knowledge about and attitudes toward HBV among undergraduate students at a private university in southern Vietnam. **Subjects and Methods:** A cross-sectional self-reported study was carried out among 535 undergraduate pharmacy students between December 2017 and February 2018 at the Faculty of Pharmacy, Lac Hong University. All data analysis was performed using SPSS 20.0. **Results:** Out of 620 distributed questionnaires, 535 were returned - a response rate of 86.3%. Out of a total of 535 students surveyed, 174 (32.5%) were male and 361 (67.5%) were female pharmacy students. Overall, there was not a significant variance in knowledge between males and females regarding the knowledge about hepatitis B. However, the attitude score of females was higher than that of males, with a mean score of 3.37 ± 0.09 for males and 3.42 ± 0.14 for females. There was no difference in knowledge between males and females, but there was a difference in attitudes toward hepatitis B vaccination. **Conclusions:** The overall knowledge of pharmacy students showed satisfactory outcomes. However, it is necessary to improve attitudes about HBV vaccine by disseminating information to students and the public, especially by showing friends and family the relevant HBV information and conducting a health education campaign for people to help them adopt proper attitudes toward a self-care educational program.

Key words: Attitude, hepatitis B virus, knowledge, pharmacy, private, student, Vietnam

INTRODUCTION

Hepatitis B is the leading cause of chronic hepatitis, cirrhosis, and hepatocellular carcinoma (HCC), which is life-threatening.^[1] Previous epidemiological studies have shown that people who are chronically infected with hepatitis B virus (HBV) are 200 times more likely to develop HCC than those who are not infected.^[2] The World Health Organization (WHO) estimated that 788,000 people die from primary liver cancer per year. Southeast Asia has the highest prevalence of chronic HBV infection in the world, with 130 million people infected with chronic HBV, which is highest in the 18–45 age group.

According to the WHO, chronic hepatitis B and C infections has serious consequences, accounting for more than half of the 100 million deaths reported, of which 43% were due to hepatitis B, and the rest

(17%) were due to hepatitis C infection. In 2015, worldwide more than 325 million people were living with chronic hepatitis B and hepatitis C.^[3]

Each year, approximately 600,000 people die from HBV infection, almost half of them in Asia (PATH, 2014). Vietnam is the country with a high prevalence of hepatitis B. In fact,

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8.6 million Vietnamese have tested positive for this illness. An estimated 8.8% of females and 12.3% of male are infected with HBV.^[4] Children, in particular, are highly vulnerable. Approximately 80–90% of infants get infected during the very 1st year of life, causing chronic infections which can cause death from virus-related conditions, including liver cancer.^[5]

Moreover, exposure to HBV usually results in self-limiting infection and may be asymptomatic or be presented as acute hepatitis, which is usually accompanied by immunity.^[2,6] Hepatitis B is an acute systemic infection which mainly affects the liver and is usually transmitted by the parenteral route. In most cases, HBV exposure is due to accidental contact with human blood or other body fluids during sexual and nonsexual contacts. In Vietnam, only around 8% of the population is chronically infected with hepatitis B, although most Vietnamese are unaware of their status. The main route of hepatitis B transmission in Vietnam is from mother to her fetus.^[7] Occupational infectious diseases, including hepatitis B, have been reported among healthcare workers (HCWs) in developing countries. A study from the Lao People's Democratic Republic showed that 86.5% of medical students there have a poor understanding of HBV's route of transmission.^[8] Testing and diagnosis of HBV/HCV infection are the only way to implement prevention as well as care and treatment services. Those are crucial components of an effective response to the hepatitis epidemic. A new generation of vaccines that have been genetically engineered, synthesized, and do not contain any blood products was developed in 1986 and is currently going through an approval process in the United States. Approximately 80% of all liver cancer cases are caused by hepatitis B. Thus, a certain type of vaccine which is the first type of protection against hepatitis B infection can also help prevent liver cancer.^[9]

HCWs are at high risk of contracting blood-borne infections in health-care settings, including HBV infection.^[10] The factors that contribute to the rising worldwide prevalence of HBV are of particular relevance in developing countries: Lack of awareness and lack of knowledge. It is worth mentioning that HCWs are not only medical staff such as nurses and doctors but also pharmacists who practice medicine and pharmacy. In other words, enhancing awareness of and changing attitudes toward chronic diseases in general and hepatitis B, in particular, is essential and urgent for HCWs and students in the health sector. Because medical and pharmacy students will be in direct contact with patients infected with hepatitis B in guiding patients infected to use correct medication and providing knowledge about hepatitis B for the people.

Moreover, their general knowledge of and attitude toward hepatitis B and its transmission and prevention by vaccination will go a long way toward safeguarding the well-being of these young people, who play a key role in providing health information and can stop this disease in society.^[11,12] The study was undertaken to evaluate knowledge about and attitudes

toward HBV among undergraduates at a private university in the southern part of Vietnam.

SUBJECTS AND METHODS

Study design

A cross-sectional self-reported study was carried out among pharmacy students between December 2017 and February 2018 at the Faculty of Pharmacy, Lac Hong University, Dongnai province. This province is located in the southeast of Vietnam, 30 km from Ho Chi Minh City. It is one of Vietnam's most populous provinces (ranked fifth) with a population of 2.84 million in 2014.^[13] The province is located in the Southeast Economic Region, the most economically dynamic part of the country.

Lac Hong University has experienced many years of development in the field of education. It is a multidisciplinary university which is open to the pharmaceutical to provide quality pharmaceutical personnel, meeting the development needs of society.

Population, sample size, and determination

The sample size was calculated using the following formula with a 95% confidence level ($Z^2 = 1.96$); with 50% proportion and 5% margin of error.

$$N = \frac{Z^2 \times P(1 - P)}{d^2}, N = \frac{1.96^2 \times 0.5(1 - 0.5)}{0.05^2} = 384$$

According to the theory, the sample needs 384 with 10% loss. Therefore, the total sample should be 423. However, in fact, the study has collected 535 (86.3%) valid in 620 samples emitted that is to increase credibility in the research process.

The internal consistency was assessed using Cronbach's alpha unit ($\alpha = 0.7$). The study was conducted at one academic institution, Lac Hong University and was followed by the systematic random sampling technique. The study instrument used was a pre-designed and pre-tested structured questionnaire for face-to-face data collection. The respondents filled out the questionnaires, and the questionnaires were subsequently collected after completion (direct interviews). Demographic data were collected while the questionnaire was distributed. The data included gender, year of study, type of job, cohabitants, and monthly expenses.

Research tool

A self-administered questionnaire was developed based on the previous work of certain scientists (Lee *et al.*, 2007; Taylor *et al.*, 2002) and the norms of Vietnamese culture. The questionnaire includes questions on various aspects of

hepatitis B. Each one consists of three parts, comprising 34 items questionnaires. Part 1 includes 12 questions regarding demographic characteristics, while Part 2 includes 18 questions which aim to explore students' knowledge of HBV's route of transmission, symptoms, and complications. The last part contains seven questions to assess student attitudes toward HBV vaccination. The questionnaire was used to collect information about the demographic characteristics of the respondents, their knowledge of hepatitis B, and the attitude among pharmacy students concerning hepatitis B vaccination.

The questionnaires utilized the Likert five-point scale which enables an individual to express how much they agree or disagree with each question. The mean knowledge score and attitude score were determined based on gender, with five options regarding the level of agreement: From strongly disagree, slightly disagree, and neutral to slightly agree, and strongly agree.

Data analysis

The collected data which were input using SPSS 20.0 software was utilized for the data analysis in this study. To examine the demographic characteristics of the study, both frequency analysis and descriptive statistics were calculated, such as mean \pm standard deviation (SD). Both descriptive statistics for the prevalence and the Pearson Chi-square particle correlation test were used to check the correlation

between quantitative social variables, according to gender, year of study, and monthly expenses (US dollars). Correlation analysis was conducted to examine the relationship between knowledge, attitude toward HBV, and attitude toward HBV vaccination. The continuous variables were represented by mean, SD, median, and range (25th–75th percentile), while the categorical variables were measured in percent and the significance level set at $P = 0.05$.

Bivariate and multivariate analysis was used to check the relationship between the outcome variables (mean knowledge and attitude) and sociodemographic characteristics (gender, expenditure, and year of study).

Ethical considerations

The study was approved by the Faculty of Pharmacy, Lac Hong University. Written informed consent was obtained from participants involved in the study before the specimen collection and questionnaire survey.

RESULTS

In the sample of 535 subjects, there were 174 males (32.5%) and 361 females (67.5%). In particular, there were 66 freshmen (12.3%), 102 sophomores (19.1%), 66 juniors (12.3%), 36 seniors (6.7%), and 265 students in their 5th year

Table 1: Overall knowledge and attitude by sociodemographic characteristics, Lac Hong University, Dongnai Province, 2017 ($n=535$, $n[\%]$)

| Characteristics | Male | Female | Total |
|-----------------------|------------|------------|-------------|
| Gender | 174 (32.5) | 361 (67.5) | 535 (100.0) |
| Year of study | | | |
| 1 st | 23 (4.3) | 43 (8.0) | 66 (12.3) |
| 2 nd | 39 (7.3) | 63 (11.8) | 102 (19.1) |
| 3 rd | 19 (3.6) | 47 (8.7) | 66 (12.3) |
| 4 th | 8 (1.5) | 28 (5.2) | 36 (6.7) |
| 5 th | 85 (15.9) | 180 (33.7) | 265 (49.6) |
| Part-time job | | | |
| No | 103 (19.3) | 254 (47.4) | 357 (66.7) |
| Yes | 71 (13.3) | 107 (20.0) | 178 (33.3) |
| Locality | | | |
| Urban | 129 (24.1) | 295 (55.2) | 424 (79.3) |
| Rural | 45 (8.4) | 66 (12.3) | 111 (20.7) |
| Cohabitants | | | |
| Parents | 64 (12.0) | 151 (28.2) | 215 (40.2) |
| Relatives | 30 (5.6) | 68 (12.7) | 98 (18.3) |
| Friends | 24 (4.5) | 76 (14.2) | 100 (18.7) |
| Alone | 43 (8.0) | 53 (9.9) | 96 (17.9) |
| Others ^(a) | 13 (2.4) | 13 (2.5) | 26 (4.9) |

(Contd...)

Table 1: (Continued)

| Characteristics | Male | Female | Total |
|---|------------|------------|-------------|
| Monthly expense (USD)* | | | |
| <90 | 46 (8.6) | 105 (19.6) | 151 (28.2) |
| 90–<130 | 61 (11.4) | 141 (26.4) | 202 (37.8) |
| 130–<180 | 29 (5.4) | 59 (11.0) | 88 (16.4) |
| ≥ 180 | 38 (7.1) | 56 (10.5) | 94 (17.6) |
| Do you think it's enough for your life? | | | |
| Yes | 131 (24.5) | 274 (40.5) | 348 (65.0) |
| No | 43 (8.0) | 87 (27.0) | 187 (35.0) |
| Have you been immunized with HBV vaccine? | | | |
| Yes | 111 (20.7) | 237 (44.3) | 348 (65.0) |
| No | 63 (11.8) | 124 (23.2) | 187 (35.0) |
| Why do no you want to be vaccinated? | | | |
| Do not know where to get vaccinated | 63 (33.7) | 124 (66.3) | 187 (100.0) |
| The vaccine is too expensive | 14 (7.5) | 23 (12.3) | 37 (19.8) |
| Fear of side effects of the vaccine | 4 (2.1) | 11 (5.9) | 15 (8.0) |
| Fear of side effects of the vaccine | 5 (2.7) | 10 (5.3) | 15 (8.0) |
| Fear some needles | 9 (4.8) | 24 (12.8) | 33 (17.6) |
| No fear of catching HBV | 7 (3.7) | 7 (3.7) | 14 (7.4) |
| Others ^(b) | 24 (12.9) | 49 (26.3) | 73 (39.2) |
| Do you intend to get vaccinated for HBV? | | | |
| Yes | 39 (20.9) | 101 (54.0) | 140 (74.9) |
| No | 24 (12.8) | 23 (12.3) | 47 (25.1) |
| The willingness to pay for vaccination (USD)* | | | |
| <15 | 26 (13.9) | 49 (26.2) | 75 (40.1) |
| 15–<20 | 16 (8.6) | 33 (17.6) | 49 (26.2) |
| 20–<30 | 12 (6.4) | 36 (19.3) | 48 (25.7) |
| ≥ 30 | 9 (4.8) | 6 (3.2) | 15 (8.0) |

(^a): Dormitory, rented house, (^b): Do not know HBV can be infected, do not like, *USD: US Dollar. HBV: Hepatitis B virus

(49.6%). With regard to cohabitants, there were 215 students (40.2%) living with parents, while 98 of them (18.3%) were living with other relatives, 100 (18.7%) with friends, and 22.8% with others, and more than three-quarters of students lived in urban areas. The number of students intending to get vaccinated was 74.9% while 47 students (25.1%) not intending to get hepatitis B vaccination. The adolescents' demographic characteristics are shown in Table 1.

