

## CRITERIA MAPPING

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**Abstract** — Criteria mapping is a method of quality assessment developed in the 1970s and used to judge the quality of care in hospitals. It is based on retrospective chart audit using prespecified explicit criteria arranged in algorithms. Because it considers only the criteria that are relevant to the case, it yields a better measure of quality than the criteria list method of explicit chart review. Criteria mapping lends itself readily to the program evaluation field because it can be program based instead of diagnosis based and collects both process and outcome data. The method is currently used mainly in hospitals, but it is applicable to any field that relies on a standardized case-based record.

**Résumé** — La planification des critères est une méthode d'évaluation de la qualité élaborée au cours des années soixante-dix et qui est employée pour juger de la qualité des soins dispensés dans les hôpitaux. Elle est basée sur la vérification rétrospective des courbes, à l'aide de critères explicites spécifiés à l'avance et représentés sous forme algorithmique. Etant donné qu'elle ne prend en considération que les critères applicables au cas à l'étude, cette méthode offre une meilleure évaluation de la qualité que la méthode d'énumération des critères fournie par l'examen de la courbe explicite. La planification des critères s'adapte aisément au domaine de l'évaluation de programme, car elle peut être basée sur un programme plutôt que sur un diagnostic, et qu'elle permet de rassembler des données de traitement et de sortie à la fois. A l'heure actuelle, cette méthode est utilisée principalement dans les hôpitaux, mais elle peut s'appliquer à tout domaine qui s'appuie sur un rapport standardisé basé sur cas particulier.

**INTEREST IN QUALITY ASSESSMENT** in the health-care field has grown considerably since the 1960s. Methods of assessing quality of care have developed largely as a result of the rising cost of health care, and consumer expectations regarding outcome (Graham, 1982). In this article we discuss the literature; illustrate a method of quality assessment called criteria mapping, using a self-care disabilities map; and explain the relevance of criteria mapping to the field of program evaluation.

## PROGRAM EVALUATION AND QUALITY ASSESSMENT

The purpose of the program evaluation is to provide useful information to assist management in making decisions about program modification or continuation. The need for such decisions gives rise to what are referred to in the literature as formative and summative evaluations. Formative evaluations are used most frequently and attempt to improve program planning, delivery, outcome, or efficiency. Summative evaluations question the very existence of the program (Shortell & Richardson, 1978). Managers may ask about program need, implementation, effect, and efficiency. The two most frequently asked questions concern process and outcome or program implementation and effect (Posavac & Carey, (1989).

According to the program evaluation literature, process evaluations assess the human and physical resources expended in implementing a program and seek to determine the degree to which the program was implemented as planned. Outcome evaluations determine whether the target group benefited from the program. Outcome evaluations do not necessarily focus on individual effect, but may attempt to determine an effect at a group level.

The quality-of-care assessment field is narrower in scope than program evaluation, focusing solely on the provision of individual patient services to the exclusion of other objectives that a program may have (Donabedian, 1980). The quality-of-care assessment model developed by Donabedian and widely accepted in the health-services research field consists of three concepts: structure, process, and outcome. Structure refers to the physical plant and human resources that are available in an institution. These resources may be used as indicators of quality on their own, and have been linked to the process and outcome of care (Flood & Scott, 1987). Process refers to care activities, and determines whether they were appropriate to the individual case and were performed adequately (i.e., was the correct thing done was it done correctly?). Outcome refers to the benefit to the patient, and more specifically, to the determination of whether the patient's health benefited as a result of the care received (Donabedian, 1980).

The quality-of-care assessment model, consisting of the three components of structure, process, and outcome, differs somewhat from the program evaluation model, where process incorporates Donabedian's definition of structure but only to determine whether the effort was as planned and/or was sufficient to bring about the desired effect on the target group. Process, in the quality assessment field, refers to judging the appropriateness of care on an individual case basis to determine if the right things were done to the patient and if they

were done well enough to constitute good care. The concept of outcome appears to be the same in both fields, focusing on patient benefit, but outcome may in fact be captured more globally in the program evaluation field.

To date, quality-assessment activities, including quality assurance, have focused mainly on the structure and process of care (Clemenhagen & Champagne, 1986). However, a number of national organizations, including the Canadian Hospital Association, the Canadian Council on Health Facilities Accreditation, and the Joint Commission on Accreditation of Healthcare Organizations in the United States, are interested in gathering outcome data in addition to structure and process information. In addition, questions of quality that go beyond immediate patient care are being directed at program, department, and hospital levels.

Program evaluation has not been used as extensively in hospital settings as it has in other health and social service settings (Stuart, Rutman, & Staisey, 1985). This may be due to two factors in particular: the origin of program evaluation, and the existing body of research knowledge and expertise in the medical field. Program evaluation originates in the social sciences (Posavac & Carey, 1989) but hospitals are organized to reflect medicine, a branch of biological sciences that emphasizes the identification, classification, and treatment of disease. Therefore, hospitals have traditionally organized around disease entities or diagnostic groups, not programs. This has been changing in recent years, with the result that hospitals are providing more program-based services using multidisciplinary teams. However, medicine has its own branch of research or epidemiology, concerned primarily with the occurrence of disease and health-related problems (Last, 1983). While hospitals may increasingly require program evaluation activities, studies will most likely be conducted by health researchers trained in epidemiology.

