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PHARMACOECONOMICS AS A TOOL TO ENHANCE EFFICENCY OF HEALTH CARE SERVICES

Pharmacoeconomics identifies, measures, and compares the costs and consequences of drug therapy to health care systems and society. This article discusses the principles and methods of pharmacoeconomics and how they can be applied to clinical pharmacy practice, and thereby how they can assist in the valuation of pharmacotherapy and other modalities of treatment in clinical practice. By understanding the principles, methods, and application of pharmacoeconomics, health care professionals will be prepared to make better, more informed decisions regarding the use of pharmaceutical products and services.

Key words: pharmacoeconomics, pharmacotherapy, cost, consequences, pharmaceutical care.

Today's cost-sensitive healthcare environment has created a competitive and challenging workplace for clinicians. Competition for diminishing resources has necessitated that the appraisal of healthcare goods and services extends beyond evaluations of safety and efficacy and considers the economic impact of these goods and services on the cost of healthcare. A challenge for healthcare professionals is to provide quality patient care while assuring an efficient use of resources. Defining the *value* of medicine is a common thread that unites today's healthcare practitioners. With serious concerns about rising medication costs and consistent pressure to decrease pharmacy expenditures and budgets, clinicians/prescribers, pharmacists, and other healthcare professionals must answer the question, "What is the value of the pharmaceutical goods and services I provide?" *Pharmacoeconomics*, or the discipline of placing a value on drug therapy [1], evolved to answer that question.

Challenged to provide high-quality patient care in the least expensive way, clinicians have developed strategies aimed at containing costs. However, most of these strategies focus solely on determining the least expensive alternative rather than the alternative that represents the best value for the money. The "cheapest" alternative – with respect to drug acquisition cost – is not always the best value for patients, departments, institutions, and healthcare systems. Quality patient care must not be compromised while attempting to contain costs. The products and services delivered by today's healthcare professionals should demonstrate *pharmacoeconomic value* – that is, a balance of economic, humanistic, *and* clinical outcomes. Pharmacoeconomics can provide the systematic means for this quantification. This chapter discusses the principles and methods of pharmacoeconomics and how they can be applied to clinical pharmacy practice, and thereby how they can assist in the valuation of pharmacotherapy and other modalities of treatment in clinical practice.

Pharmacoeconomics identifies, measures, and compares the costs and consequences of drug therapy to health care systems and society. The perspective of a pharmacoeconomic evaluation is paramount because the study results will be highly dependent on the perspective selected. Health care costs can be categorized as direct medical, direct non medical, indirect nonmedical, intangible, opportunity, and incremental costs. Economic, humanistic, and clinical outcomes should be considered and valued using pharmacoeconomic methods, to inform local decision making whenever possible. To compare various health care choices, economic valuation methods are used, including cost-minimization, cost-benefit, cost-effectiveness, and cost-utility analyses. These methods all provide the means to compare competing treatment options and are similar in the way they measure costs (dollar units). They differ, however, in their measurement of outcomes and expression of results. In today's health care settings, pharmacoeconomic methods can be applied for effective formulary management, individual patient treatment, medication policy determination, and resource allocation. When evaluating published pharmacoeconomic studies, the following factors should be considered: study objective, study perspective, pharmacoeconomic method, study design, choice of interventions, costs and consequences, discounting, study results, sensitivity analysis, study conclusions, and sponsorship. Both the use of economic models and conducting pharmacoeconomic analyses on a local level can be useful and relevant sources of pharmacoeconomic data when rigorous methods are employed.

Pharmacoeconomics has been defined as the description and analysis of the cost of drug therapy to health care systems and society [2]. More specifically, pharmacoeconomic research is the process of identifying, measuring, and comparing the costs, risks, and benefits of programs, services, or therapies and determining which alternative produces the best health outcome for the resource invested [3]. For most practitioners, this translates into weighing the cost of providing a pharmacy product or service against the consequences (outcomes) realized by using the product or service to determine which alternative yields the optimal outcome per dollar spent. This information can assist clinical decision makers in choosing the most cost-effective treatment options [4].

