

Economic Evaluations and Usefulness of Standardized Nursing Terminologies

Patricia W. Stone, PhD, RN, Nam-Ju Lee, MSN, RN, Melinna Giannini, and Suzanne Bakken, DNSc, RN, FAAN

PURPOSE. *To review different types of economic analyses commonly found in healthcare literature, discuss methodologic considerations in framing economic analyses, identify useful resources for economic evaluations, and describe the current and potential roles of standardized nursing terminologies in providing cost and outcome data for economic analysis.*

DATA SOURCES. *The Advanced Billing Concepts Code Resource-based Relative Value Scale and Nursing Outcomes Classification.*

DATA SYNTHESIS. *Using case studies, the applicability of standardized nursing terminologies in cost-effectiveness analysis is demonstrated. While there is potential to inform specific questions, comparisons across analyses are limited because of the many outcome measures.*

CONCLUSIONS. *Including a standardized quality-of-life measure in nursing terminologies would allow for the calculation of accepted outcome measures and dollars per quality adjusted life years gained.*

IMPLICATIONS FOR PRACTICE. *The nurse's ability to assess and contribute to all aspects of rigorous economic evidence is an essential competency for responsible practice.*

Search terms: *Cost analysis, informatics, standardized nursing terminologies*

Avaliações Econômicas e Utilidade das Linguagens Padronizadas de Enfermagem

OBJETIVOS. *Revisar os diferentes tipos de análise econômica comumente encontrados na literatura da área da saúde, discutir considerações metodológicas na elaboração de análises econômicas, identificar recursos úteis para avaliações econômicas, e descrever o papel atual e potencial das linguagens padronizadas de enfermagem no fornecimento de dados de custos e de resultados para análises econômicas.*

FONTES DE DADOS. *O Código de Conceitos Avançados para Faturamento (ABC code), a Escala de Valores Relativos baseada em Recursos (RRVS) e a Classificação de Resultados de Enfermagem (NOC).*

SÍNTESE DOS DADOS. *Utilizando estudos de casos, demonstra-se a aplicabilidade de linguagens padronizadas de enfermagem nas análises de custo-efetividade. Embora haja um potencial para informar questões específicas, as comparações entre análises são limitadas devido às várias formas de mensurar resultados.*

CONCLUSÕES. *A inclusão de uma medida padronizada de qualidade de vida nas linguagens de enfermagem permitiria o cálculo de medidas de resultados aceitas e de dólares por anos ganhos de vida com qualidade ajustada.*

IMPLICAÇÕES PARA A PRÁTICA. *A habilidade da enfermeira de avaliar e contribuir com todos os aspectos de evidência econômica rigorosa é uma competência essencial para a prática responsável.*

Palavras para busca: *Análise de custos, informática, linguagens padronizadas de enfermagem*

Translation by Jeanne Michel, PhD, RN,
and Alba de Barros, PhD, RN

Evaluaciones Económicas y Utilidad de las Terminologías Estandarizadas de Enfermería

PROPÓSITO. *Revisar los diferentes tipos de análisis económicos encontrados en la bibliografía de cuidados de salud, comentar las consideraciones metodológicas al enmarcar el análisis económico, identificar los recursos útiles para las evaluaciones económicas y describir los roles actual y potencial de las terminologías estandarizadas de Enfermería, al proporcionar datos de coste y resultado para el análisis económico.*

FUENTES DE LOS DATOS. *Escala de Valor Relativo Basada en la Fuente de Códigos de Conceptos de Facturación Avanzada y la Clasificación de Resultados de Enfermera.*

SÍNTESIS DE LOS DATOS. *Utilizando estudios de casos, se demuestra la aplicabilidad de las terminologías estandarizadas de Enfermería en el análisis coste-efectividad. Aunque hay un potencial para informar cuestiones específicas, las comparaciones a través del análisis son limitadas debido a las muchas medidas de resultados.*

CONCLUSIONES. *La inclusión de una medida de calidad de vida estandarizada en las terminologías enfermeras, permitiría el cálculo de medidas de resultado aceptadas y dólares por años ganados de calidad de vida.*

IMPLICACIONES PARA LA PRÁCTICA. *La habilidad de la enfermera para valorar y contribuir a todos los aspectos de evidencia económica rigurosa es una competencia esencial para la práctica responsable.*

Palabras clave: *Análisis de coste, informática, terminologías estandarizadas de enfermería*

Translation by Mercedes Ugalde Apalategui, MHS, RN

Patricia W. Stone, PhD, RN, is Assistant Professor; Nam-Ju Lee, MSN, RN, is a doctoral student; and Suzanne Bakken, DNSc, RN, FAAN, is Alumni Professor of Nursing and Professor of Biomedical Informatics, Columbia University, New York. Melinna Giannini is President and Founder, Alternative Link, Albuquerque, NM.

As healthcare technology continues to expand, the cost of using all effective clinical services exceeds available resources. Because of the scarcity of resources, decisions regarding the implementation of new services frequently need to be based on economic analysis. Economic evidence seeks to inform decisions on resource allocation at different levels, including institutions (e.g., hospitals) and regional or national governments. In order to develop applicable economic evidence for practice, nurses need to understand the methods used to assess the rigor of economic evaluations, which is often unfamiliar territory. Moreover, there have been few linkages between the methods associated with economic analyses and standardized nursing terminologies that have been designed to describe nursing diagnoses, nursing interventions, and nursing-sensitive outcomes.

