A Primer on Outcomes in Dentistry

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Abstract

Expectations for evidence of "value" on the part of dental care purchasers and growth in the evidence-based dentistry movement are beginning to demonstrate the narrow and incomplete nature of dentistry's knowledge of the outcomes of dental conditions and treatment. In this paper a classification scheme for dental outcomes is described that illustrates the broad range of outcomes information important to patients, health care providers, purchasers, and society. The uses for outcomes information are discussed and suggestions are offered for improving dentistry's knowledge of outcomes through the cooperative involvement of dental research, dental education, and dental practice. [J Public Health Dent 1999;59(3):131-5]

Key Words: dental health care outcomes, classification scheme, evidence-based dentistry.

Oral health outcomes are the results or consequences of the provision of oral health care and, occasionally, medical care. Assessments of outcomes, while based on information collected from individual patients, usually reflect the experience of groups of patients. Such assessments are used not only to evaluate particular treatments, but also to evaluate general effects of all dental care received. In recent years calls have become more frequent for the development and use of measures to assess a broad array of oral health outcomes (1-4). However, a framework and rationale for this expanded use of outcome assessments in dentistry have not been described. This paper outlines a proposed classification scheme for oral health outcomes and suggests how such information can benefit patients, health care providers, purchasers, and the public.

Dentistry has always assessed outcomes of oral health care; however, the methods and focus of such assessments have been limited. Outcome assessments have tended to emphasize the "quality" aspects of care delivery that individual dentists felt were important to them and for which they were directly responsible. As a result, meticulous inspection of the mechanical characteristics of restorations has been a principal element in outcomes assessment (5,6), and distributions of procedures provided to patients and patient satisfaction also have been assessed (7,8). An implicit assumption underlies these types of assessments: that the procedures provided are, by and large, the best possible solutions to the problems presented by individual patients. In recent years, this assumption of the appropriateness of individual dentists' treatment decisions, often termed the "art of care," has been challenged. Several studies have shown that there is substantial variation among dentists in the procedures they recommend for the same conditions (9,10), often in the same patients (11). Further, studies of dentist/patient interaction suggest that satisfaction may be more strongly related to interpersonal qualities of the dentist than to the outcomes of care provided (12). These findings indicate the need for a broad range of outcome measures of dental care that portray the perspectives of patients, providers, purchasers, and society.

In medicine, this natural evolution of concern over variation in treatment leading to more detailed examination of the relation between the provision of treatment and its consequences has already occurred (13). The analyses of variation in dentistry, together with dentistry's nascent developmental interest in practice guidelines (14), may indicate the beginning of a similar sea change. Clearly, dentists want to recommend and provide effective treatments; patients need to make informed decisions; and, as health care costs increase, those who purchase coverage for groups want to know what their premiums are buying—i.e., how effective is the coverage they pay for? For all of these reasons, dentistry may find itself in the midst of increasing demands for information about outcomes of care. The problem is that this information does not exist; dentistry currently has relatively little information about outcomes of its treatments to share (15). Equally as problematic, the available information often is subjectively assessed and narrow in scope, focusing only on a few clinical outcomes. While this is of interest to dentists, it may not be the type of outcomes information desired by patients, purchasers, or society in general.

In this paper we describe a classification of oral health care outcomes that includes dimensions important to all of these interested parties, and briefly discuss both the current status and possible uses for the wide range of outcomes information included in the classification scheme. In so doing, our aim is to inform readers of the need for dentistry's attention to outcomes, and to stimulate the development and use of measures for such outcomes.

Classification and Measurement of Outcomes of Oral Health Care

Outcomes traditionally are categorized into dimensions according to what types of information are measured. A modification of a previously

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proposed basic classification scheme for oral health outcomes (15) has four dimensions: biological, clinical, psychosocial, and economic (Table 1). This section summarizes the types of outcomes contained in each dimension and the types of measures of these outcomes in common use in clinical practice.

The biological dimension includes outcomes associated with physiological and microbiological conditions and processes. Physiological status outcomes include considerations such as salivary and crevicular flow, and demineralization. Microbiological status outcomes focus on the presence and concentration of putative pathogens for caries and periodontal disease, while anatomical status outcomes concern bone and tissue levels as well as a variety of orthodontic measurements. Sensory status outcomes deal with pain and the presence of parathesia. Although objective measures have been developed for most of these outcomes, they are little utilized in general practice. Biological outcomes are routinely assessed in practice: objective measurements are less often made and recorded. Pain is an important outcome that is almost always assessed informally and subjectively. Radiographs also are used almost universally to assess demineralization; here too, measurement or interpretation is almost exclusively subjective. Bone levels are routinely noticed by clinicians, but not usually quantified in the dental chart. In contrast, probing depth is an objective measure of a consequence of periodontal disease that is in relatively common use.