In this study, the average score for students' knowledge toward HBV was 3.51 ± 0.18 (ranging from 2.0 to 5.0). In general, the knowledge of hepatitis B transmission, symptoms, and complications did not differ much between genders; the mean score was 3.51 ± 0.19 . With respect to the attitude question "only children aged from 0 to 10 years need to be vaccinated for HBV," more than half of the surveyed students answered this question incorrectly. The proportions of each gender responding to each individual question in the knowledge and attitude sections are shown in Table 2.

Regarding knowledge and attitudes toward HBV infection and vaccination by year of the study, overall less than half of the students knew that hepatitis B was not genetic in origin, while only 18.2% of the 1st year students, 35.3% of the 2nd-year, and a third of the 3rd–5th-year students knew this ($P = 0.002$). There was no difference between students' cohorts with regard to HBV symptoms and complications (80% students responded correctly) [Table 3].

There were no significant differences with regard to monthly expenditures ($P > 0.05$) and Monthly individual expenditure does not affect knowledge or attitudes about hepatitis B vaccination in this study. Most of the students (60%) knew that HBV was not transmitted through the air ($P = 0.027$). More than 70% of them answered correctly that HBV can be transmitted through contaminated needles that were previously used by infected people. Half of the students (50%) thought that it was necessary to get newborn babies vaccinated within a few hours after birth, while 25% of them thought the opposite, and 15% of them reported that they

Table 2: The proportion of gender providing the answer for each individual section and the total score ([n=535], n[%])

| Items | Gender | | | | | | Mean score±SD | | Total | | χ ² (P) |
|-----------|--------------|------------|------------|----------------|------------|------------|---------------|----------------|-----------|---------------|--------------------|
| | Male (n=174) | | | Female (n=361) | | | Male (n=174) | Female (n=361) | Mean±SD | IQR (25–75) | |
| | 1 | 2 | 3 | 1 | 2 | 3 | | | | | |
| Knowledge | | | | | | | | | | | |
| K1 | 65 (37.4) | 26 (14.9) | 83 (47.7) | 117 (32.4) | 47 (13.0) | 197 (54.6) | 3.09±1.47 | 3.25±1.45 | 3.20±1.46 | 4.0 (2.0–4.0) | 2.221 (0.329) |
| K2 | 114 (65.5) | 23 (13.2) | 37 (21.3) | 254 (70.4) | 44 (12.1) | 63 (17.5) | 2.22±1.34 | 2.09±1.26 | 2.13±1.29 | 2.0 (1.0–3.0) | 1.413 (0.493) |
| K3 | 110 (63.2) | 23 (13.2) | 41 (23.6) | 200 (55.4) | 62 (17.2) | 99 (27.4) | 3.70±1.37 | 3.42±1.40 | 3.51±1.39 | 4.0 (2.0–5.0) | 3.063 (0.216) |
| K4 | 80 (46.0) | 28 (16.1) | 66 (37.9) | 266 (73.7) | 52 (14.4) | 43 (11.9) | 3.90±1.16 | 3.93±1.14 | 3.92±1.14 | 4.0 (3.0–5.0) | 53.176 (0.000) |
| K5 | 80 (46.0) | 28 (16.1) | 66 (37.9) | 147 (40.7) | 71 (19.7) | 143 (39.6) | 2.80±1.51 | 2.91±1.43 | 2.87±1.46 | 3.0 (1.0–4.0) | 1.661 (0.436) |
| K6 | 140 (80.5) | 23 (13.2) | 11 (6.3) | 286 (79.2) | 43 (11.9) | 32 (8.9) | 4.17±0.98 | 4.08±1.06 | 4.11±1.04 | 4.0 (4.0–5.0) | 1.129 (0.569) |
| K7 | 95 (54.6) | 41 (23.6) | 38 (21.8) | 198 (54.8) | 78 (21.6) | 85 (23.5) | 3.44±1.26 | 3.38±1.32 | 3.40±1.30 | 4.0 (3.0–4.0) | 0.352 (0.839) |
| K8 | 144 (82.8) | 14 (8.0) | 16 (9.2) | 299 (82.8) | 38 (10.5) | 24 (6.6) | 1.69±1.12 | 1.67±1.03 | 1.68±1.06 | 1.0 (1.0–2.0) | 1.762 (0.414) |
| K9 | 140 (80.5) | 22 (12.6) | 12 (6.9) | 286 (79.2) | 39 (10.8) | 36 (10.0) | 4.16±1.02 | 4.08±1.11 | 4.11±1.09 | 4.0 (4.0–5.0) | 1.609 (0.447) |
| K10 | 113 (64.9) | 29 (16.7) | 32 (18.4) | 239 (66.2) | 62 (17.2) | 60 (16.6) | 2.18±1.34 | 2.12±1.27 | 2.14±1.29 | 2.0 (1.0–3.0) | 0.260 (0.878) |
| K11 | 134 (77.0) | 28 (16.1) | 12 (6.9) | 284 (78.7) | 47 (13.0) | 30 (8.3) | 4.04±0.99 | 4.03±1.00 | 4.04±0.99 | 4.0 (4.0–5.0) | 1.131 (0.568) |
| K12 | 101 (58.0) | 33 (19.0) | 40 (23.0) | 194 (53.7) | 92 (25.5) | 75 (20.8) | 3.49±1.33 | 3.45±1.21 | 3.47±1.25 | 4.0 (3.0–4.0) | 2.798 (0.247) |
| K13 | 146 (83.9) | 19 (10.9) | 9 (5.2) | 314 (87.0) | 28 (7.8) | 19 (5.3) | 4.24±0.92 | 4.25±0.93 | 4.25±0.93 | 4.0 (4.0–5.0) | 1.468 (0.480) |
| K14 | 34 (19.5) | 56 (32.2) | 84 (48.3) | 68 (18.8) | 105 (29.1) | 188 (52.1) | 3.41±1.21 | 3.45±1.15 | 3.44±1.17 | 4.0 (3.0–4.0) | 0.739 (0.691) |
| K15 | 136 (78.2) | 22 (12.6) | 16 (9.2) | 283 (78.4) | 51 (14.1) | 27 (7.5) | 4.07±1.04 | 4.06±1.02 | 4.06±1.02 | 4.0 (4.0–5.0) | 0.620 (0.733) |
| K16 | 128 (73.6) | 26 (14.9) | 20 (11.5) | 299 (82.8) | 48 (13.3) | 14 (3.9) | 3.96±1.14 | 4.15±0.88 | 4.09±0.98 | 4.0 (4.0–5.0) | 12.208 (0.002) |
| K17 | 150 (86.2) | 10 (5.7) | 14 (8.1) | 331 (91.7) | 19 (5.3) | 11 (3.0) | 4.30±0.99 | 4.42±0.83 | 4.39±0.89 | 5.0 (4.0–5.0) | 0.672 (0.035) |
| K18 | 154 (88.6) | 10 (5.7) | 10 (5.7) | 317 (87.8) | 24 (6.6) | 20 (5.5) | 4.39±0.92 | 4.33±0.97 | 4.35±0.95 | 5.0 (4.0–5.0) | 0.165 (0.921) |
| Total | 2064 (65.9) | 461 (14.7) | 607 (19.4) | 4382 (67.4) | 950 (14.6) | 1166 (18) | 3.51±0.19 | 3.50±0.19 | 3.51±0.18 | 4.0 (2.0–5.0) | 4.803 (0.461) |
| Attitude | | | | | | | | | | | |
| A1 | 73 (42.0) | 25 (14.4) | 76 (43.6) | 149 (41.3) | 59 (16.3) | 153 (42.4) | 2.98±1.58 | 3.05±1.46 | 3.02±0.08 | 3.0 (2.0–4.0) | 0.351 (0.839) |
| A2 | 137 (78.7) | 17 (9.8) | 20 (11.5) | 292 (80.9) | 36 (10.0) | 33 (9.1) | 4.08±1.17 | 4.12±1.10 | 4.10±0.05 | 4.0 (4.0–5.0) | 0.729 (0.695) |
| A3 | 78 (44.8) | 64 (36.8) | 32 (18.4) | 199 (55.1) | 104 (28.8) | 58 (16.1) | 3.41±1.25 | 3.59±1.21 | 3.50±0.05 | 4.0 (3.0–5.0) | 5.158 (0.076) |
| A4 | 58 (33.4) | 66 (37.9) | 50 (28.7) | 121 (33.5) | 140 (38.8) | 100 (27.7) | 3.05±1.26 | 3.06±1.17 | 3.06±0.06 | 3.0 (2.0–4.0) | 0.068 (0.967) |
| A5 | 78 (44.9) | 58 (33.3) | 38 (21.8) | 158 (43.8) | 125 (34.6) | 78 (21.6) | 3.36±1.13 | 3.30±1.14 | 3.33±0.01 | 3.0 (3.0–4.0) | 0.090 (0.956) |
| Total | 424 (48.7) | 230 (26.4) | 216 (24.9) | 919 (50.9) | 464 (25.7) | 422 (23.4) | 3.37±0.18 | 3.42±0.14 | 3.40±0.03 | 3.0 (2.0–5.0) | 1.279 (0.707) |

Knowledge question (K1-K18), Attitude question (A1-A5), Response from participants (1: Correct; 2: Do not know; 3: Incorrect). SD: Standard SD; Standard deviation, HBV: Hepatitis B virus, HCV: Hepatitis C virus, HDV: Hepatitis D virus, NEPI: Vienam's National Expanded Program on Immunization

Table 3: Knowledge of and attitudes toward HBV infection differences by year of study among undergraduates ($[n=535]$, $n[\%]$)