Thus, the purpose of this manuscript is to (a) review different types of economic analyses commonly found in healthcare literature, (b) discuss methodologic consideration in framing economic analyses, (c) identify useful resources for economic evaluations, and (d) describe the current usefulness and potential roles of standardized nursing terminologies in providing cost and outcome data for economic analysis.

Methods Used in Economic Analyses

The language surrounding the economic appraisal of health care can be confusing. It is important to become familiar with some of the more common terminology and its application in economic analyses (Table 1). Economic analyses are fundamentally about choices and, therefore, compare one or more alternative courses of action. Measuring only the cost of a new therapy is merely

Table 1. Glossary of Terminology Used In Economic Evaluations

Cost-Benefit Analysis

A formal economic evaluation in which effects are measured in a monetary unit.

Cost-Consequence Analysis

A formal economic evaluation where the consequences of two or more alternatives are measured in addition to the costs. The consequences of each alternative are listed and decision makers form their own opinions about the relative importance of the findings.

Cost-Effectiveness Analysis

A technique in which the cost and effects of an intervention and an alternative are presented in a ratio of incremental cost to incremental effect.

Cost-Effectiveness Ratio

The incremental cost of using an intervention to obtain a unit of effectiveness (such as dollars per life-year gained) compared to an alternative such as another treatment or no treatment.

Cost-Utility Analysis

A specific type of cost-effectiveness analysis using quality-adjusted life years as the effectiveness endpoint. By convention, cost-utility analyses are often referred to as cost-effectiveness analyses; however, not all cost-effectiveness studies use the cost-utility methodology.

Cost-Utility Ratio

The incremental cost of an intervention to achieve one quality adjusted life year, compared to an alternative intervention.

Direct Medical Costs

The cost of medical resources consumed, such as physician visits, surgery, medical supplies and hospitalization. These costs are included in the numerator of the cost-effectiveness ratio.

Direct Nonmedical Costs

The cost of nonmedical resources such as child care or transportation that are attributable to the treatment (e.g., transportation to a medical appointment). These costs are included in the numerator of the cost-effectiveness ratio.

Discounting

The conversion of future dollars spent and future health outcomes (such as life years saved in 20 years from an intervention today) to their present value.

Effectiveness

The extent to which an intervention achieves health improvements, which can be measured in terms of various outcomes such as cases of disease prevented, years of life saved, or quality-adjusted life years saved.

Framing

Essential elements of the study design, such as the perspective of the analysis, the target population, and the choice of comparators.

Health State

The condition of an individual's health, including any disease, disability, and functional status.

Incremental Cost

The difference between the cost of an intervention of interest and the cost of the comparator.

Incremental Cost-Effectiveness Ratio

The incremental cost of an intervention divided by the incremental effectiveness.

League Table

A table ranking interventions by their cost-effectiveness ratios.

Net Costs

The total cost of an intervention, taking into account any savings in medical resources that the intervention may produce (for example, a drug therapy that decreases hospitalization would have a net cost that included the price of the drug, minus the savings in hospitalization).

Preference Weights

The numerical score associated with the value attached to a given health state. Scores typically range between 1.0 for perfect health and 0.0 for dead.

Quality-Adjusted Life Years (QALYs)

A method that assigns a preference weights (also called utilities) to each health state, determines the time spent in each state, and estimates life-expectancy as the sum of the products of each preference weight and time spent for each state.

Sensitivity Analysis

Analyses that determine the impact of changing one or several variables in a model or analysis on the outcome of the analysis. A sensitivity analysis allows a range of plausible inputs to be considered when there is uncertainty about the true value of an input. An example is comparing results using a discount rate of 3% with result using rates of 5% and 10%.

Standard Gamble

A method of assessing preferences for a given health state. The respondent is asked to compare life in a given health state with a gamble between two outcomes, usually a certain amount of life in perfect health and immediate painless death. The probability in the gamble is varied systematically until the respondent is indifferent between the certain health state and the gamble between perfect health and death. The standard gamble, time-trade-off and ratings scales are all methods of assessing preference for a given health state (i.e., the utility weight) used in the calculation of QALYs.

Time Costs

The cost of the time a patient incurs while seeking or receiving care.

Time Trade-Off

A method for assessing preferences for a given health state, in which the respondent is asked how much time he or she would be willing to trade from a given lifespan in the health state to have the remaining lifespan in perfect health. For example, a respondent might have a 40-year life expectancy in a given health state, and might be willing to trade 10 years in order to have a 30-year life expectancy in perfect health. The time trade-off method does not incorporate uncertainty and, therefore, the results of this method cannot be interpreted as a utility without transformation using a conversion curve.

Utility

The preference of an individual for a particular health state or treatment outcome measured using the standard gamble technique, which incorporates risk in the assessment. The time trade-off and rating scale methodologies do not incorporate uncertainty into their questions and technically do not produce "utilities." Utilities for a given health state have been measured using different populations, including a sample of the general public, patients who have experienced the disease state or outcome, or clinicians, or other surrogate respondents.

an exercise in accounting, not a formal economic evaluation. Economic analyses are designed to inform decisions based on both effectiveness and costs of different strategies (e.g., the new intervention and the comparator, often standard care). There are different types of valid analytic methods commonly used to assess new and established healthcare interventions (Stone, 2001). The costs should be measured similarly in all analyses, but the methods used to measure effects or outcomes differ. The more common types of economic evaluations found in healthcare are cost-effectiveness analysis, cost-utility analysis, and cost-benefit analysis.