The clinical dimension contains the types of outcomes most familiar to practitioners. Survival status outcomes address the longevity and loss of teeth, tooth surfaces and restorations, as well as devitalization. These outcomes generally are measured objectively. Mechanical status outcomes deal with the characteristics of restorations and, partially because of the emphasis placed on them during dental education, these outcomes traditionally have claimed a major portion of clinicians' attention despite their subjective nature and the lack of evidence linking many of them to adverse survival status outcomes (15). Diagnostic status outcomes also are evaluated routinely by clinicians; here again, criteria for diagnoses often contain subjective assessments (16). Functional status outcomes focus on patient-level behaviors that are dependent on oral structures such as speaking and chewing. No easily applied objective measures for these outcomes exist; thus, in practice, patient report is the usual source of information (15).

The psychosocial dimension covers outcomes reported by patients that reflect the effect of oral health and oral heath care on patients' mental and social well-being. In most instances, these outcomes are measured by means of patient questionnaires. With the exception of measures of satisfaction with treatment, for which a large number of individual questions and complete questionnaires exist (8), most measures of outcomes in this dimension are in the developmental stage, and are not available for use in clinical practice (17). The concepts included in this dimension range from satisfaction with treatment, through perception of and satisfaction with esthetics and with oral health status, to preferences for various health states or health events, and assessments of oral health-related quality of life. Patient preferences, or utilities, represent explicit quantitative patient valuations of having or avoiding specific oral health conditions, or health states (18). The related concept of oral health-related quality of life is a multidimensional assessment of the value individuals assign to their current or future health status. It is affected by impairments, functional states, perceptions, and social opportunities that, in turn, are affected by oral disease, injury, and treatment (19).

The economic dimension contains two types of outcomes, direct and indirect costs. The categorization of costs as direct or indirect depends on the perspective of the categorizer. Patients view direct costs as out-of pocket payments, including any insurance premiums they must pay. To providers, direct costs represent the real costs of producing the care, while purchasers will consider fees paid as direct costs. Indirect costs will include additional expenses associated with the receipt of treatment or the condition being treated, and again depending on the perspective, can include foregone wages or other opportunity costs, costs of transportation, costs of

TABLE 1
Classification of Outcomes of Oral Health Care

Dimension	Examples
Biological status	
Physiological	Salivary flow and consistency, demineralization, inflammation
Microbiological	Oral microflora composition, presence of specific pathogens
Sensory	Presence of pain, parathesia
Clinical status	
Survival	Longevity/loss of tooth, pulp, tooth surface, restoration
Mechanical	Smoothness of margins, conformation of contours
Diagnostic	Presence of pathology, caries, periodontal disease
Functional	Ability to chew, speak, swallow
Psychosocial	
Satisfaction	Satisfaction with treatment, dentist, oral health
Perceptions	Esthetics, oral health self-rating
Preferences	Values for health states and health events
Oral health-related quality of life	Ratings for how oral health affects life
Economic costs	
Direct	Out-of pocket payments, third party payments
Indirect	Lost wages, transportation, child care expenses

premiums and copayments, and costs of ancillary products and medicines recommended by a dentist.

Outcome measures can reflect single or combined outcomes. Combined measures are those that incorporate two (or more) outcomes, such as cost-effectiveness measures. For example, cost per restoration-free year, which has been used as an outcome measure for evaluations of sealant treatment (20), requires information about the effect of sealants on survival status of occlusal surfaces and the direct costs of sealants. A newer class of weighted measures useful in a variety of decision analyses also is emerging in which outcomes are adjusted by the value ascribed to the outcomes by patients. An example of such a measure is "quality-adjusted tooth years," where the presence and absence of a tooth for a year, which might be assigned values of "1.0" and "0.0," respectively, are adjusted by patients' preferences for the benefits, harm, cost, and convenience related to either saving the tooth by means of a specific treatment or losing the tooth due to a specific condition (21). As evident in the preceding examples, outcome measures also incorporate an element of time either implicitly or explicitly. The amount of time elapsed from the treatment to the outcome assessment is a fundamental characteristic of most measures; for some survival outcomes, the measure reflects outcomes over varying lengths of time.

Uses for Outcomes Information

The possible uses for outcomes information depend to a great extent on the perspective of the potential user. Clearly, not all of the broad range of outcomes reflected in Table 1 will be of interest to all users. Thus, this section considers potential uses for outcomes information from four perspectives: those of patients, practitioners, purchasers, and society.