There is a distinct relationship between pharmacoeconomics, outcomes research, and pharmaceutical care. Pharmacoeconomics is not synonymous with outcomes research. *Outcomes research* is defined more broadly as studies that attempt to identify, measure, and evaluate the results of healthcare services [5]. Pharmacoeconomics is a division of outcomes research that can be used to quantify the value of pharmaceutical care products and services. *Pharmaceutical care* has been defined as the responsible provision of drug therapy for the purposes of achieving definite outcomes [6]. By accepting this as the paradigm or vision for our profession, pharmacy is accepting responsibility for managing drug therapy so that positive outcomes are produced.

Assessing costs and consequences – the value of a pharmaceutical product or service – depends heavily on the perspective of the evaluation. Common perspectives include those of the patient, provider, payer, and society. A pharmacoeconomic evaluation can assess the value of a product or service from single or multiple perspectives. However, clarification of the perspective is critical because the results of a pharmacoeconomic evaluation depend heavily on the perspective taken. For example, if comparing the value of alteplase (tissue plasminogen activator, or t-PA) with that of streptokinase from a patient or societal perspective, t-PA may be the best-value alternative because a 1% reduction in mortality rates is observed in this large population. Yet, from a small community hospital's perspective, streptokinase may represent a better value because it provides similar outcomes for less money. Once the perspective is clear, a full evaluation of the relevant costs and consequences can begin. Again, perspective is critical because the value placed on a treatment alternative will depend heavily on the point of view taken.

Costs. It is defined as the value of the resources consumed by a program or drug therapy of interest. *Consequence* is defined as the effects, outputs,

or outcomes of the program or drug therapy of interest. Consideration of both costs and consequences differentiates most pharmacoeconomic evaluation methods from traditional cost-containment strategies and drug-use evaluations.

Table 1

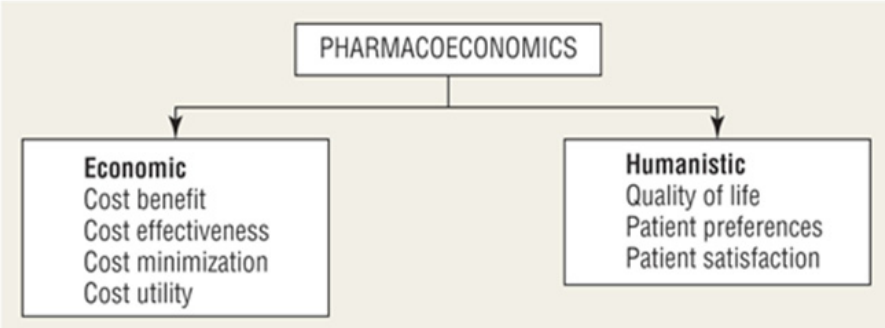
Example of Healthcare Cost Categories

Cost Category	Costs
Direct medical costs	Medications Supplies Laboratory tests Health care professionals' time Hospitalization
Direct non medical costs	Transportation Food Family care Home aides
Indirect costs	Lost wages (morbidity) Income forgone because of premature death (mortality)
Intangible costs	Pain Suffering Inconvenience Grief
Opportunity costs	Lost opportunity Revenue forgone

Source: [25].

Consequences. Similar to costs, the outcomes or consequences of a disease and its treatment are an equally important component of pharmacoeconomic analyses. The manner in which consequences are quantified is a key distinction among pharmacoeconomic methods because the assessment of costs is relatively standard. Like costs, the consequences (or outcomes) of medical care also can be categorized. One approach is to separate outcomes into three categories: economic, clinical, and humanistic. *Economic*

outcomes are the direct, indirect, and intangible costs compared with the consequences of medical treatment alternatives [14]. *Clinical outcomes* are the medical events that occur as a result of disease or treatment (e.g., safety and efficacy end points) [14]. *Humanistic outcomes* are the consequences of disease or treatment on patient functional status or quality of life along several dimensions (e.g., physical function, social function, general health and well-being, and life satisfaction) [14]. Assessing the economic, clinical, and humanistic outcomes (ECHO) associated with a treatment alternative provides a complete model for decision making.



Source: [10].

Cost-Minimization Analysis. Cost-minimization analysis (CMA) involves the determination of the least costly alternative when comparing two or more treatment alternatives. With CMA, the alternatives must have an assumed or demonstrated equivalency in safety and efficacy (i.e., the two alternatives must be equivalent therapeutically). Once this equivalency in outcome is confirmed, the costs can be identified, measured, and compared in monetary units (dollars).