Cost-Effectiveness Analysis

In cost-effectiveness analysis (CEA), the health outcomes of each alternative must be reported using the same units, such as life years gained or cases of disease prevented. Additionally, costs and effects are summarized in a cost-effectiveness ratio, which is calculated using the following formula:

$$(C_1 - C_2) \div (E_1 - E_2)$$

where C_1 = the cost of the new intervention, C_2 = the cost of the comparator, E_1 = the effect of the new intervention, and E_2 = the effect of the comparator. With CEA, analysts often use a decision analytic approach (i.e., a complex mathematical modeling technique) that captures the long-term costs and effectiveness.

Cost-Utility Analysis

Outcome measures that consider both quality and quantity of life (QOL) include disability adjusted life years (DALYs), healthy year equivalents (HYEs), and quality-adjusted life years (QALYs), which is the most common. The QALY combines an individual's estimated longevity and preferences about different levels of health-related QOL into a single measure (Torrance & Feeny, 1989). It is a unit of measure for survival that accounts for the effects of suboptimal health status and the

resulting limitations in QOL. Different health states are usually measured on a scale of 0 (representing death) to 1 (representing full health). These quality adjustments are also called "utilities," and CEA that has this outcome measure is called a cost-utility analysis (CUA).

Quality adjustment involves placing on a health state with impaired physical and emotional function a lower value than on time spent in full health; the greater the impairment, the lower the value of a particular health state. It is not realistic to expect a person to sustain the same QOL over time; rather, people move in and out of health states (e.g., a person has a stroke and then recovers). Individual QALYs are calculated by multiplying the time spent in each health state by the preference for that health state. These are then summed to arrive at an overall QALY.

Cost-Benefit Analysis

In cost-benefit analysis (CBA), outcomes are measured according to a monetary unit. A single currency figure, representing benefits minus cost, is calculated. The challenge of this approach is that many healthcare situations are difficult to quantify financially and require a value judgment. Further, there are ethical concerns surrounding the assignment of a monetary amount to the value of human life (Pauly, 1995). Because of these issues, the use of CEA has been more prevalent than CBA in the healthcare literature (Elixhauser, Halpern, Schmier, & Luce, 1998). An advantage of using CBA in health care is that the results may be compared to other areas of government investment (e.g., school education or transportation safety).

Methodologic Considerations in Framing an Economic Evaluation Perspective

Central to any economic evaluation is the perspective of the analysis. Costs and benefits might be seen differently from the points of view of society, the patient, the payer, or the provider. The appropriate resources to consider vary, depending on the perspective from which the

analysis is done and the question being asked (Gold, Siegel, Russell, & Weinstein, 1996; Stone, 2001). For example, a hospital administrator or manager may be interested only in costs incurred while patients are hospitalized. Therefore, only resources consumed by the intervention or the alternatives and the length of stay may be of interest. However, an insurer or national healthcare service will be interested in the direct costs associated with the initial hospital stays, including resources related to supplies and staffing as well as downstream resource utilization, such as readmission to hospital, outpatient visits, and other treatments. Further, when conducting an analysis from a societal perspective, costs and effects are included regardless of who accrues them. Therefore, nonhealthcare resources such as special education or other social services are included.

Ideally, all economic evaluations should have a societal perspective. However, because of the difficulty of assessing societal perspectives, as well as the specific concerns of decision makers, analyses are often done using a more narrow perspective. The danger in using a narrow perspective is that costs may simply be shifted. For example, the cost savings related to a shorter hospital stay may be shifted to the family in terms of extra caregiver burden.

Valuing Resources or Costs

In healthcare environments, charges generally do not reflect true costs. Third-party payers negotiate payment for services rendered based on the cost of the service and an agreed-on profit margin. This occurs in both for-profit and not-for-profit institutions. In order for healthcare institutions to generate more revenue, fee-for-service customers are often asked to pay full charges (i.e., a higher rate of pay). This is called institutional "cost shifting."

Analysts vary in how they value resources (Stone, Chapman, Sandberg, Liljas, & Neumann, 2000). A common method is to use cost-to-charge ratios (CCRs), mandatory calculations in hospital cost reports developed by U.S. hospitals for the Center of Medicare and Medicaid Services (CMS). CCRs are calculated by divid-

ing the total costs in a given cost center by the total charges for the same resource and, therefore, are a gross adjustment to charges. While not as accurate as a micro-costing method (where all inputs are costed out as in time and motion studies), CCRs are better than using charges alone. Additionally, because \$1 in 1990 does not have the same purchasing power as a current dollar, the costs from different years must be calculated and placed into a standard year format. Furthermore, when costs come from different countries, standardization of all costs to the same currency is also essential.

Quality Adjustment Weights and Patient Preferences

The measurement of QOL is a specific field of research and has standard methodologies (Hirth, Chernew, Miller, Fendrick, & Weissert, 2000). Measurement of QOL in economics includes assessment of preferences for a particular health state or treatment outcome. This is called utility assessment of patient preferences. Utilities for a given health state have been measured using different populations, including a sample of the general public, patients who have experienced the disease state or outcome, and clinicians or other surrogate respondents (Bell, Chapman, Stone, Sandberg, & Neumann, 2001; Hornberger & Lenert, 1996). The community population preferences are recommended when the analysis is conducted from the societal perspective. Non-preference-based QOL measures are available that are both generic (e.g., Medical Outcomes Study Short Form 36) and disease specific (e.g., Cedars-Sinai Health-Related Quality of Life Instrument for Rheumatoid Arthritis).

