

Infrastructure for Quality of Care



Review ■

Outcomes Monitoring: Adjusting for Risk Factors, Severity of Illness, and Complexity of Care

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Abstract Adjusting for risk factors, severity of illness, and complexity of care is important when comparing and interpreting outcomes. Current and future approaches for examining risk factors, severity of illness, and complexity of care are described within the contexts of administrative, economic, and clinical outcomes. Reasons why the current standardized instruments, computerized severity systems, and workload/intensity measurements, when used alone, are inadequate for outcomes monitoring are proposed. A more comprehensive model for outcomes monitoring is required, one that adjusts outcomes for risk factors, severity of illness, and complexity of care.

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Outcomes management is one approach to monitoring administrative, economic, and clinical outcomes.¹⁻³ Outcome, a measurable product, is the changed state or condition of an individual as a consequence of health care.⁴ Outcomes monitoring draws on protocols and standards for practice.^{5,6} Analysis of aggregate clinical and cost data provides estimates of relationships between care interventions and outcomes, and between outcomes and costs.⁷⁻⁹

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The purpose of this article is to discuss the comparison and interpretation of outcomes (administrative, economic, and clinical) within the context of adjusting for risk factors, severity of illness, and complexity of care. The following are addressed: 1) types of administrative, economic, and clinical outcomes¹⁰; 2) issues about data necessary for outcomes monitoring; 3) current and future approaches to examining links among risk factors, severity of illness, and complexity of care; 4) considerations of data reliability and validity; and 5) future models for outcomes analyses.

Administrative, Economic, and Clinical Outcomes

There are three types of outcomes: administrative (efficiency, efficacy, equity, and effectiveness); economic (utilization and optimization); and clinical (morbidity, mortality, perceived satisfaction, and quality of life).¹⁰ Efficiency is the degree to which

care received has the desired effect with minimum effort and waste.⁷ Efficacy is the expected benefit when health care services are provided under ideal conditions.⁷ Equity is conforming to principles that ensure a fair and just distribution of health care services.⁴ Equity must be discussed within the contexts of culture, gender, and societal norms. Effectiveness is the benefit realized from services rendered by clinicians for typical patients under normal conditions.⁸ Effectiveness is measured according to timeliness (i.e., care made available when required); appropriateness (i.e., care congruent with the needs of an individual in an accessible manner); and continuity (i.e., care coordinated among practitioners and across the organization for an individual's episode of illness).¹¹ Utilization refers to health care resource use and includes indicators such as number of emergency visits, length of stay, and readmissions. Optimization represents the balancing of costs against the efficiency, efficacy, and effectiveness of care.⁴

Morbidity and mortality as aggregate clinical outcomes are indicators that the quality of care may have been compromised, especially when these outcomes are unexpected or are avoidable.⁷ In an attempt to shift from outcomes about sentinel events, measurements of satisfaction and quality of life have been pursued. If clinical outcomes are to be relevant, we must move beyond rate-based indicators. Although satisfaction has received attention as a clinical outcome, its utility as an outcome is questionable. Satisfaction with care is merely the perception that individual needs have been met, not necessarily that quality treatment has been received.⁸ Satisfaction as an individual's perception must be articulated within the contexts of personal and cultural values, beliefs, and attitudes. Quality of life, sometimes referred to as bio-psychosocial and spiritual well-being, when compared with satisfaction, has greater relevance as a clinical outcome.¹ Therefore, although satisfaction can be extrapolated to reflect how an individual feels about health care received, it is not as comprehensive as is quality of life. Quality of life as an outcome measure incorporates both a subjective opinion about well-being and an objective assessment about functional status. Therefore, as a measure of outcome, quality of life is often preferred to satisfaction because subjective and objective assessments are explained within the contexts of functional ability and overall well-being.