Patient Perspective. Patients are not a monolithic bloc of humanity with common interests and needs. Nevertheless, some generalizations are possible with respect to patient priorities for outcomes information. Patients view pain as a discrete assessable component of dental treatment, as evidenced by the factor structures of dental satisfaction instruments (8). Surprisingly, however, little standardized outcomes information is available concerning pain associated with various treatments and conditions. Dental providers routinely assure their patients that procedures "should be painless," only to find that patients perceive pain (22). It would be useful to have generalizable information on pain associated with specific treatments with which to inform patients. Similar information describing functional status and survival status following specific treatments would be of even greater use. Patients will frequently ask how long a restoration will last, or how much reattachment they can expect, or how well they will be able to chew, and objective answers to these questions often are not available. Patients also may want information describing quality-of-life issues associated with some surgical treatments. Finally, with respect to selecting a dentist, patients often ask others about satisfaction with a particular practitioner. Thus, satisfaction outcomes information for specific practitioners may be useful for consumer searching.

Provider Perspective. As noted, providers need to have accurate, generalizable, survival status and function status information for alternative treatments if they are to help patients set reasonable expectations and to assist patients in making treatment selections. This need is the basis of the "evidence-based dentistry" movement, which parallels a similar movement in medicine. Because it is often misunderstood, it is important to note that as applied in practice, evidence-based dentistry does not promote a rigid doctrine about what is the "correct treatment" for a specific clinical situation. Rather, evidence-based dentistry is founded on the premise that dentists and patients must know as much as possible about the outcomes of all treatment alternatives, so that the alternative most appropriate for the specific patient will be chosen (23). The hallmarks of evidence-based dentistry are informed choice and clinical judgment. Providers can use outcomes information garnered from their own patients to compare with generalized outcomes data as a means of internal quality assessment.

Satisfaction outcomes already are used by some providers in a similar vein. However, perhaps a greater contribution will stem from providers' decisions to demand information describing other psychosocial outcomes of treatment, to evaluate these outcomes in their own patients, and to use this information in helping patients make informed choices (24). Selection of an optimal treatment for any given patient should be based not only on knowledge of functional and survival outcomes of alternative treatment strategies, but also the preferences of patients for these various outcomes. These same concepts are embodied in the classic definition of appropriate treatment, wherein "the expected health benefit ... exceeds the expected negative consequences by a sufficiently wide margin that the procedure is worth doing" (25). Thus, ensuring that care is appropriate requires knowledge not only of clinical and biological outcomes, but also patient preferences—i.e., how patients value the outcomes of care. Patient satisfaction, and especially patient preference questionnaires can clarify feelings that patients often are unable to articulate effectively.

Purchaser Perspective. Historically, only two characteristics of dental services were of primary importance to purchasers: reasonable cost and the absence of employee dissatisfaction. More recently, a few purchasers have begun to consider other aspects of dental services when they select a dental plan, including the effectiveness of both the procedures covered by the policy and the treatment provided under the policy (26). This expectation that the purchaser will demand outcomes information, chiefly related to diagnostic, survival, and functional status, is a driving force in the emergence of outcomes in dentistry. While individual patients generally trust that their dentists will make appropriate treatment decisions, it is assumed that purchasers increasingly will expect evidence that what they buy is as effective as possible, and will be dissatisfied when they discover that such evidence is more often lacking than available. What purchasers would probably find useful is information about dental plans similar to that contained in medical plan "report cards," such as the HEDIS® measures (27). Unfortunately, not only are the data for such report cards generally unavailable due to the lack of electronic data collection systems and the incomplete nature of diagnostic information in dentists' records, but also knowledge is lacking of what procedures represent needed and appropriate care and, hence, should be considered in report cards. Thus, report card measures with face validity such as "percent of patients with new dental caries" and "percent of patients with improvement in pocket depth" are difficult or impossible to calculate due to incomplete or missing data. Measures such as "percent of patients with a recall examination within one year" and "percent of patients receiving oral hygiene instruction" are meaningless because the effectiveness of these procedures is unknown.

Societal Perspective. Society also has an interest in dental care, one that can be characterized most easily as a desire to achieve equity, to ensure fairness in the distribution of dental treatment resources. This perspective emphasizes assessments of cost effectiveness and cost benefits. While most of these assessments have focused on clinical dimension outcomes, the inclusion of psychosocial outcomes in considerations of benefits or effectiveness is increasingly recommended (28). Such considerations will broaden the scope of "good" in the catch phrase "the greatest good for the greatest number" beyond the traditional clinical concept of the absence of disease.