The Panel on Cost-Effectiveness in Health and Medicine

Because of the complexity of these methods and resulting variability employed, as well as a desire to increase quality and comparability of economic evaluations, efforts have been taken to increase the standardization in economic evaluations. The Panel on Cost-Effectiveness Analysis in Health Care and Medicine

convened by the U.S. Public Health Service Department made a number of recommendations and suggested a standard set of methodologic practices intended to improve the comparability of cost-effectiveness evidence, which is called a Reference Case (Gold et al., 1996). Some of the recommendations for an ideal Reference Case include adopting a societal perspective, reporting results in terms of dollars per QALY, including downstream net costs (and savings), discounting future costs and QALYs, and conducting a minimal standard set of sensitivity analyses (i.e., analyses where a parameter is varied and indicates the degree of influence it has on the results of the base analysis).

Useful Resources for Economic Evaluations

There are a number of software programs designed to help with the development of decision analytic cost-effectiveness analyses, societies interested in economic evidence, and useful Web sites dedicated to economic evidence (Table 2). TreeAge produces a number of software packages designed to support decision analyses, including those related to cost-effectiveness analysis. Data for Healthcare allows the analyst to create the decision tree and add probabilities, outcomes, and costs associated with alternative interventions. It also supports sensitivity analyses so that the effects of variations in probabilities, outcomes, and costs can be assessed.

The principal Web site (www.bls.gov/bls/wages.htm) produced by the U.S. Department of Labor, Bureau of Labor Statistics (BLS), is an excellent source for U.S. aggregate labor statistics. Under the Wages, Earnings, and Benefits category, there is a large amount of information on the wages, earnings, and benefits of various types of workers. Generally, this information is categorized in one or more of the following ways: geographic area (e.g., national, regional, state, metropolitan area, or county data), occupation (e.g., nurse), and industry (e.g., healthcare). Additional categories (e.g., age, sex, union membership) may be found in some cases. It also contains many healthcare provider salaries (www.bls.gov/oes/2000/oes291111.htm). For example, in 2000 the mean annual wage for an RN in the United States was \$46,410; for li-

Table 2. Useful Software, Societies, and Websites

Software

- Data TreeAge (www.treeage.com)

Societies

- International Health Economics Association (www.healtheconomics.org/cgi-bin/WebObjects/ihea)
- International Society for Pharmacoeconomics and Outcomes Research (<http://ispor.org/>)
- Society for Medical Decision Making (<http://smdm.org/>)

Web Sites

- Agency for Healthcare Research and Quality (www.AHRQ.gov/)
- Alternative Link, Inc. (<http://alternativelink.com>)
- Bureau of Labor Statistics (www.bls.gov/)
- The CEA Registry (www.hsph.harvard.edu/cearegistry/backgrnd.html)
- National Library of Medicine Etext on Health Technology Assessment (HTA) Information Resources (www.nlm.nih.gov/nichsr/ehta/)
- Relative Value Studies, Inc. (<http://rvsdata.com>)

censed vocational or practical nurses it was \$30,470. In the primary metropolitan statistical area of New York, the mean annual wage for RNs was \$57,310. The data are also given by mean hourly wage as well as median hourly wage, the latter of which may be more useful when salary data are skewed. A limitation to the data is that advanced practice nursing is consolidated with all RNs.

Another very useful section of the BLS web page is the Inflation and Consumer Spending category (www.bls.gov/bls/inflation.htm). It has consumer price indices and an easy-to-use inflation calculator linked to these indices. The inflation calculator allows the user to convert U.S. dollars from a previous year into another year's currency value. In general, the BLS Web page provides high-level data that may be useful in the development of economic analyses.

The objective of the CEA registry (www.hsph.harvard.edu/cearegistry/) is to create a single electronic source comprising all the information contained in a detailed database of CUAs (and in the future other CEAs).

The researchers have systematically audited English-language published CUAs. This Web site can be used to compare the cost-effectiveness of a broad range of interventions using standardized cost-utility ratios, and to investigate variations in the methods used in their estimation. The registry is intended to help public and private policy makers better understand the relative benefits and costs of diverse interventions and to aid in resource allocation decisions. It also should help move the field toward consistency in estimation techniques. Given the well-documented lack of standards in the field and the need for a common metric for comparison purposes, the registry should prove important to future policy makers in a wide range of disciplines.

Use of Claims Databases for Resource Utilization

Often, resource utilization is captured using claims data (Lave et al., 1994). Claims data are used for billing and are based on standardized medical coding systems such as the International Classification of Diseases (ICD), diagnosis-related group (DRGs), and current procedural terminology (CPT). While claims data are not without errors or variations in coding practices, these data have often been the best source available for direct healthcare resource utilization. However, the claims data often do not reflect nursing care. Cost-accounting systems are more specific and include direct healthcare cost components, such as variable costs (e.g., some type of measure of nursing time per hospital unit day plus supplies) and fixed overhead costs (e.g., rent and percentage of administration costs).