Comparison and Interpretation of Outcomes

Outcomes, the changed states or conditions of individuals as a consequence of health care, can be

measured from administrative, economic, and clinical perspectives.¹⁰ However, if individual or population outcomes are to be compared and interpreted, they must first be adjusted for risk factors, severity of illness, and complexity of care. According to Ellwood,¹ this adjustment is a far from trivial undertaking.

Risk Factors

Risk, the likelihood of an outcome,¹² cannot be measured without considering factors that may influence an outcome. There are three types of risk factors: 1) etiologic, such as allergies, hypertension, and infections; 2) demographic, such as genetic predisposition, age, sex, and socioeconomic status; and 3) environmental, such as natural and occupational exposures.^{8,12} The chance of developing an outcome when one or more risk factors are present can be described using either probability or incidence.

Incidence reflects the proportion of those who develop a specific outcome within a specified time period.¹³ Its numerator consists of individuals who were free of the outcome at the beginning of the time period and who actually developed the outcome. Its denominator reflects the total number of individuals who were originally free of the outcome and who could have developed the outcome during the time period. Kramer¹³ provides an example of incidence, relative risk, and attributable risk from a study of deaths from selected causes associated with heavy cigarette smoking by British male physicians¹⁴; the annual lung cancer death rate per 1,000 was 0.07 for nonsmokers, whereas the annual lung cancer death rate per 1,000 was 2.27 for heavy smokers.¹³ These two incidence rates can be compared by their relative risks and attributable risks. The relative risk provides the best estimate of the strength or magnitude of the association between the risk factor and the outcome and therefore is useful for making causal inferences.¹³ For the above example, the relative risk for death is 32.43 ($2.27 \div 0.07$), indicating a strong association between smoking and lung cancer.¹³ In health care, attributable risk is often more useful because it indicates the frequency with which the outcome can be attributed to the risk factor. Using the previous example, 2.2 of the 1,000 deaths from lung cancer ($2.27 - 0.07$) can be attributed to smoking.¹³ When the incidence rate of an outcome shows a significant change over time, a thorough investigation may be required.

One approach used for comparisons of outcomes among institutions, communities, and states is known as risk adjustment or standardization.¹⁵ Standardization, a statistical procedure, permits valid comparisons. In the direct method, outcome occurrence in

the standard population, such as rates of disease by age and sex, is applied to institutions to determine what would be expected to occur. Alternately, with the indirect method, outcome occurrence in the institution, such as rates of disease by age and sex, is applied to the standard population to determine what would be expected to occur. This method is more valid when comparing outcomes between two or more institutions, with all comparisons made against a benchmark.

Severity of Illness

In addition to identifying risk factors, one cannot adequately compare and interpret outcomes without also adjusting for severity of illness.^{12,16} Severity of illness measurements are associated with diagnosis related groups (DRGs) (in the United States) and case/mix groupings (CMGs) (in Canada). Severity of illness measurements are in part discipline-specific.¹² For example, physical and occupational therapists generally focus on functional status assessments and activities of daily living; nurses focus on physiologic and psychological stability; and physicians focus on the impact of a particular disease on physiologic integrity.^{7,12,16} Components of a severity of illness measurement are 1) functional ability of the individual, that is, ability to conduct activities of daily living; 2) burden of illness that reflects cost to society; and 3) physiologic, morphologic, and biologic derangements.¹² Therefore, it seems most relevant first to identify the components of a severity of illness measurement and then to have each discipline contribute data to determine a composite score for severity of illness. The actual measurement of the reliability and validity of severity measurements must also be addressed.