| Items | Year of study | | | | | | | | | | | | | | | χ^2 (P) |
|-----------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|--------------|---------------|-------------------|
| | Year 1 | | | Year 2 | | | Year 3 | | | Year 4 | | | Year 5 | | | |
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| Knowledge | | | | | | | | | | | | | | | | |
| K1 | 12 (18.2) | 9 (13.6) | 45 (68.2) | 36 (35.3) | 20 (19.6) | 46 (45.1) | 27 (40.9) | 9 (13.6) | 30 (45.5) | 12 (33.3) | 10 (27.8) | 14 (38.9) | 95 (35.8) | 25 (9.4) | 145 (54.8) | 23.789 (0.002) |
| K2 | 44 (66.7) | 13 (19.7) | 9 (13.6) | 75 (73.5) | 7 (6.9) | 20 (19.6) | 54 (81.8) | 4 (6.1) | 8 (12.1) | 24 (66.7) | 6 (16.7) | 6 (16.6) | 171 (64.5) | 37 (14.0) | 145 (54.8) | 14.860 (0.062) |
| K3 | 31 (46.9) | 18 (27.3) | 17 (25.8) | 62 (60.8) | 13 (12.7) | 27 (26.5) | 47 (71.2) | 9 (13.6) | 10 (15.2) | 24 (66.6) | 6 (16.7) | 6 (16.7) | 145 (54.8) | 39 (14.7) | 80 (30.2) | 16.782 (0.032) |
| K4 | 45 (68.2) | 13 (19.7) | 8 (12.1) | 69 (67.6) | 16 (15.7) | 17 (16.7) | 50 (75.8) | 13 (19.7) | 3 (4.5) | 25 (69.4) | 6 (16.7) | 5 (13.9) | 203 (76.6) | 28 (10.6) | 34 (12.8) | 11.622 (0.169) |
| K5 | 18 (27.3) | 18 (27.3) | 30 (45.4) | 50 (49) | 15 (14.7) | 37 (36.3) | 32 (48.5) | 15 (22.7) | 19 (28.8) | 20 (55.6) | 4 (11.1) | 12 (33.3) | 107 (40.4) | 47 (17.7) | 111 (41.9) | 15.755 (0.046) |
| K6 | 50 (75.8) | 13 (19.7) | 3 (4.5) | 83 (81.4) | 10 (9.8) | 9 (8.8) | 55 (83.3) | 7 (10.6) | 4 (6.1) | 30 (83.3) | 5 (13.9) | 1 (2.8) | 209 (78.9) | 30 (11.3) | 26 (9.8) | 7.958 (0.438) |
| K7 | 37 (56.1) | 13 (19.7) | 16 (24.2) | 59 (57.9) | 18 (17.6) | 25 (24.5) | 39 (59.1) | 19 (28.8) | 8 (12.1) | 22 (61.2) | 7 (19.4) | 7 (19.4) | 136 (51.3) | 62 (23.4) | 67 (25.3) | 8.320 (0.403) |
| K8 | 51 (77.3) | 9 (13.6) | 6 (9.1) | 86 (84.3) | 7 (6.9) | 9 (8.8) | 57 (86.4) | 5 (7.6) | 4 (6.0) | 30 (83.3) | 5 (13.9) | 1 (2.8) | 219 (82.6) | 26 (9.8) | 20 (7.6) | 4.951 (0.763) |
| K9 | 47 (71.2) | 8 (12.1) | 11 (16.7) | 82 (80.4) | 8 (7.8) | 12 (11.8) | 60 (90.9) | 5 (7.6) | 1 (1.5) | 29 (80.5) | 5 (13.9) | 2 (5.6) | 207 (78.1) | 35 (13.2) | 23 (8.7) | 14.300 (0.074) |
| K10 | 43 (65.2) | 9 (13.6) | 14 (21.2) | 72 (70.6) | 8 (7.8) | 22 (21.6) | 44 (66.7) | 11 (16.7) | 11 (16.6) | 23 (63.9) | 7 (19.4) | 6 (16.7) | 170 (64.2) | 56 (21.1) | 39 (14.7) | 11.471 (0.176) |
| K11 | 53 (80.3) | 11 (16.7) | 2 (3.0) | 77 (75.5) | 9 (8.8) | 16 (15.7) | 47 (71.2) | 15 (22.7) | 4 (6.1) | 25 (69.4) | 9 (25.0) | 2 (5.6) | 216 (81.5) | 31 (11.7) | 18 (6.8) | 22.069 (0.005) |
| K12 | 35 (53.0) | 17 (25.8) | 14 (21.2) | 55 (54.0) | 18 (17.6) | 29 (28.4) | 27 (40.9) | 25 (37.9) | 14 (21.2) | 17 (47.2) | 14 (38.9) | 5 (13.9) | 161 (60.8) | 51 (19.2) | 53 (20.0) | 21.139 (0.007) |
| K13 | 52 (78.7) | 10 (15.2) | 4 (6.1) | 88 (86.3) | 5 (4.9) | 9 (8.8) | 59 (89.4) | 6 (9.1) | 1 (1.5) | 30 (83.3) | 4 (11.1) | 2 (5.6) | 231 (87.2) | 22 (8.3) | 12 (4.5) | 10.256 (0.248) |
| K14 | 14 (21.2) | 30 (45.5) | 22 (33.3) | 25 (24.5) | 19 (18.6) | 58 (56.9) | 14 (21.2) | 16 (24.2) | 36 (54.6) | 5 (13.9) | 15 (41.7) | 16 (44.4) | 44 (16.6) | 81 (30.6) | 140 (52.8) | 20.638 (0.008) |
| K15 | 47 (71.2) | 12 (18.2) | 7 (10.6) | 77 (75.5) | 11 (10.8) | 14 (13.7) | 53 (80.3) | 9 (13.6) | 4 (6.1) | 32 (88.9) | 3 (8.3) | 1 (2.8) | 210 (79.3) | 38 (14.3) | 17 (6.4) | 10.627 (0.224) |
| K16 | 50 (75.8) | 9 (13.6) | 7 (10.6) | 75 (73.6) | 14 (13.7) | 13 (12.7) | 58 (87.9) | 6 (9.1) | 2 (3.0) | 32 (88.9) | 3 (8.3) | 1 (2.8) | 212 (80.0) | 42 (15.8) | 11 (4.2) | 16.522 (0.035) |

(Contd...)

Table 3: (Continued)

| Items | Year of study | | | | | | | | | | | | | | | χ^2 (P) | |
|-----------|---------------|---------------|---------------|---------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|----------------|---------------|---------------|-------------------|
| | Year 1 | | | Year 2 | | | Year 3 | | | Year 4 | | | Year 5 | | | | |
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | | |
| Knowledge | | | | | | | | | | | | | | | | | |
| | K17 | 58 (87.9) | 5 (7.6) | 3 (4.5) | 88 (86.3) | 3 (2.9) | 11 (10.8) | 61 (92.4) | 4 (6.1) | 1 (1.5) | 31 (86.1) | 3 (8.3) | 2 (5.6) | 243 (91.7) | 14 (5.3) | 8 (3.0) | 13.898 (0.084) |
| | K18 | 54 (81.8) | 5 (7.6) | 7 (10.6) | 85 (83.4) | 4 (3.9) | 13 (12.7) | 58 (87.9) | 7 (10.6) | 1 (1.5) | 31 (86.1) | 3 (8.3) | 2 (5.6) | 243 (91.7) | 15 (5.7) | 7 (2.6) | 22.706 (0.004) |
| | Total | 741 (62.4) | 222 (18.7) | 225 (18.9) | 1244 (67.8) | 205 (11.2) | 387 (21) | 842 (70.9) | 185 (15.6) | 161 (13.5) | 442 (68.2) | 115 (17.7) | 91 (14.1) | 3222 (66.3) | 679 (14) | 956 (19.7) | 14.870 (0.154) |
| Attitude | | | | | | | | | | | | | | | | | |
| | A1 | 23 (34.8) | 12 (18.2) | 31 (47.0) | 57 (55.9) | 12 (11.8) | 33 (32.3) | 34 (51.5) | 10 (15.2) | 22 (33.3) | 21 (58.3) | 6 (16.7) | 9 (25.0) | 87 (32.8) | 44 (16.6) | 134 (50.6) | 26.729 (0.001) |
| | A2 | 45 (68.2) | 13 (19.7) | 8 (12.1) | 83 (81.4) | 8 (7.8) | 11 (10.8) | 46 (69.7) | 13 (19.7) | 7 (10.6) | 30 (83.3) | 5 (13.9) | 1 (2.8) | 225 (84.9) | 14 (5.3) | 26 (9.8) | 24.683 (0.002) |
| | A3 | 35 (53.1) | 23 (34.8) | 8 (12.1) | 50 (49.0) | 30 (29.4) | 22 (21.6) | 35 (53.1) | 23 (34.8) | 8 (12.1) | 23 (63.9) | 8 (22.2) | 5 (13.9) | 134 (50.6) | 84 (31.7) | 47 (17.7) | 6.302 (0.613) |
| | A4 | 22 (33.3) | 32 (48.5) | 12 (18.2) | 41 (40.2) | 21 (20.6) | 40 (39.2) | 19 (28.8) | 27 (40.9) | 20 (30.3) | 8 (22.2) | 15 (41.7) | 13 (36.1) | 89 (33.6) | 111 (41.9) | 65 (24.5) | 23.319 (0.003) |
| | A5 | 30 (45.5) | 27 (40.9) | 9 (13.6) | 57 (55.9) | 25 (24.5) | 20 (19.6) | 29 (44.0) | 21 (31.8) | 16 (24.2) | 14 (38.9) | 12 (33.3) | 10 (27.8) | 106 (40.0) | 98 (37.0) | 61 (23.0) | 12.062 (0.148) |
| | Total | 155 (47.0) | 107 (32.4) | 68 (20.6) | 288 (56.5) | 96 (18.8) | 126 (24.7) | 163 (49.4) | 94 (28.5) | 73 (22.1) | 96 (53.3) | 46 (25.6) | 38 (21.1) | 641 (48.4) | 351 (26.5) | 333 (25.1) | 18.619 (0.153) |

Knowledge question (K1-K18), attitude question (A1-A5), response from participants (1: Correct; 2: Do not know; 3: Incorrect). SD: Standard deviation, HBV: Hepatitis B virus, HCV: Hepatitis C virus, HDV: Hepatitis D virus, NEPi: Vietnam's National Expanded Program on Immunization

Table 4: Hepatitis B knowledge and attitude among pharmacy students by monthly expense (USD) ([n=535], n(%))

| Items | Expenditure (USD) | | | | | | | | | | | | χ^2 (P) |
|-----------|-------------------|--------------|--------------|---------------|--------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------------|
| | <90 | | | 90<130 | | | 130<180 | | | ≥180 | | | |
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| Knowledge | | | | | | | | | | | | | |
| K1 | 42 (27.8) | 21 (13.9) | 88 (58.3) | 70 (34.7) | 32 (15.8) | 100 (49.5) | 33 (37.5) | 11 (12.5) | 44 (50.0) | 37 (39.4) | 9 (9.6) | 48 (51.1) | 6.232 (0.398) |
| K2 | 100 (66.2) | 29 (19.2) | 22 (14.6) | 142 (70.3) | 25 (12.4) | 35 (17.3) | 63 (71.6) | 6 (6.8) | 19 (21.6) | 63 (67.0) | 7 (7.4) | 24 (25.5) | 14.286 (0.027) |
| K3 | 77 (50.9) | 33 (21.9) | 41 (27.2) | 117 (57.9) | 26 (12.9) | 59 (29.2) | 54 (61.3) | 13 (14.8) | 21 (23.9) | 62 (66.0) | 13 (13.8) | 19 (20.2) | 9.560 (0.144) |
| K4 | 103 (68.2) | 27 (17.9) | 21 (13.9) | 152 (75.2) | 26 (12.9) | 24 (11.9) | 66 (75.0) | 13 (14.8) | 9 (10.2) | 71 (75.5) | 10 (10.6) | 13 (13.8) | 4.084 (0.665) |
| K5 | 56 (37.1) | 32 (21.2) | 63 (41.7) | 98 (48.5) | 38 (18.8) | 66 (32.7) | 35 (39.8) | 13 (14.8) | 40 (45.4) | 38 (40.4) | 16 (17.0) | 40 (42.6) | 7.986 (0.239) |
| K6 | 117 (78.2) | 21 (13.9) | 12 (7.9) | 156 (77.2) | 26 (12.9) | 20 (9.9) | 72 (81.8) | 11 (12.5) | 5 (5.7) | 81 (86.2) | 7 (7.4) | 6 (6.4) | 4.774 (0.573) |
| K7 | 71 (47.0) | 40 (26.5) | 40 (26.5) | 110 (54.4) | 45 (22.3) | 47 (23.3) | 54 (61.4) | 14 (15.9) | 20 (22.7) | 58 (61.7) | 20 (21.3) | 16 (17.0) | 8.305 (0.217) |
| K8 | 126 (83.4) | 15 (9.9) | 10 (6.7) | 166 (82.2) | 23 (11.4) | 13 (6.4) | 72 (81.8) | 7 (8.0) | 9 (10.2) | 79 (84.0) | 7 (7.4) | 8 (8.5) | 2.876 (0.824) |
| K9 | 125 (83.5) | 15 (9.9) | 10 (6.6) | 151 (74.8) | 35 (17.3) | 16 (7.9) | 70 (79.6) | 6 (6.8) | 12 (13.6) | 79 (84.0) | 5 (5.3) | 10 (10.6) | 15.776 (0.015) |
| K10 | 94 (62.3) | 32 (21.2) | 25 (16.5) | 131 (64.9) | 38 (18.8) | 33 (16.3) | 62 (70.5) | 11 (12.5) | 15 (17.0) | 65 (69.1) | 10 (10.6) | 19 (20.2) | 6.622 (0.357) |
| K11 | 126 (83.4) | 19 (12.6) | 6 (4.0) | 153 (75.8) | 35 (17.3) | 14 (6.9) | 70 (79.6) | 9 (10.2) | 9 (10.2) | 69 (73.4) | 12 (12.8) | 13 (13.8) | 11.814 (0.066) |
| K12 | 81 (53.6) | 37 (24.5) | 33 (21.9) | 104 (51.5) | 56 (27.7) | 42 (20.8) | 55 (62.5) | 11 (12.5) | 22 (25.0) | 55 (58.5) | 21 (22.3) | 18 (19.1) | 8.622 (0.196) |
| K13 | 132 (87.4) | 11 (7.3) | 8 (5.3) | 172 (85.1) | 21 (10.4) | 9 (4.5) | 73 (83.0) | 9 (10.2) | 6 (6.8) | 83 (88.3) | 6 (6.4) | 5 (5.3) | 2.673 (0.849) |
| K14 | 22 (14.6) | 49 (32.5) | 80 (52.9) | 36 (17.8) | 65 (32.2) | 101 (50.0) | 21 (23.9) | 27 (30.7) | 40 (45.4) | 23 (24.5) | 20 (21.3) | 51 (54.3) | 8.157 (0.227) |
| K15 | 118 (78.2) | 29 (19.2) | 4 (2.6) | 162 (80.2) | 29 (14.4) | 11 (5.4) | 64 (72.7) | 10 (11.4) | 14 (15.9) | 75 (79.8) | 5 (5.3) | 14 (14.9) | 28.501 (0.000) |
| K16 | 120 (79.4) | 25 (16.6) | 6 (4.0) | 172 (85.1) | 24 (11.9) | 6 (3.0) | 63 (71.6) | 14 (15.9) | 11 (12.5) | 72 (76.6) | 11 (11.7) | 11 (11.7) | 17.986 (0.006) |

(Contd...)