Roles for Standardized Nursing Terminologies in Economic Analyses

Although nursing standardized terminologies have not typically been used in economic analyses, there are several potential roles as they become more fully developed and widely used. Standardized terms for nursing interventions may be used to represent the alternatives being compared (e.g., "parenting education: group" versus "parenting education: individual"). However, the name of the nursing in-

tervention alone is not sufficient for its use in economic analyses; some method of estimating the resources associated with the intervention is necessary because time alone is an inadequate measure. Advanced Billing Concepts (ABC) codes were designed to serve this purpose.

Resource-Based Relative Value Scale

ABC codes include nursing interventions derived from the Home Health Care Classification, the Nursing Interventions Classification (NIC), and the Omaha System with associated relative value units (Martin & Scheet, 1992; McCloskey & Bulechek, 2000; Saba, 2002). The ABC code Resource-Based Relative Value Scale (RBRVS) was developed using the same methodology used to create the CMS RBRVS for conventional physician reimbursement. That is, RBRVS determines the relative value based on the resource costs used to produce services (i.e., time and intensity of nursing). The RBRVS units for ABC codes are based on 15-minute treatments unless another time element is indicated in the ABC code description. Therefore, a RBRVS of 1.5 translates to 22.5 minutes of nursing time.

Pairing RBRVS units with other code sets makes it possible to calculate the cost-effectiveness of various nursing strategies by diagnosis. The following three case studies illustrate the use of standardized nursing terminologies in economic analyses. Effectiveness is measured using the Nursing Outcomes Classification (NOC) (Iowa Outcomes Project, 2002) (Table 3). Although not utility based, NOC is useful because it was developed to measure nursing-sensitive outcomes. Other outcomes of interest may include those that relate to patient improvement specific to diagnostic codes such as the International Classification of Diseases, ninth edition (ICD-9), nursing diagnostic codes such as the NANDA labels, or standardized generic measures such as patient satisfaction or the Short Form-12.

Case Studies

Three case studies are presented. Related interventions, RBRVS units, and NOC measures for each case



Economic Evaluations and Usefulness of Standardized Nursing Terminologies

Table 3. Nursing Outcomes Classification Scale Descriptions, Values, and Example Outcomes

Scale	Description	Scale Values (1-5)	Example Outcomes
1	Physiologic or psychological outcomes that do not have quantifiable or standardized ranges	<ul style="list-style-type: none"> ■ Extremely compromised ■ Substantially compromised ■ Moderately compromised ■ Mildly compromised ■ Not compromised 	<ul style="list-style-type: none"> ■ Cognitive Ability (0900) ■ Family Health Status (2606) ■ Quality of Life (2000)
2	Physiological states with known ranges	<ul style="list-style-type: none"> ■ Extreme deviation from expected range ■ Substantial deviation from expected range ■ Moderate deviation from expected range ■ Mild deviation from expected range ■ No deviation from expected range 	<ul style="list-style-type: none"> ■ Maternal Status: Postpartum (2511) ■ Nutritional Status: Biochemical Measures (1005) ■ Vital Signs Status (0802)
3	Degree of dependency for functional status and self-care outcomes	<ul style="list-style-type: none"> ■ Dependent, does not participate ■ Requires assistive person & device ■ Requires assistive person ■ Independent with assistive device ■ Completely independent 	<ul style="list-style-type: none"> ■ Mobility Level (0208) ■ Self-Care: Activities of Daily Living (0300)
4	Degree of motion for outcomes that describe an individual's physical mobility	<ul style="list-style-type: none"> ■ No motion ■ Limited motion ■ Moderate motion ■ Substantial motion ■ Full motion 	<ul style="list-style-type: none"> ■ Joint Movement: Active (0206) ■ Joint Movement: Passive (0207)
5	Extent of outcomes that describe a systemic response to a remedial health treatment, agent, or method or the control of physiological, psychosocial, or functional health	<ul style="list-style-type: none"> ■ Not at all ■ To a slight extent ■ To a moderate extent ■ To a great extent ■ To a very great extent 	<ul style="list-style-type: none"> ■ Blood Glucose Control (2300) ■ Energy Conservation (0002)
6	Level of adequacy for outcomes related to patient performance and safety	<ul style="list-style-type: none"> ■ Not adequate ■ Slightly adequate ■ Moderately adequate ■ Substantially adequate ■ Totally adequate 	<ul style="list-style-type: none"> ■ Caregiver Performance: Direct Care (2205) ■ Nutritional Status: Nutrient Intake Parenting (1009) ■ Safety Behavior: Fall Prevention (1909)
7	Frequency of outcomes related to safety status	<ul style="list-style-type: none"> ■ >9 ■ 7-9 ■ 4-6 ■ 1-3 ■ None 	<ul style="list-style-type: none"> ■ Safety Status: Falls Occurrence (1912)
8	Extent of outcomes that describe biopsychosocial pressure or response	<ul style="list-style-type: none"> ■ Extensive ■ Substantial ■ Moderate ■ Limited ■ None 	<ul style="list-style-type: none"> ■ Caregiver Stressors (2208)
9	Extent of patient states, behaviors, and knowledge	<ul style="list-style-type: none"> ■ None ■ Limited 	<ul style="list-style-type: none"> ■ Caregiver Home Care Readiness (2202)