The validity of a measurement indicates how closely the test result corresponds to some objective standard of the outcome.^{7,13,15} Unfortunately, some outcomes do not have readily available "gold standards" by which to assess validity.¹³ Validity is often evaluated conditionally, that is, separately in those subjects who have and those who do not have the outcome.¹³ Outcome measurements are not always sensitive (the proportion correctly identified with a particular outcome) and specific (the proportion correctly identified without the outcome).^{13,15} The perfectly valid measurement has both sensitivity and specificity equal to one.¹³

Severity of illness measurements include, but are not limited to, information collected from a variety of sources, such as standardized instruments, computerized systems, and workload/intensity measurements. When severity measures are adopted to adjust

outcomes for comparisons across organizational and state levels, standardization of data collection is critical. Documentation quality and quantity must be addressed and required data elements defined. Each of these sources is discussed below, along with the reason why it alone does not serve as an adequate measure for outcomes monitoring.

Standardized instruments have been developed to account for severity of illness. The Physiologic Severity Index for use with preterm infants is one example.¹⁷ This instrument is reported to be valid and reliable. Other reliable and valid standardized instruments include the Psychometric Assessment of the Quality of Life Index¹⁸ and the Health Status Questionnaire or Short Form-36 (SF-36).¹⁹ Systematic and standardized approaches to data collection include computerized severity systems¹⁶ such as the Acute Physiology and Chronic Health Organization System,^{20,21} the Computerized Severity Index,²² Disease Staging,²³ MedisGroups,²⁴ and Patient Management Categories.²⁵ The basis of the severity construct for each system is either physiologic assessment or resource consumption. Thus, these systems focus on acute physiologic disorders that predict poor clinical outcomes such as death or organ failure. While these systems predict adverse outcomes, such severity measurements serve primarily as screening tools,¹⁶ offering a rather limited perspective. A more useful and inclusive approach to outcomes monitoring includes adjusting for risk factors, severity of illness, and complexity of care.

Complexity of Care

Complexity of care is measured by workload/intensity, that is, the amounts and types of resources used to care for a patient over an entire hospital stay or during an episode of care.²⁶ Capturing the intensity of workload requires documentation of the direct and indirect care hours by level of caregiver. Typically, workload measurements have been used as a surrogate measure for severity of illness.

O'Brien-Pallas and Giovannetti²⁶ identified four predominant issues associated with using nursing workload/intensity data for outcomes monitoring: data availability, reliability, validity, and comparability. Serious informatics concerns exist regarding the lack of available patient-specific nursing workload/intensity data. Often, data are stored not at the individual patient level, but rather as an aggregate of resources consumed over an entire nursing unit. In addition, these data about nursing workload/intensity are rarely kept as a part of the permanent patient record, and rarely is the caregiver level flagged to the individual patient.²⁶

The extent to which an organization participates in outcomes management evaluation greatly influences the quality of the data collected. It can be assumed that each system begins with some level of data validity and reliability.²⁶ A necessary condition is that the validity and reliability of workload/intensity measures be attended to on an ongoing basis and be the responsibility of each organization. Major problems exist when workload/intensity data are used as a surrogate measure for severity of illness for outcomes monitoring. Common patient classification systems used to measure the intensity of nursing often provide very different estimates of nursing response when applied to the same patients.²⁷ Differences in nursing care hours as great as 4.53 hours per patient per day were observed when four different patient classification (nursing workload/intensity) tools were applied to the same patients.²⁷

Because neither severity of illness systems nor workload/intensity systems seem to provide valid and reliable data for outcomes monitoring, other approaches are necessary. Consideration needs to be given to whether nursing diagnosis or other nursing classification taxonomies could better serve as severity measures. O'Brien-Pallas et al.²⁷ think that none of the aforementioned approaches for outcomes monitoring (severity of illness and complexity of care) provides comprehensive measures and considerations for monitoring administrative, economic, and clinical outcomes.

Issues Related to Outcomes Monitoring and Adjusting for Risk Factors, Severity of Illness, and Complexity of Care

Interest in outcomes monitoring from administrative, economic, and clinical perspectives arose after changes were made in hospital reimbursement systems. It is clear that the current leading work in the area of outcomes monitoring is focused primarily on medical outcomes.²⁸ There is little clarity about the relationship of DRGs and CMGs with respect to risk factors, severity of illness, and complexity of care. For example, when to obtain outcome measurements is an important issue. It is believed that measures of risk factors, severity of illness, and complexity of care should be obtained at admission and over an entire episode of care. The challenge is to describe patient outcomes and to illustrate how outcomes are influenced by nursing treatments. Furthermore, it is essential to develop models with adjustment calculations that are inclusive of patient responses to nursing treatments and medical treatments.