Table 4: (Continued)

| Items | Expenditure (USD) | | | | | | | | | | | | χ^2 (P) |
|-----------|-------------------|---------------|---------------|----------------|---------------|---------------|----------------|---------------|---------------|----------------|---------------|---------------|-------------------|
| | <90 | | | 90–<130 | | | 130–<180 | | | ≥180 | | | |
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| Knowledge | | | | | | | | | | | | | |
| K17 | 139 (92.0) | 6 (4.0) | 6 (4.0) | 183 (90.6) | 13 (6.4) | 6 (3.0) | 77 (87.5) | 6 (6.8) | 5 (5.7) | 82 (87.2) | 4 (4.3) | 8 (8.5) | 6.305 (0.390) |
| K18 | 131 (86.7) | 11 (7.3) | 9 (6.0) | 180 (89.1) | 15 (7.4) | 7 (3.5) | 79 (89.8) | 4 (4.5) | 5 (5.7) | 81 (86.2) | 4 (4.3) | 9 (9.6) | 6.123 (0.410) |
| Total | 1780 (65.5) | 452 (16.6) | 484 (17.9) | 2455 (69.2) | 572 (16.1) | 519 (14.7) | 1083 (68.4) | 195 (12.3) | 306 (19.3) | 1173 (69.3) | 187 (11.1) | 332 (19.6) | 9.482 (0.311) |
| Attitude | | | | | | | | | | | | | |
| A1 | 53 (35.1) | 24 (15.9) | 74 (48.0) | 84 (41.6) | 35 (17.3) | 83 (41.1) | 39 (44.3) | 11 (12.5) | 38 (43.2) | 46 (48.9) | 14 (14.9) | 34 (36.2) | 6.335 (0.387) |
| A2 | 128 (83.8) | 11 (7.3) | 12 (7.9) | 156 (77.2) | 27 (13.4) | 19 (9.4) | 71 (80.7) | 5 (5.7) | 12 (13.6) | 74 (78.8) | 10 (10.6) | 10 (10.6) | 7.691 (0.262) |
| A3 | 83 (54.0) | 44 (29.1) | 24 (15.9) | 91 (45.0) | 81 (40.1) | 30 (14.9) | 49 (55.7) | 22 (25.0) | 17 (19.3) | 54 (57.5) | 21 (22.3) | 19 (20.2) | 13.136 (0.041) |
| A4 | 46 (29.5) | 66 (43.7) | 39 (25.8) | 67 (33.1) | 86 (42.6) | 49 (24.3) | 29 (33.0) | 31 (35.2) | 28 (31.8) | 37 (39.3) | 23 (24.5) | 34 (36.2) | 12.34 (0.055) |
| A5 | 67 (43.4) | 47 (31.1) | 37 (24.5) | 86 (42.6) | 73 (36.1) | 43 (21.3) | 45 (51.1) | 29 (33.0) | 14 (15.9) | 38 (40.4) | 34 (36.2) | 22 (23.4) | 4.220 (0.647) |
| Total | 310 (51.3) | 145 (24) | 149 (24.7) | 398 (49.3) | 229 (28.3) | 181 (22.4) | 188 (53.4) | 69 (19.6) | 95 (27) | 211 (56.1) | 68 (18.1) | 97 (25.8) | 8.744 (0.278) |

Knowledge question (K1-K18), Attitude question (A1-A5), Response from participants (1: Correct; 2: Do not know; 3: Incorrect). SD: Standard deviation, HBV: Hepatitis B virus, HCV: Hepatitis C virus, HDV: Hepatitis D virus, NEPI: Vietnam's National Expanded Program on Immunization. USD: US Dollar

did not know. Monthly expenditures of <90 USD or ≥180 USD did not affect significantly on knowledge ($P = 0.311$), attitudes were ($P = 0.278$). The resulting description of the knowledge and attitudes of the pharmacy students by expenses per month is in Table 4..

Each response was assessed good or poor knowledge, positive or negative attitude. The positive score is ≥3.50 (≥70%) and negative one is <3.50 (<70%). Overall, the respondents had negative attitudes toward hepatitis B, with the mean scores shown in Figure 1.

Considering the knowledge of hepatitis B in terms of demographic characteristics, males scored better than females

(>3.50). However, females had better attitudes toward hepatitis B prevention than males, which is presented in Table 5.

DISCUSSION

The findings of the current study revealed impressive facts regarding the knowledge of pharmacy students and their attitude toward HBV. In addition, the study showed different recognition rates and attitude scores among pharmacy students in Dongnai province.

Several studies have focused on the immune status of HCWs

Table 5: The relationship between demographic characteristics, knowledge score, and attitude score by mean score comparison

| Characteristics | Knowledge | | | | Attitude | | | |
|---|-----------|------------------|-----------|------------------|-----------|------------------|-----------|------------------|
| | Male | | Female | | Male | | Female | |
| | Mean±SD | MD (IQR [25–75]) | Mean±SD | MD (IQR [25–75]) | Mean±SD | MD (IQR [25–75]) | Mean±SD | MD (IQR [25–75]) |
| Year of study | | | | | | | | |
| 1 st | 3.39±0.48 | 3.39 (3.2–3.8) | 3.54±0.33 | 3.56 (3.3–4.0) | 3.4±0.48 | 3.39 (3.0–3.9) | 3.48±0.46 | 3.40 (3.2–3.8) |
| 2 nd | 3.43±0.27 | 3.39 (3.2–3.7) | 3.38±0.32 | 3.44 (3.2–3.8) | 3.38±0.59 | 3.40 (2.9–3.9) | 3.31±0.60 | 3.40 (3.0–3.9) |
| 3 rd | 3.57±0.24 | 3.67 (3.3–3.9) | 3.54±0.36 | 3.56 (3.4–3.7) | 3.18±0.49 | 3.20 (3.0–3.7) | 3.64±0.41 | 3.67 (3.4–3.9) |
| 4 th | 3.22±0.40 | 3.34 (2.8–3.5) | 3.69±0.42 | 3.72 (3.5–4.0) | 3.10±0.40 | 3.40 (2.9–2.1) | 3.44±0.66 | 3.4 (3.2–3.7) |
| 5 th | 3.60±0.41 | 3.67 (3.3–3.9) | 3.50±0.40 | 3.50 (3.2–3.8) | 3.43±0.53 | 3.40 (3.0–3.8) | 3.47±0.55 | 3.4 (3.0–3.8) |
| Part-time job | | | | | | | | |
| No | 3.51±0.35 | 3.50 (3.2–3.8) | 3.50±0.36 | 3.50 (3.2–3.8) | 3.41±0.55 | 3.40 (3.0–3.8) | 3.39±0.54 | 3.40 (3.0–3.8) |
| Yes | 3.53±0.42 | 3.61 (3.2–3.9) | 3.52±0.42 | 3.56 (3.3–3.9) | 3.33±0.54 | 3.40 (3.0–3.8) | 3.55±0.65 | 3.60 (3.2–4.0) |
| Locality | | | | | | | | |
| Urban | 3.53±0.38 | 3.61 (3.2–3.9) | 3.52±0.37 | 3.56 (3.3–3.8) | 3.36±0.53 | 3.40 (3.0–3.8) | 3.44±0.56 | 3.40 (3.0–3.8) |
| Rural | 3.46±0.35 | 3.42 (3.3–3.7) | 3.43±0.38 | 3.47 (3.2–3.7) | 3.51±0.53 | 3.60 (3.0–3.8) | 3.38±0.57 | 3.40 (3.0–3.8) |
| Cohabitants | | | | | | | | |
| Parents | 3.59±0.41 | 3.67 (3.3–3.9) | 3.52±0.37 | 3.56 (3.3–3.8) | 3.45±0.54 | 3.60 (3.0–3.8) | 3.38±0.53 | 3.40 (3.0–3.8) |
| Relatives | 3.49±0.41 | 3.42 (3.2–3.7) | 3.48±0.37 | 3.50 (3.2–3.8) | 3.49±0.59 | 3.60 (3.0–3.8) | 3.41±0.56 | 3.40 (3.0–8.8) |
| Friends | 3.49±0.29 | 3.36 (3.3–3.8) | 3.52±0.38 | 3.56 (3.3–3.9) | 3.04±0.42 | 3.00 (2.8–3.5) | 3.47±0.59 | 3.40 (3.2–4.0) |
| Alone | 3.42±0.37 | 3.43 (3.2–3.7) | 3.46±0.40 | 3.44 (3.2–3.8) | 3.34±0.54 | 3.40 (3.0–3.8) | 3.43±0.59 | 3.40 (3.0–4.0) |
| Others ^(a) | 3.58±0.32 | 3.67 (3.2–3.9) | 3.53±0.36 | 3.50 (3.3–4.1) | 3.46±0.71 | 3.20 (3.0–3.8) | 3.74±0.60 | 3.80 (3.4–4.2) |
| Monthly expense (USD)* | | | | | | | | |
| <90 | 3.53±0.35 | 3.50 (3.2–3.8) | 3.50±0.38 | 3.50 (3.3–3.8) | 3.43±0.50 | 3.60 (3.0–4.0) | 3.49±0.54 | 3.60 (3.2–4.0) |
| 90–<130 | 3.49±0.35 | 3.56 (3.2–3.8) | 3.51±0.38 | 3.50 (3.2–3.8) | 3.20±0.57 | 3.20 (2.8–3.6) | 3.47±0.55 | 3.40 (3.0–3.8) |
| 130–<180 | 3.53±0.39 | 3.44 (3.2–3.9) | 3.48±0.34 | 3.56 (3.2–3.8) | 3.54±0.54 | 3.60 (3.0–4.2) | 3.35±0.61 | 3.40 (2.9–3.8) |
| ≥180 | 3.53±0.43 | 3.67 (3.2–3.9) | 3.54±0.38 | 3.56 (3.4–3.8) | 3.45±0.58 | 3.40 (3.2–3.8) | 3.30±0.58 | 3.40 (3.0–3.6) |
| Do you think it is enough for your life | | | | | | | | |
| Yes | 3.51±0.38 | 3.56 (3.2–3.9) | 3.50±0.38 | 3.50 (3.2–3.8) | 3.32±0.55 | 3.40 (3.0–3.8) | 3.42±0.57 | 3.40 (3.0–3.8) |
| No | 3.52±0.36 | 3.56 (3.2–3.8) | 3.53±0.36 | 3.56 (3.3–3.9) | 3.53±0.51 | 3.60 (3.0–4.1) | 3.44±0.54 | 3.40 (3.0–4.0) |

(Contd...)