Scale	Description	Scale Values (1–5)	Example Outcomes
		<ul style="list-style-type: none"> ■ Moderate ■ Substantial ■ Extensive 	<ul style="list-style-type: none"> ■ Comfort Level (2100) ■ Knowledge: Medication (1808)
10	Extent to which cells and tissues have regenerated	<ul style="list-style-type: none"> ■ None ■ Slight ■ Moderate ■ Substantial ■ Complete 	<ul style="list-style-type: none"> ■ Bone Healing (1104) ■ Wound Healing: Secondary Intention (1103)
11	Outcomes that describe perception of own appearance, body function, or worth	<ul style="list-style-type: none"> ■ Never positive ■ Rarely positive ■ Sometimes positive ■ Often positive ■ Consistently positive 	<ul style="list-style-type: none"> ■ Body Image (1200) ■ Self-Esteem (1205)
12	Outcomes that describe a person's ideas and perceptions that influence health behavior	<ul style="list-style-type: none"> ■ Very weak ■ Weak ■ Moderate ■ Strong ■ Very strong 	<ul style="list-style-type: none"> ■ Health Beliefs: Perceived Ability to Perform (1701) ■ Health Beliefs: Perceived Resources (1703)
13	Outcomes for a number of behaviors in which consistency of behavior	<ul style="list-style-type: none"> ■ Never demonstrated ■ Rarely demonstrated ■ Sometimes demonstrated ■ Often demonstrated ■ Consistently demonstrated ■ Asthma Control (0704) ■ Compliance Behavior (1601) ■ Family Functioning (2602) 	
14	Outcomes that describe the severity of physiological or psychological response or disturbance from illness	<ul style="list-style-type: none"> ■ Severe ■ Substantial ■ Moderate ■ Slight ■ None 	<ul style="list-style-type: none"> ■ Depression level (1208) ■ Pain: Disruptive Effects (2101) ■ Symptom Severity: Perimenopause (2104)
15	Extent of evidence related to health behavior or status	<ul style="list-style-type: none"> ■ No evidence ■ Limited evidence ■ Moderate evidence ■ Substantial evidence ■ Extensive evidence 	<ul style="list-style-type: none"> ■ Abuse Cessation (2500)
16	Extent of delay of an individual's physical, emotional, and social maturation	<ul style="list-style-type: none"> ■ Extreme delay from expected range ■ Substantial delay from expected range ■ Moderate delay from expected range ■ Mild delay from expected range ■ No delay from expected range 	<ul style="list-style-type: none"> ■ Child Development: 6 Months ■ Child Development: Middle
17	Outcomes that describe the health, well-being, and functioning of a community or population	<ul style="list-style-type: none"> ■ Poor ■ Fair ■ Average ■ Good ■ Excellent 	<ul style="list-style-type: none"> ■ Community Risk Control: Communicable Disease (2801) ■ Community Risk Control: Lead Exposure (2803)

study are summarized in Table 4. Using a conversion factor of \$35.13 per RBRV, the cost-effectiveness of each case is discussed below. This dollar conversion factor is based on the 2004 CMS RBRVS conversion factor and is multiplied for the units listed for each intervention. Using a standard dollar multiplier and the same relative value methodology to convert intervention resources into dollars provides precise measurement of the cost of nursing interventions to compare against physician or other provider care.

To calculate the costs associated with each case study, the number of total RBRVS for each coded diagnosis must be summed. Next, the total relative value units are multiplied by the dollar conversion factor to obtain an overall cost per intervention associated with the diagnosis. Data from many patients across multiple settings can be added together for each diagnosis and divided by the number of patient encounters to find the average treatment cost for the entire group. This information can then be measured against other treatment options and the incremental costs calculated. Mean effectiveness, measured using NOC outcomes, is calculated for each group. This allows us to calculate a cost-effectiveness ratio (incremental costs per incremental effectiveness)

Case study 1. A community health center traditionally has used public health nurses to educate teen parents individually or as couples. The center director recently instituted the alternative of providing group versus individual educational sessions for teen parents with a nursing diagnosis of *deficient knowledge related to infant care*. After a 6-month trial, the director wishes to compare cost-effectiveness of individual versus group educational sessions on selected outcomes. For the experimental group teaching, RBRVS units total 1.39 and this translates into a cost of \$49 ($1.39 \times \$35.13 = \48.83) per participant. For the control group using individual teaching, the RBRVS units total 2.88, a cost of \$101 ($2.88 \times \$35.13 = \101.17) per participant. The outcome Family Functioning was measured on a scale of 1 to 5, with 1 = never demonstrated and 5 = consistently demonstrated. If the mean family functioning score is 4.1 in the experimental group and 3.8 in the control group, the experi-

mental group teaching is cost-saving: that is, it costs less and is more effective than individual teaching for *deficient knowledge related to infant care*.

Case study 2. An outpatient hypertension clinic has initiated a multifaceted intervention (medication teaching, decision-making support, coping enhancement) aimed at improving adherence to medication regimen for clients with a diagnosis of *noncompliance related to medication regimen*. The addition of more comprehensive teaching interventions will obviously take more time and, therefore, be more expensive. In addition to changes in blood pressure, the clinicians want to determine if the intervention is cost-effective compared to usual care (medication teaching) for the outcome of Compliance Behavior. If the average Compliance Behavior score is 4 in the experimental group compared with 3.5 in the control group, the incremental effectiveness is .5. The cost of the experimental group is \$76 ($76.58 = 2.18 \times 35.13$) compared with an average cost of \$29 in the control group ($28.81 = .82 \times 35.13$). Given the hypothetical increase in compliance and increased cost, the cost-effectiveness ratio is \$95 ($95 = 47.78 / .5$) per unit of compliance increase.