As we approach the year 2000, integration of the numerous variables influencing care planning, treatment, and outcomes monitoring into a common database will be enhanced by common terminology and will build on the research efforts currently under way. Nurse leaders in both Canada and the United States are actively supporting the inclusion of a nursing minimum data set in automated patient records. Common nursing data elements include a taxonomy for defining nursing diagnoses, interventions, workload/intensity, and outcomes of care. Concurrently, researchers are beginning to unravel complex relationships surrounding the variables that influence nurse resource use and nursing intensity, two important aspects of monitoring outcomes. While many of the emerging studies are not yet complete, preliminary findings are compelling. They provide insight into future approaches to adjust outcomes for complexity of care. To illustrate the early direction of the paradigm shift, elements and assertions of an American approach and a Canadian approach are explored briefly.

Issues of variability in nursing care and treatments in relation to DRGs were explored by Prescott.²⁹ Prescott suggested that factors influencing complexity of nursing care, such as physiologic stability and emotional needs, were not sufficiently incorporated into current patient classification systems. Based on these findings, Prescott et al.³⁰ developed the Patient Intensity for Nursing Index (PINI). As defined by the PINI model, nursing workload/intensity includes amount of care, complexity of care, and clinical judgment necessary to care for patients in a specific setting. Each variable may be important in a comprehensive model for monitoring outcomes of care. The four distinct, but related, multidimensional concepts that comprise the PINI are 1) severity of illness (the gravity of a patient's condition); 2) dependency (a patient's need for nursing, which includes items found in traditional workload measurement systems, such as the need for assistance with activities of daily living, as well as items related to teaching and psychosocial support); 3) complexity (the knowledge, skill, and experience associated with tasks and procedures, and the intricacy of decision making associated with the nursing care); and 4) time (the hours of care actually provided within a specified time frame). The construct validity of this model, configured as a measure of nursing workload/intensity, has been established and reported.³⁰

Concurrently, O'Brien-Pallas et al.³¹ developed an alternative model, motivated by case costing activities occurring in Canada and the realization that mean time per medical CMG was not a sensitive measure

of nurse resource use, that is, nursing workload/intensity. These investigators set out to examine the patient-, nurse-, medical-, and environment-specific factors that contribute to shifts in nurse resource use. Nursing workload/intensity data were collected by determining the direct nursing care hours as measured by PRN 80.³² The complexity of a patient's condition, from a nursing perspective, was measured by way of nursing diagnoses using the Taxonomy of Nursing Diagnoses developed by the North American Nursing Diagnoses Association (NANDA).³³ When categorized according to Gordon's Functional Health Patterns,³⁴ nursing diagnoses had positive linear relationships with nursing workload/intensity, and explained a positive and statistically significant amount of the variability in nurse resource use. Nursing diagnoses provided estimates of the complexity and variability in nursing workload/intensity that, in part, influenced the amount of nursing care provided to patients. Medical case mix also explained a substantive and significant amount of the observed variability in the nursing intensity. Both the nursing and the environmental elements were examined in an initial qualitative study of nurses' perceptions of the factors causing shifts in their workloads.