Table 5: (Continued)

| Characteristics | Knowledge | | | | Attitude | | | |
|---|-----------|------------------|-----------|------------------|-----------|------------------|-----------|------------------|
| | Male | | Female | | Male | | Female | |
| | Mean±SD | MD (IQR [25–75]) | Mean±SD | MD (IQR [25–75]) | Mean±SD | MD (IQR [25–75]) | Mean±SD | MD (IQR [25–75]) |
| Have you been immunized with HBV vaccine? | | | | | | | | |
| Yes | 3.53±0.38 | 3.56 (3.2–3.9) | 3.53±0.39 | 1.50 (1.3–1.7) | 3.41±0.58 | 3.40 (3.0–3.8) | 3.52±0.58 | 1.80 (1.4–2.0) |
| No | 3.49±0.37 | 3.50 (3.2–3.8) | 3.46±0.35 | 1.44 (1.3–1.6) | 3.30±0.49 | 3.40 (2.9–3.7) | 3.25±0.53 | 1.80 (1.4–2.0) |
| Why don't you want to be vaccinated? | | | | | | | | |
| Do not know where to get vaccinated | 3.44±0.27 | 3.53 (3.3–3.7) | 3.42±0.41 | 3.44 (3.2–3.8) | 3.03±0.42 | 3.10 (2.7–3.6) | 3.29±0.44 | 3.40 (3.0–3.7) |
| The vaccine is too expensive | 3.43±0.67 | 3.34 (3.2–3.5) | 3.49±0.31 | 3.67 (3.2–3.8) | 3.25±0.82 | 3.25 (2.8–3.8) | 3.42±0.40 | 3.40 (3.1–3.6) |
| Fear of side effects of the vaccine | 3.23±0.49 | 3.17 (2.8–3.7) | 3.39±0.29 | 3.36 (3.2–3.5) | 3.16±0.75 | 3.60 (2.8–3.6) | 3.32±0.59 | 3.40 (2.9–3.6) |
| Fear some needles | 3.61±0.27 | 3.67 (3.4–3.9) | 3.59±0.41 | 3.70 (3.4–4.0) | 3.49±0.42 | 3.60 (3.2–3.6) | 3.48±0.55 | 3.40 (3.0–3.8) |
| No fear of catching HBV | 3.29±0.42 | 3.33 (3.0–3.6) | 3.54±0.36 | 3.67 (3.2–3.8) | 3.29±0.38 | 3.00 (2.7–3.9) | 3.17±0.56 | 3.20 (2.8–3.4) |
| Others ^(b) | 3.59±0.29 | 3.62 (3.2–3.9) | 3.41±0.33 | 3.56 (3.2–3.8) | 3.43±0.43 | 3.40 (3.2–3.8) | 3.09±0.56 | 3.20 (2.8–3.6) |
| Do you intend to get vaccinated for HBV? | | | | | | | | |
| Yes | 3.47±0.33 | 3.44 (3.2–3.7) | 3.44±0.36 | 3.50 (3.2–3.9) | 3.21±0.43 | 3.40 (2.9–3.6) | 3.24±0.54 | 3.40 (3.0–3.6) |
| No | 3.52±0.43 | 3.70 (3.3–4.0) | 3.53±0.35 | 3.56 (3.3–3.8) | 3.45±0.58 | 3.60 (3.0–3.9) | 3.32±0.48 | 3.40 (3.0–3.7) |
| The willingness to pay for vaccination (USD)* | | | | | | | | |
| <15 | 3.35±0.37 | 3.33 (3.1–3.6) | 3.49±0.32 | 3.56 (3.3–3.8) | 3.20±0.48 | 3.20 (2.8–3.6) | 3.36±0.51 | 3.40 (3.0–3.6) |
| 15–<20 | 3.52±0.47 | 3.67 (3.3–3.8) | 3.55±0.43 | 3.50 (3.2–3.9) | 3.38±0.58 | 3.40 (3.0–3.6) | 3.37±0.52 | 3.40 (3.0–3.8) |
| 20–<30 | 3.69±0.23 | 3.67 (3.5–4.0) | 3.33±0.31 | 3.47 (3.0–3.8) | 3.55±0.42 | 3.60 (3.4–3.9) | 3.07±0.49 | 3.20 (2.8–3.4) |
| ≥30 | 3.57±0.36 | 3.78 (3.1–3.9) | 3.45±0.45 | 3.81 (3.5–3.9) | 3.13±0.47 | 2.00 (1.6–2.0) | 2.77±0.88 | 2.80 (2.6–3.3) |

SD: Standard deviation, Range: Min-Max, MD: Median, IQR: (Q1: 25th percentile, Q3: 75th percentile). ^(a): Dormitory or rented house, ^(b): Do not know HBV can be infected or do not like, *USD: US Dollar. HBV: Hepatitis B virus

with regard to hepatitis B, relatively few of them were dedicated to students in training for the health professions, although vaccination should precede exposure to the occupational risks of HBV infection. This study, which was conducted in a country possessing a high HBV prevalence rate, enabled the conducting of interviews in a total sample of 535 pharmacy students at a private university. It was shown that 37.4% of the male and 31.4% of the female students thought HBV transmission were caused through genes, with 31.4% of the female students thinking the same. In terms of year of study, the figures were 18.2% for the 1st-year students and 36.3% for the rest. Only a little over 30% of students knew that using tableware in common could not cause viral transmission. On the other hand, more than half of them were aware that HBV could be transmitted through blood, injection needles, and toothbrushes. In general, we concluded that pharmacy students were greatly aware of the symptoms and

complications of hepatitis B (>70.0%). For instance, hepatitis B can lead to cirrhosis as well as liver cancer; moreover, alcohol abuse can intensify the processor can even lead to hepatitis C or D. In comparison, Noubiap *et al.* in Cameroon found an 83.2% level of good knowledge of the risk factors for HBV infection.^[14] On the contrary, Shalaby *et al.* (2010) in Egypt at reported that interviewees had adequate knowledge of transmission, vaccination, and treatment of hepatitis B.^[15] The report among medical in Pakistan showed fair level of knowledge toward hepatitis B and C among university students.^[16,17] Mansour-Ghanaei *et al.* also concluded that the level of HCWs' HBV comprehension was average and the HBV knowledge of females was better than that of males.^[12] In this study, a huge portion of the pharmacy students (>80%) knew that it is necessary to have an urgent cure for HBV and the vaccination method can be used to achieve the most effective results.

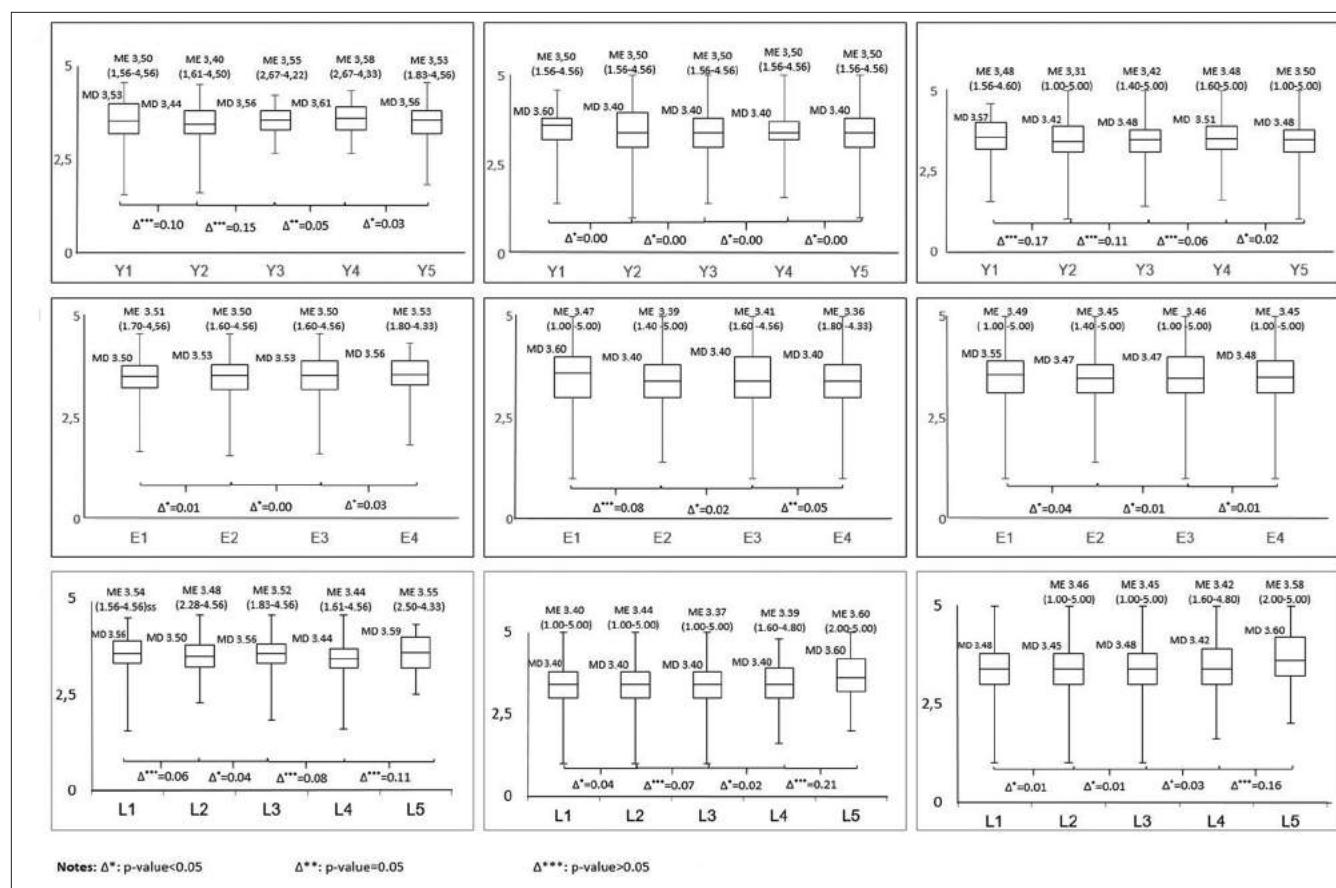


Figure 1: Description of knowledge and attitude score sub-group by (1) year of study, (2) monthly expense, (3) cohabitants. (a) Knowledge score, (b) attitude score, (c) total score. Δ^* : $P<0.05$, Δ^{**} : $P=0.05$, Δ^{***} : $P<0.05$

Although the results reveal good knowledge about hepatitis B, there was the negative attitude (<70.0%) toward vaccination against that the overall attitudes toward HBV prevention was positive among less than one in two participants.^[18] In research in Iran, Karimi-Sari *et al.* found that pharmacy students (54.0%) had a greater intention of getting vaccinated for HBV than others (20.9%).^[19]

With regard to HBV vaccination, the WHO recommends that it be done worldwide, but especially in developing countries, including Vietnam. Vietnam is one of the nations both participating in and developing a project called “Vietnam’s National Expanded Program on Immunization,” which is based on the WHO’s global policies for immunization and establishment of the goal of providing universal immunization to all children by 1990 (PATH, 2014).

The current study sought to evaluate HBV awareness and attitudes toward HBV vaccination among pharmacy students at Lac Hong University. It also sought to encourage collaboration with government counterparts and instill confidence in health workers to provide vaccination services, including counseling to pregnant mothers regarding vaccination. The goal is to improve access to care and increase the rate of on-time hepatitis B birth-dose vaccination. The study had certain limitations, as it could not be generalized

due to the cross-sectional self-reported nature of the study, as well as the small sample size and limited area in which it was conducted. Improving students’ awareness of and perspective toward HBV is really important. Moreover, being knowledgeable about hepatitis B and vaccination against it at school is probably essential. Pharmacists are considered to be extremely knowledgeable and experienced in the field of vaccines. It can be seen that the immunization guidelines of HCWs and pharmacists are considered as the most important because of the rising awareness and changing attitudes of people toward vaccination. Forthcoming studies could assess the knowledge and attitudes of practicing community pharmacists.