Case study 3. In an academic health center, the nurses on the surgical ward are interested in managing the pain related to thoracentesis. They have read articles suggesting that providing sensory information is useful patient preparation for some procedures. Consequently, they wish to compare the cost-effectiveness of education alone versus education plus sensory information on patient level of pain. If the education plus sensory information group's Pain Disruptive Effects is 3.3 compared with 4.2 of the education only group then the cost-effectiveness ratio is \$32 per unit of less pain disruption.

Discussion

These case studies illustrate the use of standardized intervention terms with associated RBRVS unit values and outcomes to determine the cost-effectiveness of competing strategies of nursing care. Case study 1 is easy to interpret because it illustrates a cost-saving intervention. However, while the other analyses inform the setting-

Table 4. Nursing Interventions, Research-Based Relative Value Scale, and Outcomes for Three Case Studies

Case Study 1. Nursing Diagnosis *Deficient knowledge related to infant care*

	Nursing Interventions	RBRVS	Nursing-Sensitive Outcome (Mean Score)
<i>Experimental Group</i>	■ Teen Parent Education, Group	.82	Family Functioning (4.1)
	■ Teaching Infant Nutrition, Group	.23	
	■ Teaching Infant Safety, Group	.23	
	■ Support System Enhancement, Group	.11	
	Total RBRVS	1.39	
	Total Cost	\$48.83	
<i>Control Group</i>	■ Teen Parent Education, Individual	.54	Family Functioning (3.8)
	■ Teaching Infant Nutrition, Individual	.93	
	■ Teaching Infant Safety, Individual	.93	
	■ Support System Enhancement, Individual	.48	
	Total RBRVS	2.88	
	Total Cost	\$101.17	
<i>Cost-effectiveness ratio calculation: (48.83 - 101.17)/(4.1 - 3.8) = cost savings</i>			

Case Study 2. Nursing Diagnosis *Noncompliance related to medication regimen*

	Nursing Interventions	RBRVS	Nursing-Sensitive Outcome (Mean Score)
<i>Experimental Group</i>	■ Teaching Prescribed Medication	.82	Compliance Behavior (4)
	■ Coping Enhancement	.82	
	■ Decision-Making Support	.54	
	Total RBRVS	2.18	
	Total Cost	\$76.58	
<i>Control Group</i>	■ Teaching Prescribed Medication	.82	Compliance Behavior (3.5)
	Total RBRVS	.82	
	Total Cost	\$28.81	
<i>Cost-effectiveness ratio calculation: (76.58 - 28.81)/(4 - 3.5) = \$95.54 per unit of compliance</i>			

Case Study 3. Nursing Diagnosis *Acute Pain*

	Nursing Interventions	RBRVS	Nursing-Sensitive Outcome (Mean Score)
<i>Experimental Group</i>	■ Treatment Procedure Education: Individual	.36	Pain: Disruptive Effects (3.3)
	■ Preparatory Sensory Information	.82	
	Total RBRVS	1.18	
	Total Cost	\$41.54	
<i>Control Group</i>	■ Treatment Procedure Education: Individual	.36	Pain: Disruptive Effects (4.2)
	Total RBRVS	.36	
	Total Cost	\$12.65	
<i>Cost-effectiveness ratio calculation: (41.54 - 12.65)/(3.3 - 4.2) = \$32.10 per fewer pain disruptive effects</i>			

Note: RBRVS = Resource based relative value scales

Total cost equals total RBRVS times 35.13, which is based on the Centers for Medicare and Medicaid Services payment for RBRVS.

specific user, trying to interpret these data across analyses is more difficult. What is more cost-effective: \$95 per unit of compliance increase or \$32 per unit of less pain disruption?

Most analysts use more standard outcome measures such as dollars per life year gained or dollars per QALY gained when possible. While many nursing interventions may not affect mortality (and, therefore, life years), it is reasonable to believe most nursing interventions affect a patient's QOL. A goal of nursing should be to include standardized preference-based QOL measures in their assessment to inform economic analyses.

Nursing has often not been able to demonstrate the value of nursing interventions because of a lack of standardized economic analyses. For example, in a well-cited systematic review (Stone, Teutsch, et al., 2000) examining published evidence of the cost-effectiveness of prevention methods, data from the CEA Registry were examined and included 50 CUAs pertaining to clinical prevention services and 174 corresponding cost-effectiveness ratios. Cost-effectiveness ratios ranged from cost-saving to \$27 million QALY, with a median of \$14,000 million QALY. While 14 of the ratios were from studies designed to estimate the cost-effectiveness of patient counseling interventions, no studies could be directly related to nursing care, and not one study was published in a nursing journal.

Nursing is lagging behind other disciplines in its contribution to rigorous economic literature, as recommended by the Panel on Cost-Effectiveness Analysis in Health Care and Medicine. This may be because of (a) the complexity of analyses, (b) variations in the methods employed, or (c) lack of standardized nursing data in electronic format. The National Institute of Nursing Research is hoping to increase nurse researchers' understanding of methods used in cost-effectiveness analyses and is sponsoring a workshop to meet this goal. Given the nursing profession's long history of interest in patients' QOL, incorporating preference-based QOL measures as part of computer-based nursing assessment would be a significant contribution to this field. Ruland and Bakken (2002) propose an approach for accom-

plishing this objective. However, standard criteria to assess the many different QOL instruments available are also needed (Lohr et al., 1996). The nurse's ability to assess and contribute to all aspects of rigorous economic evidence is an essential competency for responsible practice.