CMA is a relatively straightforward and simple method for comparing competing programs or treatment alternatives as long as the therapeutic equivalence of the alternatives being compared has been established. If no evidence exists to support this, then a more comprehensive method such as cost-effectiveness analysis should be employed. Remember, CMA shows only a "cost savings" of one program or treatment over another [25].

Cost-Benefit Analysis. Cost-benefit analysis (CBA) is a method that allows for the identification, measurement, and comparison of the benefits and costs of a program or treatment alternative. The benefits realized from a program or treatment alternative are compared with the costs of providing it. Both the costs and the benefits are measured and converted into equivalent

dollars in the year in which they will occur [8; 16]. Future costs and benefits are discounted or reduced to their current value.

These costs and benefits are expressed as a ratio (a benefit-to-cost ratio), a net benefit, or a net cost. A clinical decision maker would choose the program or treatment alternative with the highest net benefit or the greatest benefit-to-cost (B : C) ratio [9]. Guidelines for the interpretation of this ratio are indicated [16; 25; 27] :

– If the B : C ratio is greater than 1, the program or treatment is of value. The benefits realized by the program or treatment alternative outweigh the cost of providing it.

– If the B : C ratio equals 1, the benefits equal the cost. The benefits realized by the program or treatment alternative are equivalent to the cost of providing it.

– If the B : C ratio is less than 1, the program or treatment is not economically beneficial. The cost of providing the program or treatment alternative outweighs the benefits realized by it.

Cost-Effectiveness Analysis. Cost-effectiveness analysis (CEA) is a way of summarizing the health benefits and resources used by competing healthcare programs so that policymakers can choose among them [17]. CEA involves comparing programs or treatment alternatives with different safety and efficacy profiles. Cost is measured in dollars, and outcomes are measured in terms of obtaining a specific therapeutic outcome. These outcomes are often expressed in physical units, natural units, or nondollar units (e.g., lives saved, cases cured, life expectancy, or drop in blood pressure) [8; 13].

The results of CEA are also expressed as a ratio – either as an average cost-effectiveness ratio (ACER) or as an incremental cost-effectiveness ratio (ICER). An ACER represents the total cost of a program or treatment alternative divided by its clinical outcome to yield a ratio representing the dollar cost per specific clinical outcome gained, independent of comparators. The ACER can be summarized as follows [7; 13; 25]:

$$\text{ACER} = \frac{\text{health care costs (\$)}}{\text{clinical outcome (not in \$)}}$$

This allows the costs and outcomes to be reduced to a single value to allow for comparison. Using this ratio, the clinician would choose the alternative with the least cost per outcome gained [9]. The most cost-effective alternative is not always the least costly alternative for obtaining a specific

therapeutic objective. In this regard, cost-effectiveness need not be cost reduction but rather cost optimization [14].

Often clinical effectiveness is gained at an increased cost. Is the increased benefit worth the increased cost? Incremental CEA can be used to determine the additional cost and effectiveness gained when one treatment alternative is compared with the next best treatment alternative [7]. Thus, instead of comparing the ACERs of each treatment alternative, the additional cost that a treatment alternative imposes over another treatment is compared with the additional effect, benefit, or outcome it provides. The ICER can be summarized as follows:

$$\text{Incremental Cost Effectiveness Ratio} = \frac{(\text{cost of drug A} - \text{cost of drug B})}{(\text{benefits of drug A} - \text{benefits of drug B})}$$

$$\text{ICER} = \frac{\text{difference in costs (A-B)}}{\text{difference in benefits (A-B)}}$$

Cost-Utility Analysis. Pharmacoeconomists sometimes want to include a measure of patient preference or quality of life when comparing competing treatment alternatives. Cost-utility analysis (CUA) is a method for comparing treatment alternatives that integrates patient preferences and HRQOL. CUA can compare cost, quality, and the quantity of patient-years. Cost is measured in dollars, and therapeutic outcome is measured in patient-weighted utilities rather than in physical units. Often the utility measurement used is a quality-adjusted life year (QALY) gained. QALY is a common measure of health status used in CUA, combining morbidity and mortality data [3].