CONCLUSION

The current study has identified the relationship among attitudes toward HBV prevention. The study sought to evaluate knowledge of HBV and attitudes toward HBV vaccination among pharmacy students at Lac Hong University, and the result of the study reveals crucial findings for the pharmaceutical industry. A program to educate people, especially pharmacy students, is necessary. The study found that female students have a better attitude than their male counterparts, but there is no difference in awareness between

Table 6: Distribution shown by mean, median, range, and interquartile range of knowledge and attitude score subgroup by year of study, cohabitants and monthly expense (USD)

| Characteristics | Total score (n) | | | | | | | | | | | |
|------------------------|-----------------|-----------|------|------------------|------------------|--|-----------|-----------|------|------------------|------------------|-------|
| | Knowledge | | | | | | Attitude | | | | | |
| | Mean±SD | Range | MD | 25 th | 75 th | | Mean±SD | Range | MD | 25 th | 75 th | Total |
| Year of study | | | | | | | | | | | | |
| 1 st | 3.50±0.38 | 1.40–4.60 | 3.53 | 3.2 | 3.8 | | 3.46±0.53 | 1.40–4.60 | 3.60 | 3.2 | 3.8 | 3.48 |
| 2 nd | 3.40±0.31 | 1.00–5.00 | 3.44 | 3.2 | 3.9 | | 3.22±0.59 | 1.00–5.00 | 3.40 | 3.0 | 4.0 | 3.31 |
| 3 rd | 3.55±0.33 | 1.40–5.00 | 3.56 | 3.3 | 3.8 | | 3.29±0.54 | 1.40–5.00 | 3.40 | 3.0 | 3.8 | 3.42 |
| 4 th | 3.58±0.41 | 1.60–5.00 | 3.61 | 3.3 | 3.7 | | 3.37±0.61 | 1.60–5.00 | 3.40 | 3.2 | 3.7 | 3.48 |
| 5 th | 3.53±0.40 | 1.00–5.00 | 3.56 | 3.2 | 3.8 | | 3.46±0.55 | 1.00–5.00 | 3.40 | 3.0 | 3.8 | 3.50 |
| Cohabitants | | | | | | | | | | | | |
| Parents | 3.54±0.38 | 1.56–4.50 | 3.56 | 3.3 | 3.9 | | 3.40±0.53 | 1.00–5.00 | 3.40 | 3.0 | 3.8 | 3.47 |
| Relatives | 3.48±0.39 | 2.28–4.56 | 3.50 | 3.2 | 3.8 | | 3.44±0.57 | 1.00–5.00 | 3.40 | 3.0 | 3.8 | 3.46 |
| Friends | 3.52±0.36 | 1.83–4.56 | 3.56 | 3.3 | 3.8 | | 3.37±0.55 | 1.00–5.00 | 3.40 | 3.0 | 3.8 | 3.45 |
| Alone | 3.44±0.39 | 1.61–4.56 | 3.44 | 3.2 | 3.7 | | 3.39±0.57 | 1.60–4.80 | 3.40 | 3.0 | 3.9 | 3.42 |
| Others ^(a) | 3.55±0.34 | 2.50–4.33 | 3.59 | 3.2 | 4.0 | | 3.60±0.64 | 2.00–5.00 | 3.60 | 3.2 | 4.2 | 3.58 |
| Monthly expense (USD)* | | | | | | | | | | | | |
| <90 | 3.51±0.37 | 1.67–4.56 | 3.50 | 3.3 | 3.8 | | 3.47±0.53 | 1.00–5.00 | 3.47 | 3.0 | 4.0 | 3.49 |
| 90–<130 | 3.50±0.38 | 1.56–4.56 | 3.53 | 3.2 | 3.8 | | 3.39±0.55 | 1.40–5.00 | 3.39 | 3.0 | 3.8 | 3.45 |
| 130–<180 | 3.50±0.36 | 1.61–4.56 | 3.53 | 3.2 | 3.9 | | 3.41±0.58 | 1.00–5.00 | 3.41 | 3.0 | 4.0 | 3.46 |
| ≥180 | 3.53±0.40 | 1.83–4.33 | 3.56 | 3.3 | 3.9 | | 3.36±0.58 | 1.00–5.00 | 3.36 | 3.0 | 3.8 | 3.45 |

SD: Standard deviation, Range: Min-Max, MD: Median, IQR: (Q1: 25th percentile; Q3: 75th percentile), *USD = US Dollar

the two groups. However, it is essential that enhancement of the knowledge and attitudes of pharmacy students relating to HBV infection be added to the learning process, with an up-to-date program. On the other hand, it is also essential to disseminate information to students and the public, especially by sharing HBV information with one's friends and family members. In addition, it is necessary to conduct a health education campaign aimed at the general public to disseminate proper attitudes toward a self-care educational program.

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Nephrolithiasis Treatment Costs among Patients at a Vietnamese Public Hospital

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Abstract

Introduction: Nephrolithiasis has been rising in prevalence worldwide, imposing a significant cost burden on both patients and society in general. *Desmodium styracifolium* extract (DSE) and Rowatinex[®] are the two stone-eroding pharmaceuticals most commonly used to treat nephrolithiasis in Vietnam. This study aimed to compare the treatment costs and durations between Rowatinex[®] and DSE in Vietnamese patients with nephrolithiasis. **Materials and Methods:** This was a retrospective cost-of-illness analysis of the information extracted from a public hospital's electronic database. This study was based on the prevalence approach, and it focused on the health-care provider perspective. All ambulatory patients who were diagnosed with nephrolithiasis from January 2015 to December 2017 were filtered using specific inclusion and exclusion criteria. **Results and Discussion:** A total of 1,001 patients who were prescribed Rowatinex[®] and 882 patients who were prescribed DSE were included in this research. The majority were 30–59 years old and had no health insurance. The pharmaceutical expenses accounted for the highest percentage of the total cost (59.8% for Rowatinex[®] and 67.9% for DSE). Overall, the Rowatinex[®] treatment had a higher average cost per patient than the DSE (290.5 vs. 264.3 US dollars); however, it was used over a shorter duration of time (10.8 weeks vs. 19.6 weeks). **Conclusion:** Based on the results of this study, Rowatinex[®] is a more ideal choice for patients with kidney stone disease.

Key words: Cost, *Desmodium styracifolium*, kidney stone, nephrolithiasis, Rowatinex[®], Vietnam

INTRODUCTION

Nephrolithiasis is the third most common disorder encountered in primary care practice, just after urinary tract infections and prostate disease, and it is usually diagnosed based on the clinical symptoms, physical examination, and imaging studies (computed tomography scan and ultrasonography). Ureteral stones can form calcium stones (18%), most of which are composed primarily of calcium oxalate or calcium phosphate. The other main types include uric acid, struvite, and cystine stones.^[1-3] Kidney stones have been rising in prevalence worldwide, creating a significant cost burden for patients as well as society in general (direct procedures, hospitalization, indirect costs associated with a loss of worker productivity, and additional costs for prevention, and medical management). Worldwide, the overall prevalence of kidney stones is 5–10% and this proportion is about 8.8% in the United States (US) and 7.54% in China.^[4] Many studies

evaluating the nephrolithiasis costs have been published. In the US, a significant economic burden is associated with kidney stones, with annual estimates exceeding 5 billion US dollars (USD), including indirect costs of approximately 775 million USD per year.^[5,6]

Due to their complex nature, the treatment of kidney stones depends on the size and location of the stones, as well as the pain and the patient's ability to keep fluids down. Approximately 10–20% of all kidney stones require surgical

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removal. However, considerable progress has been made in the medical and surgical management of nephrolithiasis over the past 20 years. Three minimally invasive surgical techniques that significantly reduce the morbidity of stone removal have been developed and are currently available: Shock wave lithotripsy (SWL), percutaneous nephrolithotomy, and ureteroscopy. Apart from medical procedures, medical therapies also play key roles in the prevention of new stone formation and the facilitation of stone passage. Specifically, *Desmodium styracifolium* extract (DSE) and Rowatinex® are usually used to treat nephrolithiasis in Vietnam.

The herbal medicine namely Kim Tien Thao contains triterpenoids extracted from *D. styracifolium* (Osbeck) Merr., and it has been proven to be effective in treating kidney stones. Rowatinex® (Rowa Pharmaceuticals Ltd., Bantry, Co. Cork, Ireland) is a combination of seven naturally available terpenes (31 mg of pinene [$\alpha+\beta$], 15 mg of camphene, 3 mg of cineol, 4 mg of fenchone, 10 mg of borneol, 4 mg of anethol, and 33 mg of olive oil) that help to dissolve/break down and remove kidney and urinary tract stones, as well as relieve muscle spasms, thus reducing the pain. It also increases the blood flow and reduces inflammation, which can be associated with the presence of kidney stones. Based on the results of one study, Rowatinex® had no significant effect on the clearance rate of kidney calculi after SWL, but it did accelerate the passage of calculi after 2 weeks without any significant adverse effects.^[7] Another study designed to investigate the safety and efficacy of a special terpene combination in the treatment of patients with urolithiasis after extracorporeal SWL (ESWL) revealed that it was a well-tolerated, safe, and efficacious therapy for eliminating calculi fragments generated by ESWL when compared to a placebo treatment.^[8]

Undoubtedly, it is crucial to optimize health care for nephrolithiasis by choosing an ideal treatment that is economical for patients, but still safe and effective. Therefore, the objective of this study was to compare the treatment costs and treatment durations between Rowatinex® and DSE in patients suffering from nephrolithiasis in Vietnam.

SUBJECTS AND METHODS

Study design

A retrospective database analysis was conducted using a hospital electronic records database to determine the direct medical costs of nephrolithiasis cases during the 3 fiscal years from January 2015 to December 2017. This study was based on the prevalence approach, and it focused on the health-care perspective.

Study site

This study was conducted at a public hospital (Binh-Dan Hospital) located in Ho Chi Minh City, which is the largest

city in the southeastern region and the economic center of Vietnam. This central-level hospital plays a key role in the health-care system, especially in urology, with a capacity of 700 beds. Approximately 13 thousand urological surgeries are conducted annually, with 400,000 outpatient visits per year.

Study population

The patient characteristics and cost data were collected from the hospital's electronic database. These patient characteristics included an identified code, gender, year of birth, address, health insurance status (coverage percentage), and kidney stone diameter. The cost data included the physician consultation, diagnostic examination, laboratory tests, imaging technique, medical procedure, pharmaceuticals, medical supplies, and other expenditures.

Inclusion and exclusion criteria

All the ambulatory patients who were diagnosed with nephrolithiasis using code N20.0 of the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10)^[9] were eligible to participate in this study if they met the following requirements: (1) prescribed Rowatinex® or DSE by a physician, (2) complied with the treatment protocol and follow-up appointments, and (3) exhibited treatment success during the study period (no stones). Those patients with missing information, errors in the information entered into the electronic database, or who voluntarily discontinued treatment were excluded.

Cost of illness measurements

The treatment cost was investigated by calculating the resource utilization, including the diagnosis (physician consultation and diagnostic examinations), laboratory testing, imaging technique, pharmaceuticals, medical supplies, and other costs. The costs from previous years were converted to 2017 USD using the consumer price index, with an exchange rate of one USD for 22,698.4 Vietnamese Dong.^[10]

Data analysis and presentation

The data were managed and analyzed using the Microsoft Excel 2013 statistical software for Windows®. Descriptive statistics (frequency, percentage, mean, median, min, max, standard deviation, and 25–75 percentiles) were used to summarize the data describing the demographic characteristics, clinical status, and cost components.

Ethical approval

The study protocols were approved by the hospital to ensure that all the information was used only for research purposes.

Because the study information was obtained from the hospital's electronic record database without patient contact, written informed consent from the patients was waived. The data related to the resources used were de-identified to minimize the risk of the unintended disclosure of the individuals' identities and the information about them. During the data collection, each patient was identified anonymously by creating an alphanumeric code.

RESULTS

Table 1 depict the general characteristics of the patients being treated for nephrolithiasis using Rowatinex® and DSE at Binh-Dan Hospital between 2015 and 2017. The average

ages of the patients in the 2 treatment groups were roughly similar to one another, while the age range of the DSE patients was somewhat wider than its counterpart (30–66 years old vs. 36–61 years old, respectively). In both the Rowatinex® and DSE groups, the age group with the largest number of patients was 31–59 years old, with a total of 1,069 out of 1,883 recorded patients. While those patients who were treated with Rowatinex® had little insurance to cover their fees (704 out of 1,001 had to use their personal funds), the DSE group was more well covered (308 out of 882 patients had full coverage for their hospital costs). However, the duration of hospitalization for the DSE treatment group was significantly longer than that of the Rowatinex® group, with an average of 19.6 days compared to only 10.8 days for the Rowatinex® group.

