Architecture of Clinical Information and Prediction of Service Utilization and Cost

by Juan E. Mezzich

Abstract

The state of the art in predicting service utilization and cost in general medical care and psychiatry is reviewed. Diagnosis-related groups (DRGs) and measures of illness severity are specifically examined. Building on this experience and searching for other promising informational elements, key components of clinical information schemas are considered. The interface between patient and treatment domains is examined by using multiaxial classifications connected with the upcoming Tenth Revision of the International Classification of Diseases and the European International Classification of Mental Health Care. Within this framework, univariate and multivariate approaches to the prediction of service utilization and cost are outlined.

The rational utilization of clinical care and the prediction of its cost and outcome are receiving increasing attention. The rapidly escalating costs of clinical services and the intricacies of the information involved in describing both the patient’s condition and the treatment process make this effort compelling. This article will review systematic approaches to the description of clinical conditions and care to improve the prediction of service utilization, cost, and outcome.

Current predictive approaches designed for use in general medical care are reviewed, followed by a summary of procedures pertinent to psychiatric cases and an appraisal of the effectiveness of these procedures. Next, developments in the organization of descriptive information on the patient’s condition and clinical services are explored. Finally, the articulation of clinical case and treatment classifications are examined in order to facilitate the study of service utilization and the prediction of cost.

Case-Mix Predictive Approaches in General Medical Care

The prospective payment system is an approach developed over the past two decades in the United States for the rational reimbursement of clinical service costs. This approach sets the clinical characteristics of patient groups (“case mix”) and expectations on their utilization of services as the basis for service reimbursement.

The best known prospective payment system, designed in the late 1960’s, is known as “diagnosis-related groups” (DRGs) (Fetter et al. 1985). DRGs involve establishing patient groups whose members are purportedly homogeneous in their consumption of care. These groups are defined by their clinical diagnoses as referenced by the U.S. Modification of the Ninth Revision of the International Classification of Diseases (ICD-9-CM; World Health Organization 1977; U.S. Commission on Professional and Hospital Activities 1978). The Health Care Financing Administration (HCFA), U.S. Department of Health and Human Services, has used DRGs in the Medicare program over the last decade. DRGs have had considerable influence on clinical operations and HCFA has had some success in containing hospital costs (Widem et al. 1984).

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However, the use of DRGs has been criticized because of their serious limitations as predictors of either costs or clinical outcome, particularly outside the surgical arena. Legislation was passed in 1986 requiring the development of proposals to adjust DRGs for severity of illness and case complexity. A number of schemas were prepared, primarily dealing with illness severity. One of the earliest of these was the Acute Physiology and Chronic Health Evaluation (APACHE; Knaus et al. 1981), which was later refined and computerized as APACHE II (Knaus et al. 1985). This plan allows an estimate of a patient's risk of death while he or she is in the hospital, based on 12 common physiological measures such as vital signs, venous blood tests, and arterial blood gases. Disease Staging (Gonnella et al. 1984) uses concepts derived from clinical oncology to produce severity scores for specific diseases but does not yield an overall severity score. The Medical Illness Severity Grouping System (MedisGroups; Brewster et al. 1983) measures likelihood of organ failure by coding “key clinical findings” (symptoms, signs, laboratory results) combined through a proprietary algorithm into a 0-4 overall severity score. Patient Management Categories (Young 1984) involve patient assignments based on diagnoses and procedures recorded in discharge abstracts and encompass illness severity and comorbidity. The Computerized Severity Index (a refinement of a previous Severity of Illness Index) (Horn and Horn 1986) produces an overall score on a 4-point scale combining the values of seven characteristics: principal diagnosis, its complications, concurrent interacting conditions, dependence on hospital staff, extent of nonoperating room procedures, response to therapy, and remaining impairment.

Attempts to systematize the appraisal of illness severity systems should consider the following parameters: (1) reliability—typically measured through agreement among raters applying the system to a sample of cases; (2) content validity—the face-value suitability of the approach as judged by a panel of experts; (3) predictive validity—correlational level between the severity measurement at intake or admission and variables of interest, such as outcome, assessed at followup; (4) construct validity—correlation level between the severity score and verifiable consequences of the theory underlying the severity system, such as length of hospital stay; (5) manipulability—the degree to which the severity measurement process allows “gaming” or inflation of severity scores; and (6) cost—license fees, manpower, and equipment expenses, both for implementation of the system and in terms of its impact on regular hospital operations.

Thomas (1987) conducted an empirical study of APACHE II, Disease Staging, MedisGroups, and Patient Management Categories according to the evaluation criteria listed above. He found that none of the severity measures was clearly superior to the others in all areas, although APACHE II and Patient Management Categories did well on the largest number (three) of evaluation criteria.

**Case-Mix Predictive Approaches in Psychiatry**

As of 1990, DRGs were not mandatory for patients in psychiatric hospitals or units because their suitability in this area had not been documented. In fact, several studies have reported serious shortcomings in the use of DRGs for predicting service utilization by psychiatric patients (e.g., Coffman and Mezzich 1984; Taube et al. 1984).