Results of CUA are also expressed in a ratio, a cost-utility ratio (C : U ratio). Most often this ratio is translated as the cost per QALY gained or some other health-state utility measurement [8; 16]. The preferred treatment alternative is that with the lowest cost per QALY (or other health-status utility). QALYs represent the number of full years at full health that are valued equivalently to the number of years as experienced. For example, a full year of health in a disease-free patient would equal 1.0 QALY, whereas a year spent with a specific disease might be valued significantly lower, perhaps as 0.5 QALY, depending on the disease.

Application of pharmacoeconomics. One of the primary applications of pharmacoeconomics in clinical practice today is to aid clinical and policy decision making. Through the appropriate application of pharmacoeconomics, practitioners and administrators can make better, more informed de-

cisions regarding the products and services they provide. Complete pharmacotherapy decisions should contain assessments of three basic outcome areas whenever appropriate: economic, clinical, and humanistic outcomes (ECHO). Traditionally, most drug therapy decisions were based solely on the clinical outcomes (e.g., safety and efficacy) associated with a treatment alternative. Over the past 20 years, it has become quite popular also to include an assessment of the economic outcomes associated with a treatment alternative. The current trend is also to incorporate the humanistic outcomes associated with a treatment alternative, that is, to bring the patient back into this decision-making equation. This ECHO model for medical decision making has become prevalent in current healthcare settings [14]. In today's healthcare environment, it is no longer appropriate to make drug-selection decisions based solely on acquisition costs. Thus, through the appropriate application of pharmacoeconomic principles and methods, incorporating these three critical components into clinical decisions can be accomplished.

Source: [6].

Controversies with Pharmacoeconomic Literature. Over the years, the literature has highlighted the misuse of pharmacoeconomic terms, inconsistent reporting, and disagreement on the methods used for pharmacoeconomic analyses. Because pharmacoeconomics is still a fairly new discipline that lacks strong consensus with respect to its methods and technically appropriate applications, the disagreement between leading researchers in this field has been widespread and evident [24]. Unfortunately, this has led to some external skepticism, as well as the inability of clinicians to use the findings of these analyses as extensively as they could to inform their local

decision making [23]. Creating and implementing a standardized system for conducting and reporting results of pharmacoeconomic analyses are critical to minimize or eliminate some of these controversies. A review of national guidelines for various countries was published and revealed some areas of emerging standardization [21]. Such a standardized system would enhance clinicians' and decision makers' comprehension of the available data, as well as provide increased assurance that the results reported are methodologically sound.

The principles and methods of pharmacoeconomics provide the means to quantify the value of pharmacotherapy through balancing costs and outcomes. Providing quality care with minimal resources is the future, and the future is here. By understanding the principles, methods, and application of pharmacoeconomics, healthcare professionals will be prepared to make better, more informed decisions regarding the use of pharmaceutical products and services – that is, decisions that ultimately represent the best interests of the patient, the healthcare system, and society.

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ФАРМАКОЕНОМІКА ЯК ІНСТРУМЕНТ ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ МЕДИЧНИХ ПОСЛУГ

Фармакоекономіка визначає, вимірює та порівнює витрати та наслідки медикаментозної терапії для системи охорони здоров'я та суспільства. У цій статті аналізуються принципи та методи фармакоекономіки та шляхи їх застосування у практичній клінічній діяльності, а отже, як вони можуть допомогти в оцінці фармакотерапії та інших способів лікування в клінічній практиці. Розуміючи принципи, методи та застосування фармакоекономіки, фахівці охорони здоров'я будуть готові робити кращі та обґрунтовані рішення щодо використання фармацевтичних продуктів та послуг.

Ключові слова: фармакоекономіка, фармакотерапія, витрати, наслідки, фармацевтична допомога.

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ФАРМАКОЭНОМИКА КАК ИНСТРУМЕНТ ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ МЕДИЦИНСКИХ УСЛУГ

Фармакоэкономика определяет, измеряет и сравнивает затраты и последствия медикаментозной терапии для системы здравоохранения и общества. В этой статье анализируются принципы и методы фармакоэкономтки и пути их применения в практической клинической деятельности, а также как они могут помочь в оценке фармакотерапии и других способах лечения в клинической практике. Понимая принципы, методы и применение фармакоэкономики, специалисты системы здравоохранения будут готовы принять обоснованные решения касательно использования фармацевтических продуктов и услуг.

Ключевые слова: фармакоэкономика, фармакотерапия, затраты, последствия, фармацевтическая помощь.