Table 1: Demographic characteristics of included patients in Binh-Dan hospital [n (%)]

| Characteristics | Rowatinex® | | | | DSE | | | |
|-----------------------------------|-----------------|-----------------|-----------------|-----------------------|-----------------|-----------------|-----------------|----------------------|
| | 2015 (n=338) | 2016 (n=320) | 2017 (n=343) | 2015–2017 (n=1001) | 2015 (n=284) | 2016 (n=301) | 2017 (n=297) | 2015–2017 (n=882) |
| Age (years) | | | | | | | | |
| Mean±SD | 49.4±12.6 | 51.2±10.3 | 48.0±9.6 | 50.1±10.9 | 52.6±10.3 | 49.2±12.0 | 54.0±19.1 | 51.8±13.8 |
| Range (min – max) | 23–81 | 21–80 | 19–79 | 19–81 | 23–79 | 21–88 | 20–90 | 20–90 |
| Median (IQR [25–75]) | 49 (40–60) | 50 (35–58) | 46 (32–63) | 49 (36–61) | 51 (33–68) | 50 (27–65) | 54 (39–67) | 49 (30–66) |
| Age group | | | | | | | | |
| ≤30 | 27 (8.0) | 17 (5.3) | 34 (9.9) | 78 (7.8) | 48 (16.9) | 50 (16.6) | 42 (14.1) | 140 (15.9) |
| 31–59 | 224 (66.5) | 203 (63.4) | 218 (63.8) | 645 (64.4) | 137 (48.2) | 143 (47.5) | 144 (48.5) | 424 (48.1) |
| ≥60 | 87 (25.5) | 100 (31.3) | 91 (26.3) | 278 (27.8) | 99 (34.9) | 108 (35.9) | 111 (37.4) | 318 (36.0) |
| Gender | | | | | | | | |
| Female | 185 (54.8) | 179 (55.9) | 196 (57.1) | 560 (55.9) | 132 (46.5) | 160 (53.2) | 145 (48.8) | 437 (49.5) |
| Male | 153 (45.2) | 141 (44.1) | 147 (42.9) | 441 (44.1) | 152 (53.5) | 141 (46.8) | 152 (51.2) | 445 (50.5) |
| Health insurance(%) | | | | | | | | |
| 0* | 255 (75.4) | 213 (66.6) | 236 (68.8) | 704 (70.3) | 98 (34.5) | 119 (39.5) | 101 (34.0) | 318 (36.1) |
| 48 | 43 (12.7) | 28 (8.8) | 67 (19.5) | 138 (13.8) | 35 (12.3) | 56 (18.6) | 45 (15.2) | 136 (15.4) |
| 80 | 10 (3.0) | 17 (5.3) | 18 (5.2) | 45 (4.5) | 9 (3.2) | 12 (4.0) | 29 (9.8) | 50 (5.7) |
| 95 | 5 (1.5) | 12 (3.8) | 10 (2.9) | 27 (2.7) | 47 (16.5) | 13 (4.3) | 10 (33.3) | 70 (7.9) |
| 100 | 25 (7.4) | 50 (15.5) | 12 (3.5) | 87 (8.7) | 95 (33.5) | 101 (33.6) | 112 (37.7) | 308 (34.9) |
| Location | | | | | | | | |
| Rural | 192 (56.9) | 210 (65.6) | 199 (58.0) | 601 (60.0) | 99 (34.9) | 159 (52.8) | 139 (46.8) | 397 (45.0) |
| Urban | 146 (43.1) | 110 (34.4) | 144 (41.9) | 400 (40.0) | 185 (65.1) | 142 (47.2) | 158 (53.2) | 485 (55.0) |
| Treatment duration (weeks) | | | | | | | | |
| Mean±SD | 11.0±7.5 | 10.2±4.7 | 11.4±3.8 | 10.8±5.2 | 18.7±4.8 | 20.1±3.7 | 20.2±3.9 | 19.6±4.4 |
| Range (Min – Max) | 1–31 | 2–33 | 2–32 | 1–32 | 10–39 | 14–40 | 9–36 | 9–40 |
| Median [IQR (25–75)] | 10 (5–15) | 9 (5–14) | 9 (4–16) | 9 (5–15) | 18 (12–30) | 24 (18–34) | 20 (17–23) | 21 (15–28) |

DSE: *Desmodium styracifolium* extract, IQR: Interquartile 25%–75%, SD: Standard deviation

Regarding the average annual expense for the nephrolithiasis treatment, it was shown that most of the two groups' expenses dropped slightly in 2016 before increasing again in 2017, with the exception of antibiotics and other drugs expenditures, which declined continuously from 2015 to 2017. The Rowatinex® group had an overall economic burden between 2015 and 2017 of 290,759.4 USD, which was slightly higher than the 233,086 USD for DSE. A closer look revealed that most of the Rowatinex® group's burden came directly from Rowatinex® itself as part of the pharmaceutical expenditure (contributing 37.9% for a total of 59.8% of the share of pharmaceuticals in the average cost per year for the patients). However, antibiotics were the biggest contributor toward the pharmaceutical expenditure (158,323.7 USD of the total economic burden on the patients) in the DSE group. The annual cost of the medical supplies and other related costs were the smallest among all the sectors; the DSE

group's annual cost for medical supplies was only 1,704.4 USD, which was the smallest, while the sum of the medical supplies' cost and the other costs was only slightly more than 2,700 USD [Table 2].

When dividing up the annual costs based on the gender and age, we were able to determine how each individual expense can affect these characteristics differently. As shown in Table 3, the economic burden affected patients between 31 and 59 years old the most, with Rowatinex®'s total cost on the male patients having the highest recorded mean cost at over 309 USD (the total economic burden suffered by the male patients from 2015 to 2017 was staggering at 170,625.5 USD). However, the treatment of the male patients cost slightly more than the females, regardless of age, with a mean cost of treatment for male patients at all ages in the Rowatinex® group of 304.7 USD, compared to only 272.4

Table 2: Average cost per year on patients with nephrolithiasis (2017 USD)

| Cost components | Mean cost±SD | | | Economic burden 2015–2017 (%) |
|-------------------------------|--------------|------------|------------|-------------------------------|
| | 2015 | 2016 | 2017 | |
| Rowatinex® (n=1001) | | | | |
| Diagnosis | 10.0±3.0 | 9.5±2.1 | 12.4±3.1 | 10,673.2 (3.7) |
| Laboratory tests | 23.6±2.1 | 18.4±1.9 | 30.4±2.5 | 24,292 (8.4) |
| Image techniques | 45.9±3.2 | 46.8±2.2 | 39.6±4.1 | 44,073 (15.2) |
| Medical procedures | 31.4±8.1 | 29.9±7.5 | 42.0±6.3 | 34,587.2 (11.9) |
| Pharmaceuticals | 166.6±24.9 | 172.4±23.0 | 183.4±20.9 | 17,4385 (59.8) |
| Antibiotics | 14.4±3.3 | 13.2±3.4 | 12.8±3.7 | 13,481.6 (4.6) |
| Analgesics, anti-inflammatory | 10.6±2.2 | 9.2±1.7 | 13.7±1.5 | 11,225.9 (3.9) |
| Vitamin supplements | 3.0±1.1 | 2.2±0.6 | 3.1±1.4 | 2,781.3 (1.0) |
| Rowatinex | 100.3±9.0 | 107.2±11.1 | 124.6±10.9 | 1,10,943.2 (37.9) |
| Other drugs | 38.3±7.7 | 40.6±8.2 | 29.2±10.5 | 35,953 (12.4) |
| Medical supplies | 2.1±0.3 | 1.5±0.2 | 2.9±0.3 | 2,184.5 (0.8) |
| Other costs | 0.5±0.1 | 0.7±0.1 | 0.5±0.3 | 564.5 (0.2) |
| Total cost | 280.1±32.9 | 279.2±31.3 | 311.2±35.6 | 29,0759.4 (100.0) |
| DSE (n=882) | | | | |
| Diagnosis | 10.3±3.4 | 9.4±3.1 | 12.2±3 | 9,378 (4.0) |
| Laboratory tests | 13.8±6.5 | 10.7±5.1 | 18.3±6.3 | 14,365.3 (6.2) |
| Image techniques | 34±10.1 | 36±14.7 | 37.5±12.9 | 35,874.5 (15.4) |
| Medical procedures | 12.5±3.8 | 10.0±2.5 | 9.2±3.0 | 10,580.6 (4.5) |
| Pharmaceuticals | 164.3±17.8 | 153.9±18.2 | 156.1±20.1 | 1,58,323.7 (67.9) |
| Antibiotics | 92.3±12.2 | 89.4±10.2 | 72.3±13.0 | 84,604.3 (36.3) |
| Analgesics, anti-inflammatory | 4.1±0.3 | 3.6±0.5 | 4.7±0.6 | 4,149.9 (1.8) |
| Vitamin supplements | 3.0±0.8 | 3.2±0.7 | 4.6±0.2 | 3,615.8 (1.6) |
| DSE | 51.3±9.9 | 45.7±4.2 | 60.3±7.8 | 52,646.3 (22.6) |
| Other drugs | 13.6±5.0 | 12.0±3.7 | 14.2±6.0 | 13,307.4 (5.7) |
| Medical supplies | 1.8±0.2 | 1.3±0.4 | 2.0±0.2 | 17,10.4 (0.7) |
| Other costs | 2.7±0.8 | 3.6±1.0 | 2.3±1.3 | 2,853.5 (1.2) |
| Total cost | 239.4±40.5 | 224.9±36.2 | 237.6±35.4 | 2,33,086 (100.0) |

DSE: *Desmodium styracifolium* extract, IQR: Interquartile 25%–75%, SD: Standard deviation

Table 3: Costing analysis on patients suffered from nephrolithiasis with different genders and age groups (2017 USD)

| Cost components | Mean cost±SD | | | | Economic burden 2015–2017 (%) |
|------------------------------------|--------------|-------------|-------------|------------|----------------------------------|
| | ≤30 y/o | 31–59 y/o | ≥ 60 y/o | All ages | |
| Rowatinex® (n=1001) | | | | | |
| Male (n=560) | | | | | |
| Diagnosis | 9.6±1.8 | 10.3±5.1 | 11.5±1.2 | 10.5±4.0 | 5,871.4 (3.4) |
| Laboratory tests | 23.1±0.4 | 25.3±1.4 | 21.6±5.3 | 24.4±4.3 | 13,640.4 (8) |
| Image techniques | 46.1±6.8 | 52.6±9.0 | 39.5±3.5 | 49.4±7 | 27,656.9 (16.2) |
| Medical procedures | 31.9±11.7 | 37.4±14.1 | 34.3±9.0 | 36.3±10.1 | 20,349.7 (11.9) |
| Pharmaceuticals | 179.5±49.5 | 180.4±21.4 | 185.4±43.6 | 181.4±33.5 | 1,01,568.3 (59.5) |
| Antibiotics | 12.6±5.3 | 13.7±2.2 | 14±1.2 | 13.7±3.1 | 7,657.8 (4.5) |
| Analgesics, Anti-inflammatories | 10.8±1.5 | 11.5±3.1 | 8.8±3.2 | 10.9±2.7 | 6,091 (3.6) |
| Vitamin Supplements | 1.3±0.8 | 3.1±0.5 | 1.1±1.5 | 2.6±0.7 | 1,429.2 (0.8) |
| Rowatinex | 118.7±5.3 | 109.3±10.8 | 121.0±12.3 | 112.5±7.6 | 62,976.5 (36.9) |
| Other drugs | 36.1±7.8 | 42.8±10.3 | 40.5±2.1 | 41.8±5.7 | 23,413.8 (13.7) |
| Medical supplies | 2.1±1.1 | 2.4±1.4 | 1.5±1.3 | 2.2±1.2 | 1,232.3 (0.7) |
| Other costs | 0.2±0.2 | 0.7±0.3 | 0.1±0.2 | 0.5±0.2 | 306.5 (0.2) |
| Total cost | 292.5±143.4 | 309.1±111.5 | 293.9±108.3 | 304.7±139 | 1,70,625.5 (100.0) |
| Female (n=441) | | | | | |
| Diagnosis | 10.1±0.9 | 12.2±0.6 | 9.1±0.2 | 10.9±0.9 | 4,801.8 (4) |
| Laboratory tests | 22.8±2.8 | 23.4±11.7 | 25.6±3.6 | 24.2±10.2 | 10,651.6 (8.9) |
| Image techniques | 34.0±18.0 | 44.2±12.4 | 27.4±17.7 | 37.2±14.6 | 16,416.1 (13.7) |
| Medical procedures | 37.0±4.9 | 32.5±10.8 | 30.9±7.4 | 32.3±5.6 | 14,237.5 (11.9) |
| Pharmaceuticals | 183.2±31.9 | 167.3±68.7 | 157.9±64.7 | 165.1±50.3 | 72,816.7 (60.6) |
| Antibiotics | 9.7±0.8 | 15.2±2.3 | 11.0±2.8 | 13.2±1.9 | 5,823.8 (4.8) |
| Analgesics, Anti-inflammatories | 10.7±0.8 | 13.1±0.7 | 9.7±1.1 | 11.6±0.8 | 5,134.9 (4.3) |
| Vitamin Supplements | 3.0±1.3 | 3.2±1.2 | 2.9±0.6 | 3.1±1.1 | 1,352.1 (1.1) |
| Rowatinex | 120.6±47.1 | 101.4±20.2 | 117.3±18.2 | 108.8±24.5 | 47,966.7 (39.9) |
| Other drugs | 39.2±1.4 | 34.4±9.1 | 17.1±7.9 | 28.4±8.2 | 12,539.2 (10.4) |
| Medical supplies | 1.8±1.6 | 2.6±0.6 | 1.6±0.7 | 2.2±1.0 | 952.2 (0.8) |
| Other costs | 0.1±0.2 | 0.8±0.4 | 0.4±0.2 | 0.6±0.3 | 258 (0.2) |
| Total cost | 289.0±170.8 | 283.0±100.3 | 252.9±66.8 | 272.4±71.7 | 1,20,133.9 (100.0) |
| DSE (n=882) | | | | | |
| Male (n=437) | | | | | |
| Diagnosis | 9.6±3.3 | 10.3±4.6 | 13.9±1.3 | 11.6±2.4 | 5,061.9 (4.3) |
| Laboratory tests | 16.7±5.8 | 18.1±7.6 | 18.6±8.0 | 18.1±6.1 | 7,892.9 (6.7) |
| Image techniques | 46.1±8.0 | 42.7±6.8 | 48.7±2.1 | 45.5±4.6 | 19,889.9 (16.9) |
| Medical procedures | 12.9±2.6 | 13.5±3.2 | 13.8±4.3 | 13.5±4.5 | 5,907.7 (5.0) |
| Pharmaceuticals | 173.4±50.5 | 183.3±43.4 | 160.9±67.5 | 173.2±55.9 | 75,700.8 (64.5) |
| Antibiotics | 90.1±22.2 | 86.2±31.8 | 92.2±14.4 | 89.1±20.6 | 38,933.8 (33.2) |
| Analgesics, Anti-inflammatories | 4.1±1.7 | 4.8±0.4 | 3.1±1.4 | 4.1±0.4 | 1,771.5 (1.5) |
| Vitamin Supplements | 4.6±0.6 | 4.8±1.3 | 4.3±1.2 | 4.6±1.5 | 2,006.9 (1.7) |
| DSE | 62.3±19.2 | 70±19.9 | 50.9±11.0 | 61.5±14.9 | 26,879.8 (22.9) |