Improving Outcomes Information

Clearly, the current extent of outcomes information in dentistry is not sufficient for dentistry to meet the needs of patients, providers, purchasers, and society in general. For too long dentistry has relied on expert opinion founded on individual empiricism, and has not pursued the development of objective information describing the outcomes of its treatments. There are a number of reasons why the information has not been developed, including the time and expense such an effort would represent, and the perception that dentistry did not need such information. But the need is now evident, and information technology will reduce the resources required to collect basic outcomes information. Thus, dentistry should acknowledge the "outcomes era," and institute a number of activities that will help facilitate determination of outcomes of dental treatment. These activities are all predicated on the assumption that outcomes data will be collected principally in general practices. It remains impractical to mount randomized clinical trials to test the efficacy of all dental treatments for both cost and ethical reasons. Additionally, information about treatment efficacy, which is the usual product for highly controlled trials, is less useful in evaluating existing treatments than is information about effectiveness, i.e., outcomes of these treatments in actual practice.

First, work must continue to develop standardized outcome measures that are easily applicable in dental practice. While acceptable measures exist for a majority of outcomes, some of the most frequently assessed outcomes lack reliable, valid measures. Caries is a prime example: even in carefully controlled clinical trials of efficacy, examiner calibration and interexaminer reliability are constant concerns. In daily practice, dentists display substantial variation in the diagnosis of caries both clinically and radiologically (15). Without agreement on this fundamental outcome, all practice-based measures related to caries treatment and outcomes will be suspect. Other outcomes also are in need of measure development efforts. The majority of psychosocial measures, especially those addressing patient preferences and oral health-related quality of life, are research instruments too complex for easy use in practice. Yet these kinds of information are of increasing importance to both individual practitioners and purchasers; thus, development of simplified instruments is indicated.

Second, it is imperative that dentistry develop and achieve the widespread use of a standardized set of diagnostic codes. Such codes are needed to determine treatment outcomes in the light of preexisting conditions and comorbidities, as well as to determine diagnostic status outcomes (29). Because the codes will represent a new reporting activity for most dentists, it is important that the system to be introduced be both simple and efficient to use and valid and reliable in the diagnostic information it produces.

Third, general practices must begin to participate in the collection of outcomes data. A variety of avenues can be used. Practice networks should be established for the expressed purpose of conducting effectiveness trials and other outcomes determinations. These voluntary cooperative electronic networks permit practitioners to participate in the evaluation of treatment outcomes through the use of data collection protocols for specific types of patients. Practices with easily accessible computerized treatment data should consider cooperating with qualified investigators to develop information on specific treatment outcomes through retrospective analyses. This information can be used within the practice to assist in internal quality assurance activities, and in larger studies of outcomes. Data from such analyses could be entered in dental outcome registries, which would permit public access to anonymous aggregated data for specific treatments. Larger group practices, many of which are already conducting such analyses for both internal and public purposes, might consider developing formal continuing relationships with institutions and/or associations to provide assistance in disseminating their results.

Finally, the dental education and dental research communities must increase their attention to and emphasis on oral health outcomes. In fiscal year 1998, from a portfolio of over 860 projects, the National Institute of Dental and Craniofacial Research supported 18 research projects that had any treatment outcomes component (30). The Agency for Health Care Policy and Research supported three such oral health projects from a much smaller portfolio. This relatively minor support from federal sources is mirrored by support from other sources. Other than clinical trials of new materials and therapeutics, which usually assess a narrow range of outcomes, support for dental outcomes research is limited. Just as importantly, research support tends to be project specific. Each new investigation, each new data collection effort is predicated on funding of a new proposal. Pursuit of a "line" of related research questions is effectively precluded by the specificity demanded for successful competition in the study section. Creativity on the part of both sponsors and proposers of outcomes research is necessary if the current reality of limited numbers of single-focus projects is to be altered.

Dental schools are logical sponsors of outcomes research; however, they have not capitalized on opportunities to conduct such research in their clinics (2). Without the visibility such activity engenders, the attraction and development of qualified new investigators from the ranks of dental school faculty are hindered. The very nature of much outcomes research—which often requires unfamiliar research designs with "subjective" data and long lead times for developing data sources and acquiring data—precludes its pursuit in most clinical specialty programs (1). Yet dental schools are among the most important stake holders in outcomes research because the validity of their curricula depends on its products. Thus, they must attempt to create opportunities and incentives for outcomes research among their faculty. Specific actions such as improving administrative data systems, "partnering" with organizations seeking participatory research arrangements, and establishing strong linkages to alumni willing to participate in practice-based research are needed, as well as more intangible achievements such as engendering an attitude of healthy skepticism and an orientation toward inquiry among faculty and students.

No one group or organization can initiate all of these activities, let alone bring them to successful conclusions. But neither is drastic change required by any one sector of the oral heath care enterprise. What is needed is an acknowledgment by all sectors that better information on the outcomes of oral health is fundamental to improving the effectiveness and appropriateness of that care, and a concomitant commitment to long-term participation in activities designed to gain this information. To support the privilege of professional practice, all sectors of the dental profession must cooperate in the quest for information with which to improve that practice.

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