The models of Prescott and O'Brien-Pallas explored nursing complexity from different perspectives, yet common themes emerged.²⁶ Both models explored the characteristics of a patient's nursing condition, medical severity, and characteristics of caregivers. Although the ways in which these concepts were measured differed, both models moved beyond the current intervention focus measures and used multiple measures to explore the resource needs of patients. Both models embraced elements of the nursing-care component of the proposed nursing minimum data set. Also, both models included data elements that are routine components of regular nursing documentation and that, with computerized patient records, could become by-products of nursing documentation. While the models meet several of the criteria for future systems, they represent only pioneering approaches. Further research needs to be conducted to understand thoroughly the manpower implications of the complex phenomena influencing patient demands for nursing care, caregiver ability to meet these demands, and expected outcomes. Specification of expected outcomes is not only a cost issue, but also a philosophical one. If the inputs of nursing care could be directly linked to specific patient outcomes, then the actual costs and ethical issues associated with providing less care than required could be determined.

Recently environmental components have been in-

cluded in the determination of workload/intensity measures. Consideration of environmental factors in part addresses the extent to which nursing care delivered is a function of the system delivering the nursing care and the unique demands of the patient. Environmental complexity includes 1) unanticipated and delayed events; 2) multiple and long procedures that are functions of shifting patient acuity; and 3) characteristics and composition of the caregiver team. While patient age and medical/nursing conditions reflect the unique contribution of an individual patient to the demand for the nursing resource, environmental complexity reflects the complexity and variability of concurrently caring for a group of patients. Hayes' study³⁵ moved beyond the current intensity approaches of measuring tasks and treating them as equivalent to nursing time required. Patient complexity then includes the nursing, medical, and environmental components; each of these perspectives contributes uniquely to the determination of intensity for nursing.

As we move to the next generation of outcome models, there is a need for conceptual clarity in use of terminology. The terms severity and complexity are currently used interchangeably to describe the phenomenon of variability in nurse resource use; however, these terms differ conceptually in their meanings.^{27,29,35} Precise terminology will enhance both the development and the comparability of future outcome models.³⁵

Medical condition and medical complexity contribute significantly to the intensity of nursing.^{26,31} Sufficient evidence exists for including a measure of nursing complexity in the analyses of workload/intensity and costs of services. It then becomes possible to adjust outcomes using these variables. Nursing condition has consistently explained almost twice the observed variation in nursing intensity as has medical complexity.^{27,29,31} Thus, inclusion of a measure of nursing complexity, as well as of medical complexity, allows for a more valid and comprehensive examination of risk-adjusted outcomes. The various measures designed to assess medical and nursing complexity will be enhanced by including factors that address environmental complexity.

O'Brien-Pallas et al.³⁶ have been funded to expand their earlier model and examine the approach of the next generation to measuring nursing intensity in relation to selected clinical, administrative, and economic outcomes. Client outcome variables to be examined include changes in nursing problems from admission to discharge as measured by the Omaha problem-rating scale.³⁷ Changes from admission to

discharge in overall client quality of life outcomes are measured using the SF-36, which includes six health domains: 1) physical functioning, 2) role functioning, 3) physical problems, 4) social functioning, 5) bodily pain, and 6) mental health and general health perceptions. The questionnaire is based on the Rand Corporation's Physical and Mental Health Scales used in the medical outcomes study.³⁸ Administrative and economic outcomes in the study include caregiver perception of the adequacy of care and costs. Thus, the study will provide more comprehensive framework with which to begin to examine severity and complexity from a nursing perspective relative to the outcomes of care. Compromises in client outcomes (changes in nursing problems and severity) when changes are made in the quantity of care provided will also be investigated.

Conclusion

Traditionally, quality of care monitoring in health care has focused on administrative, economic, and clinical outcomes. More recently, health care providers have monitored the outcomes of health care from quality-cost perspectives.³⁹ Adjusting outcomes for risk factors, severity of illness, and complexity of care needs to be better understood before comparisons and interpretations of outcomes can support practice decisions. A rich database is necessary to compare institutions, communities, and states with respect to outcomes monitoring. If outcome measures are to provide health care and health care professionals with useful data, large databases need to be developed to allow for the kind of complex analyses that make outcome studies and comparisons useful for treatment and policy decisions.⁴⁰

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