(Contd...)

Table 3: (Continued...)

| Cost components | Mean cost±SD | | | | Economic burden 2015–2017 (%) |
|------------------------------------|--------------|------------|------------|------------|----------------------------------|
| | ≤30 y/o | 31–59 y/o | ≥ 60 y/o | All ages | |
| Other drugs | 12.3±7.5 | 17.5±3.4 | 10.4±2.0 | 14±4.4 | 6,108.7 (5.2) |
| Medical supplies | 2.1±0.4 | 2.4±0.5 | 1.6±0.5 | 2±0.2 | 892.8 (0.8) |
| Other costs | 4.3±0.3 | 4.7±0.9 | 4.7±0.6 | 4.6±0.7 | 2,029.2 (1.7) |
| Total cost | 265.1±23.6 | 275±65.3 | 262.2±42.7 | 268.6±24.2 | 1,17,375.2 (100.0) |
| Female (n=445) | | | | | |
| Diagnosis | 10.1±6.7 | 9.7±4.0 | 9.5±6.3 | 9.7±4.3 | 4,316.1 (3.7) |
| Laboratory tests | 13.9±0.3 | 14.5±5.3 | 14.9±5.5 | 14.5±4.8 | 6,472.4 (5.6) |
| Image techniques | 33.9±14.4 | 33.2±13.9 | 40.9±13.3 | 35.9±14.4 | 15,984.6 (13.8) |
| Medical procedures | 10.5±1.2 | 12.5±3.8 | 7.6±0.4 | 10.5±0.9 | 4,672.9 (4.0) |
| Pharmaceuticals | 186.4±64.0 | 187±33.7 | 183.4±85.1 | 185.7±35.7 | 82,622.9 (71.4) |
| Antibiotics | 100.9±25.8 | 103.6±19.5 | 102±28.2 | 102.6±22.2 | 45,670.5 (39.5) |
| Analgesics, Anti-inflammatories | 5.3±1.4 | 5.6±1.3 | 5±2.2 | 5.3±1.3 | 2,378.4 (2.1) |
| Vitamin Supplements | 3.9±1.5 | 4.0±1.6 | 2.9±1.9 | 3.6±0.9 | 1,608.9 (1.4) |
| DSE | 57.2±25.6 | 60.3±24.7 | 54.7±25.9 | 57.9±25.5 | 25,766.5 (22.3) |
| Other drugs | 19.1±2.8 | 13.5±4.2 | 18.7±3.2 | 16.2±3.4 | 7,198.7 (6.2) |
| Medical supplies | 1.8±1.9 | 2.3±0.7 | 1.2±0.2 | 1.8±0.1 | 817.6 (0.7) |
| Other costs | 1.2±0.5 | 1.7±1.2 | 2.4±1.0 | 1.9±0.3 | 824.3 (0.7) |
| Total cost | 257.8±76.3 | 260.9±95.5 | 259.8±88.0 | 260±89.7 | 1,15,710.8 (100.0) |

DES: *Desmodium styracifolium* extract, SD: Standard deviation, y/o: Years old

USD for the female patients. The difference between the costs in the DSE group was 8.6 USD [Table 3].

Looking closer into the cost components that formed the total economic burden of nephrolithiasis from 2015 to 2017, it can be seen that the most evident factor affecting the cost was the pharmaceutical expenditure, which took up more than 60% of the treatment costs for both the Rowatinex® and DSE groups. Among these, as stated previously, most of the cost in the Rowatinex® group was derived from the medicine itself (38.1%), while the DSE only accounted for 22.6% of the total cost for its group. Vitamin supplements contributed the least toward the pharmaceutical burden, with only 1.0% in Rowatinex® the group and 1.6% in the DSE group. Moreover, while the antibiotic cost percentage in the Rowatinex® group was only 4.6%, the DSE group's antibiotic expenditure was 36.3% of the total pharmaceutical cost. Overall, while the distributions of the proportions in terms of the treatment costs in both groups were alike, the individual cost for each medication showed the greatest difference between the 2 groups [Figure 1].

When comparing the economic burden of the two nephrolithiasis treatment methods directly, the data collected throughout the study led us to believe that the average treatment costs for both methods were relatively high in 2017, with a recorded mean cost of 290.5 USD for Rowatinex® and a DSE cost of 264.3

USD per capita. Despite the 26.2 USD gap between them, the DSE treatment plan took a significant amount of time, with an average of 19.6 weeks, which was nearly double that of the Rowatinex® at only 10.8 weeks [Figure 2].

DISCUSSION

This study was conducted to quantify the effects that nephrolithiasis, or kidney stone disease, had on patients by investigating the treatment costs. In addition, this study attempted to determine the most efficient nephrolithiasis treatment method between the two most common kidney stone medications, Rowatinex® and DSE.

The sociodemographic details of the patients who underwent treatment between 2015 and 2017 were recorded for this investigation. The average age at hospitalization for the nephrolithiasis patients at Binh-Dan Hospital was approximate 51 years old, and the 31 to 59 years old age group had the most recorded patients (1,069 patients). It is also worth noting that most of the Rowatinex® patients were not covered by health insurance (70.3%) while the DSE patients were more well-supported. Perhaps the rural dwellers (60%) were more familiar with the Rowatinex® treatment, while the DSE was more well-known in the urban population (55%).

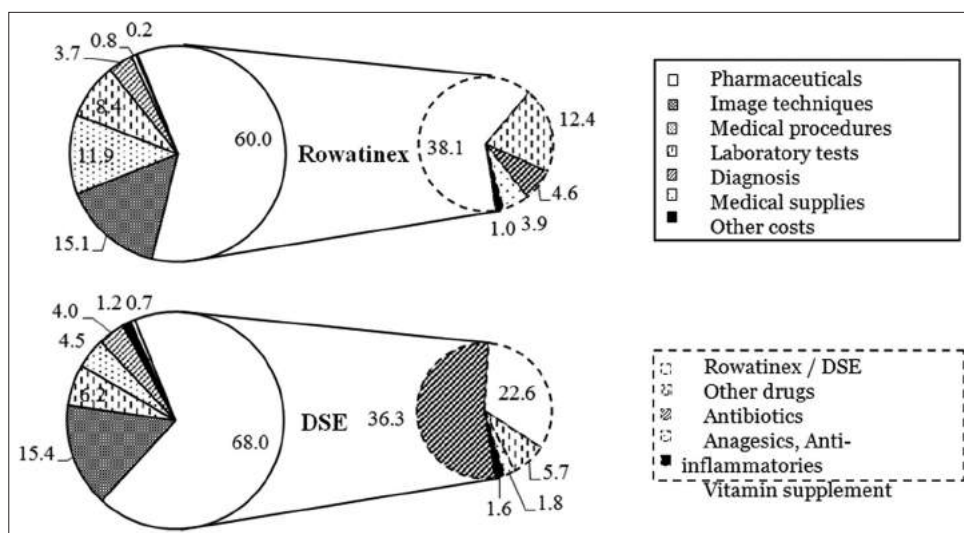


Figure 1: Cost components of nephrolithiasis treatment from 2015 to 2017 (% of total cost)

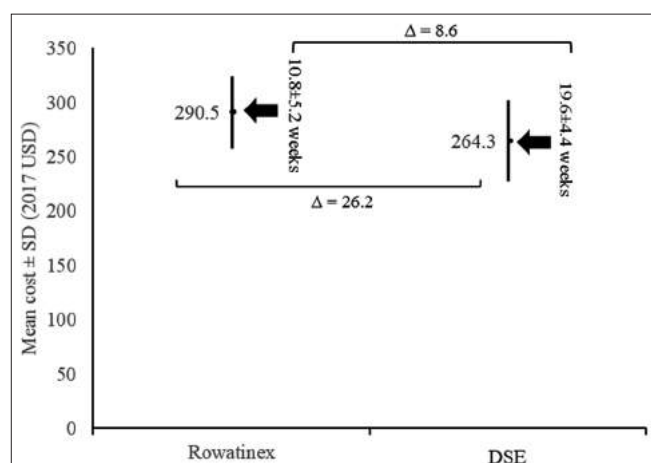


Figure 2: Differences in the average costs and treatment durations between Rowatinex® and *Desmodium styracifolium* extract

Gender was also a crucial element to be considered, and the results suggested that the male patients had significantly higher treatment cost per case than their female counterparts, likely due to the 119-patient gap between the males and females in the Rowatinex® group. However, the DSE treatment costs of the male patients were still higher than the females, even though there were only 437 male patients compared to 445 female patients recorded in the study.

When analyzing the components contributing toward the economic burden, this study determined that the Rowatinex® medication itself took up most of the expense (37.9%) when treating nephrolithiasis using this drug. However, the costliest element included in the DSE treatment was antibiotics (36.3%), with the DSE medication expenditure coming in second (22.6%). As a result, the economic burden of the pharmaceutical expenditures proved to be the most concerning aspect, because more than half of the total treatment cost was for medication in general.

This was the first attempt to evaluate the efficiency of the two most common nephrolithiasis treatment plans based on their impacts on the economic burden. The results of this study showed that there was a slight difference of 26.2 USD between the average costs of the individual treatments, with the Rowatinex® being more costly. However, when considering the length of treatment, the DSE duration was nearly double that of the Rowatinex® (19.6 weeks vs. 10.8 weeks, respectively). Therefore, the authors believe that of the two most commonly used treatments, Rowatinex® is a more ideal choice for treating patients with kidney stone disease.

The presented results can be used in further studies regarding the economic burden of nephrolithiasis. They can also be used to evaluate the differences between patients with various backgrounds. This examination of the treatment methods will be useful in aiding patients in determining the most efficient treatment plan. However, this requires further testing because there may be differences in the outcomes in other regions and nations.

CONCLUSION

This study was the first conducted in Vietnam to compare the two most common herbal medicines used for nephrolithiasis treatment. The results showed that the Rowatinex® accounted for a higher expense but earlier treatment success than the DSE. Therefore, Rowatinex® is a more ideal choice for treating patients with kidney stone disease.

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