Given these limitations, severity of illness is being considered in attempts to understand the utilization of psychiatric care (Gruber 1982; Lee and Forthofer 1983; Scherl and English 1984). A survey of mental health professionals in a comprehensive psychiatric facility revealed that symptomatology and severity of illness were the most influential factors influencing length of hospital stay (Mezzich and Coffman 1985). Further, it has been suggested that severity of illness can be helpful for clinical understanding and determining the type and level of treatment in schizophrenic and affective disorders (Abrams and Taylor 1973; Stewart et al. 1983).

Horn and colleagues (1989) incorporated the above views into attempts to predict resource consumption and developed a Psychiatric Severity of Illness Index based on seven dimensions: (1) stage of principal diagnosis, (2) complications during hospitalization, (3) interactions with secondary preexisting diagnoses, (4) level of care or dependence on hospital staff during the entire hospitalization, (5) social support, (6) rate of response to therapy given in the hospital, and (7) resolution of acute symptoms at the time of discharge. The authors reported that DRGs subdivided by their Psychiatric Severity of Illness groups explained 40 to 54 percent of the variation in length of stay. This, however, could be attributed to a certain circularity associated with dimensions 2, 4, 6, and 7, which directly reflect occurrences and care during the hospitalization period. In an effort to address these issues, a
Computerized Psychiatric Severity Index (Stoskopf and Horn 1990) was prepared by the same research group, including mental status, psychiatric history, medical complications, and psychosocial factors. When the researchers applied it to the task of predicting inpatient length of stay for a sample of schizophrenic and affective patients, they found that the computerized index accounted for only 14 percent of the variance in length of stay.

Another attempt to use the severity of illness concept to develop methodology to predict psychiatric care utilization was conducted in 1989 under contract with the Commonwealth of Pennsylvania by MediQual, the company which developed MedisGroups for general medical care. The psychiatric MedisGroups, which like its antecedent was based on the identification of symptomatological and dysfunctional "key clinical findings," has not yet been empirically validated.

Prospects for Enhanced Patient Classifications

Consideration of illness severity in the effort outlined above reflects the importance of developing more sensitive and penetrating ways of conceptualizing the patient's clinical condition. An examination of the structure of relevant clinical information may yield elements to frame patient classifications suitable for service utilization research.

Syndromic Identification. The identification of critical syndromic categories such as "psychoses" may turn out to be helpful in the basic description and cataloging of mental disorders. Empirical studies (e.g., Mezzich et al. 1984) report that this broad category had the highest correlation with decisions to hospitalize all of the psychiatric diagnoses in Axes I and II of DSM-III (American Psychiatric Association 1980). This is a particularly good time to consider the syndromic reformulations being anticipated for upcoming standard diagnostic systems. For example, the Mental Disorders Chapter of the Tenth Revision of the International Classification of Diseases (ICD-10; World Health Organization 1989) presents acute transient psychoses as a new broad category encompassing a number of "intermediate" and polymorphic psychoses traditionally observed in various regions of the world but not previously recognized in the ICD. Options for DSM-IV being contemplated (American Psychiatric Association 1991) include the reformulation of many organic brain syndromes within the structure of phenomenologically based categories; for example, organic delusional syndrome would be classified within the broad category of delusional disorders and diagnosed as "delusional disorder due to a specified physical illness or condition."

Syndromic Qualification. The description of psychiatric disorders has typically focused on the form of psychopathology, which over the past decade has been expressed primarily in terms of symptomatology. There is increasing pressure to enrich these descriptions by also rating the disorders' severity and course. Efforts are currently underway to systematize the rating of syndromic severity within the framework of the DSM-IV diagnostic system. A recent position paper (Mezzich and Sullivan, in press) reviewed the literature and proposed that illness severity be judged on the basis of the frequency and intensity of pertinent symptomatology or the degree to which the diagnostic criteria for a specific disorder were met. An examination of the literature revealed five key variables underlying the concept of course of illness, including duration, episodicity, progression, age at onset, and mode of onset (Mezzich and Jorge, in press).

Comorbidity Appraisal. In recent years there has been a growing recognition of coexisting disorders (e.g., Maser and Cloninger 1990) in contrast to the previous almost exclusive preoccupation with individual disorders. Interest in comorbidity has involved not only multiple psychiatric conditions but concomitant general medical conditions as well. Attempts to systematize the appraisal of these complex diagnostic formulations have been reported (e.g., Fabrega et al. 1990).

Functional Impairment. In addition to illness severity and comorbidity, it is important to consider the functional impairment that results from one or more illnesses. Comprehensive diagnostic models originating in three different countries have specifically included functional status (Strauss 1975; Bech et al. 1987; Jenkins et al. 1988). DSM-III and DSM-III-R (American Psychiatric Association 1980, 1987) made attempts to appraise adaptive functioning, and refined measures of this domain are being considered for DSM-IV. The key issues are whether the sources of the functional impairment should be restricted to only psychiatric disorders, or if both psychiatric and concomitant physical conditions should be considered; a global rating versus a separate appraisal of major areas of functioning such as occupational, with family,
and with other individuals and groups; and the timeframe of the rating, that is, the highest level in the last year versus current functioning.