Conclusion

Standardized nursing terminologies have not typically been used in economic analyses. The examples in this paper have illustrated the applicability of nursing intervention and outcome terms to economic analyses. Such integration is required to move beyond the critical foundational steps of labeling and defining nursing phenomena, interventions, and outcomes to determining the cost-effectiveness of nursing interventions.

Author contact: ps2024@columbia.edu, with a copy to the Editor: rose_mary@earthlink.net

References

- Bell, C.M., Chapman, R.H., Stone, P.W., Sandberg, E.A., & Neumann, P.J. (2001). An off-the-shelf help list: A comprehensive catalog of preference scores from published cost-utility analyses. *Medical Decision Making, 21*, 288-294.
- Elixhauser, A., Halpern, M., Schmier, J., & Luce, B.R. (1998). Health care CBA and CEA from 1991 to 1996: An updated bibliography. *Medical Care, 36*(5 Suppl.), MS1-147.
- Gold, M.R., Siegel, J.E., Russell, L.B., & Weinstein, M.C. (1996). *Cost-effectiveness in health and medicine*. Oxford: Oxford University Press.
- Hirth, R.A., Chernew, M.E., Miller, E., Fendrick, A.M., & Weissert, W.G. (2000). Willingness to pay for a quality-adjusted life year: In search of a standard 6. *Medical Decision Making, 20*, 332-342.
- Hornberger, J., & Lenert, L.A. (1996). Variation among quality-of-life surveys. Theory and practice. *Medical Care, 34*(12 Suppl.), DS23-DS33.
- Iowa Outcomes Project. (2000). Nursing outcomes classification: Background and use. In M. Johnson, M. Maas, & S. Moorhead (Eds.), *Nursing outcomes classification* (2nd ed., pp. 3-78). St. Louis: Mosby.

Lave, J.R., Pashos, C.L., Anderson, G.F., Brailer, D., Bubolz, T., Conrad, D., et al. (1994). Costing medical care: Using Medicare administrative data. *Medical Care*, 32(7 Suppl.), JS77-JS89.

Martin, K.S., & Scheet, N.J. (1992). *The Omaha system: Applications for community health nursing*. Philadelphia: Saunders.

McCloskey, J.C., & Bulechek, G.M. (2000). *Nursing interventions classification (3rd ed.)*. St. Louis: Mosby.

Pauly, M.V. (1995). Valuing health care benefits in money terms. In F. Sloan (Ed.), *Valuing health care: Costs, benefits, and effectiveness of pharmaceuticals and other medical technologies* (pp. 99-124). Cambridge, MA: Cambridge University Press.

Ruland, C.M., & Bakken, S. (2002). Developing, implementing, and evaluating decision support systems for shared decision making in patient care: A conceptual model and case illustration. *Journal of Biomedical Informatics* 35, 313-321.

Saba, V. (2002). *Home health care classification*. Retrieved March 14, 2002, from www.sabacare.com

Stone, P.W. (2001). Dollars and sense: A primer for the novice in economic analyses (Part I). *Applied Nursing Research*, 14, 54-55.

Stone, P.W., Chapman, R.H., Sandberg, E.A., Liljas, B., & Neumann, P.J. (2000). Measuring costs in cost-utility analyses: Variations in the literature. *International Journal of Technology Assessment in Health Care*, 16, 111-124.

Stone, P.W., Teutsch, S., Chapman, R.H., Bell, C., Goldie, S.J., & Neumann, P.J. (2000). Cost-utility analyses of clinical preventive services: Published ratios, 1976-1997. *American Journal of Preventive Medicine*, 19, 15-23.

Torrance, G., & Feeny, D. (1989). Utilities and quality-adjusted life years. *International Journal of Technology Assessment in Health Care*, 5, 559-575.

NANDA International Membership Application

Name _____

Home Address _____

City/State/Zip/Country _____

Fax/E-mail _____

Place of Employment _____

Highest Degree Held:

AD BSN MS MSN PhD DNSc

EdD Other _____

Primary Function:

Administrator/Manager

Consultant

Researcher

Other: _____

Area of Specialization:

Community Health

Maternal/Newborn

Psych/Mental health

Health Promotion

Other: _____

Clinical/Staff Nurse

Educator

Clinical Nurse Specialist

Nursing of Children

Medical/Surgical

Gerontology/Long-Term

Nursing Administration

Type of Membership:

Full Membership

\$100.00*

Retired

\$ 65.00*

Student

\$ 29.00

\$29.50 of this amount is for a one-year subscription to the official journal, *IJNTC*.

Indicate Method of Payment: Checks or money orders should be made payable to NANDA International.

Check Money Order MasterCard Visa

If using a credit card complete:

Card No. _____ Exp. Date: _____

Mail to: NANDA, 1211 Locust Street, Phil., PA 19107

Signature: _____

U.S. & Canada, call: 800.647.9002 International: 215.545.8105 fax: 215.545.8107

E-mail: rmpinc@nursecominc.com