Environmental Factors. Psychosocial factors associated with the emergence of psychopathology and those simply descriptive of the individual's context, perhaps deserving therapeutic attention in their own right, have been considered. Key aspects of the psychosocial environment being considered as options for DSM-IV are stressors and support systems.

Multiaxial Formulation of the Clinical Condition. The structural aspects of the clinical condition listed in the preceding sections can be organized into a multiaxial schema. This approach analytically separates clinical domains thought to be highly informative, then synthetically incorporates them into a form furnishing a more thorough portrayal of the ill person and facilitating more comprehensive treatment planning. Starting with the biaxial schema proposed by Essen-Möller and Wholfahrt (1947) in Sweden to articulate syndrome and etiology, over 20 multiaxial systems originating in 11 different countries have been published in the international literature. Multiaxial schemas are also being prepared for the Tenth Revision of the International Classification of Diseases (Mezzich 1988) and DSM-IV (Williams et al., in press).

Table 1. Interface between patient and treatment classifications

<table>
<thead>
<tr>
<th>ICD-10 multiaxial schema</th>
<th>ICMHC dimensions of care</th>
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<tbody>
<tr>
<td>I. Clinical diagnoses</td>
<td>Psychotherapeutic intervention</td>
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<tr>
<td></td>
<td>Biological psychiatric intervention</td>
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<td></td>
<td>General medical care</td>
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<td>II. Disabilities</td>
<td>Personal care assistance</td>
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<td></td>
<td>Rehabilitative interventions (educational, vocational)</td>
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<tr>
<td>III. Psychosocial/environmental factors</td>
<td>Crisis management</td>
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<td></td>
<td>Social support interventions</td>
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<td></td>
<td>Housing assistance</td>
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Note.—ICMHC = International Classification of Mental Health Care.

1Adapted from Mezzich 1990.

2Adapted from World Health Organization European Regional Office 1990.

Prospects for Enhanced Treatment Classifications in Psychiatry

Attempts to organize information on psychopathology and the patient's condition are traditional concerns. Ordering efforts are now also being focused on clinical interventions and services.

In 1990, the European Regional Office of the World Health Organization convened meetings to explore ideas for systematizing information on mental health care. An International Classification of Mental Health Care was considered by first setting dimensions of available care. These dimensions were diagnostic evaluation, crisis management, social support intervention, psychotherapeutic intervention, biological psychiatric intervention, general medical care, assistance with personal care, housing assistance, and rehabilitative intervention. The extent to which each dimension of care is implemented in a given facility is measured through a quantification of levels of care. These are presented next, illustrated with examples from psychotherapeutic intervention.

3 = Intensive activities, e.g., ambulatory psychotherapy more than once a week;
2 = Moderately intensive activities, e.g., ambulatory psychotherapy weekly or biweekly;
1 = Minimally intensive activities, e.g., ambulatory psychotherapy less than biweekly;
0 = None or occasional activities, e.g., ambulatory psychotherapy virtually nonexistent.

This appears to be a reasonable approach to the complexity of clinical services. Of course, its reliability and validity need to be assessed empirically. Furthermore, its relevance to other regions of the world and the adjustments it would require, small or large, all need to be determined.

Interfacing Patient and Treatment Classifications

The original motivation for preparing this article, that is, exploring the prediction of service utilization and cost on the basis of information on the patient's condition, can be framed more generally as the relationship between patient and treatment classifications. This interface is illustrated in table 1 using classifications corresponding to the multiaxial schemas being developed for ICD-10.
and the European International Classification of Mental Health Care (World Health Organization European Regional Office 1990). The ICD-10 triaxial schema, composed of clinical diagnoses (psychiatric and nonpsychiatric), disabilities, and environmental factors, corresponds to its latest draft as commented by Mezzich (1990). The interface is presented next by displaying at the level of each ICD-10 axis the modalities of care most relevant to it.

The interface displayed in table 1 points out the value of these multidimensional classifications for more effective and comprehensive treatment planning and for clarifying and justifying specific treatment modalities and the corresponding multidisciplinary expertise required. Such mappings of the patient and treatment fields can also be helpful for systematically organizing investigations on the utilization of clinical services, their cost, and outcome. These investigations can be framed by univariate analyses, such as which axial element is more useful to predict utilization of a given modality of care. Predictive studies can also use multivariate strategies, as exemplified by the combination of stressor and functioning variables to predict length of psychiatric hospitalization (Gordon et al. 1985).

One way or another, the systematic consideration of the architecture of clinical information has potential for advancing our understanding of service utilization and cost.

References


Fetter, R.B.; Freeman, J.L.; and Mullin, R.L. DRG's: How they evolved and are changing the way hospitals are managed. Pathologist, 39:17–21, 1985.


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