## **METHODS FOR QUALITY ASSESSMENT**

Two basic approaches are used to assess hospital quality of care: implicit and explicit review. Both use the medical record as a source of information. Implicit review relies on clinicians' examinations of patients' records to judge the quality of care. Criteria used are internal to the reviewer. Explicit review consists in defining the criteria used to judge quality before proceeding to review patients' records. Explicit review criteria are usually determined by group consensus (Brook & Appel, 1973). There are two types of explicit review: criteria lists and criteria maps.

## Criteria Lists

The criteria list specifies everything that should be done to the patient during the course of admission, diagnosis, and treatment. For example, the list may specify all the diagnostic tests, laboratory tests, and procedures that should be performed on a patient with a particular diagnosis. This approach has been criticized for encouraging clinicians to do "everything to everybody," because the clinician is implicitly penalized for *not* performing specific procedures even though they may not have been relevant to the case.

Criteria lists have also been criticized for failing to measure quality of care adequately. In using criteria lists for quality assessment, it is possible to have an inverse relationship between compliance and quality of care. In other words, there may be very low compliance with the criteria but the quality of care may be quite good. The criteria-list approach has been adapted by assigning weights to individual criteria to reflect their importance in the care of the patient. For example, appropriate surgery might be considered a more important criterion than a routine blood test. However, the choice of weight is somewhat arbitrary and may vary depending upon the patient and the setting (Greenfield, Lewis, Kaplan, & Davidson, 1975).

## Criteria Maps

The second method of judging quality using explicit review is known as criteria mapping. Developed by Dr. Sheldon Greenfield in the 1970s, it models the clinical decision-making process by using an explicit set of criteria arranged in "if-then" sequences. The criteria are expressed as the quantitative results of examinations, tests, and procedures performed on the patient. The method is flexible, as it takes into consideration, the differences between cases through the use of the branches in the map. In this way the clinician is not penalized for omitting procedures that were not relevant to the case. The method is also unique in that it collects data on both the process and the outcome of care. Furthermore, it has been demonstrated that the process of care, as measured by criteria mapping, is related to patient outcome (Greenfield, Cretin, Worthman, Dorey, Solomon, & Goldberg, 1981).

Several applications of criteria mapping have been reported in the literature, including maps for uncomplicated diabetes mellitus (Greenfield et al., 1975), urinary tract infections (Greenfield, Kaplan, Goldberg, Nadler, & Deigh-Hewerston, 1978), chest pain (Greenfield, Nadler, Morgan, & Shine, 1977), anemia (Woo, Jen, Rosenthal, Bunn, & Goldman, 1981) complex partial

epilepsy (Lewis & Treiman, 1983), chronic obstructive pulmonary disease (Kemeny, Hargreaves, Gerbert, Stone, & Gullion, 1984), scorpion envenomation (Hershkovich et al., 1985), a health problem in long-term care facilities (Chambers et al, 1984), breast cancer (Greenfield, Blanco, Elashoff, & Ganz, 1987) and self-care disabilities (Law, Ryan, Townsend, & O'Shea, in press).

A number of authors have compared criteria mapping to other approaches to quality assessment. Kemeny et al. (1984) compared chart audits using criteria mapping to direct observation, patient interviews, and physician interviews. Gerbert and Hargreaves (1986) refined the analysis and concluded that two methods of assessment are preferable to a single method. Greenfield et al. (1978) compared three methods of assessing the quality of care for urinary tract infections treated on an outpatient basis: a short criteria list, an extensive criteria list, and a criteria map. They found that criteria mapping was a more sensitive measure of quality and that physicians preferred it to the criteria-list approach.

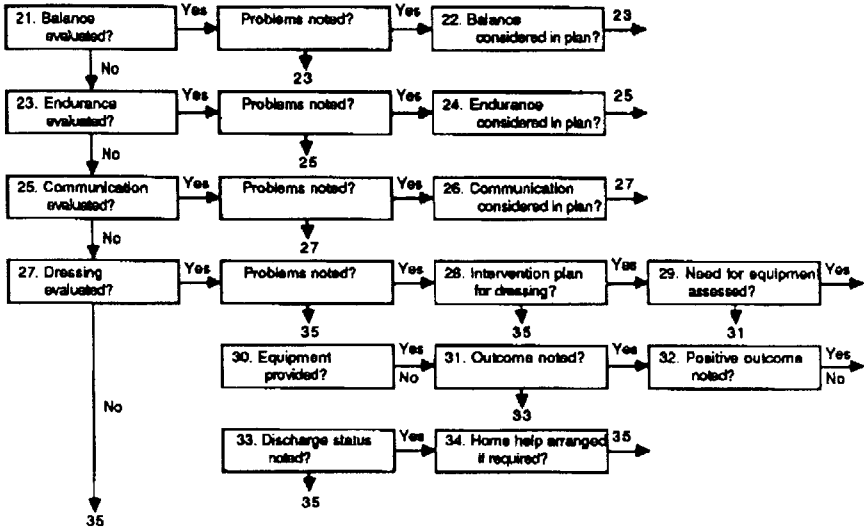
Further, a comparative evaluation determined that criteria mapping was superior to a criteria list in assessing the quality of care for patients presenting to emergency departments with chest pain (Greenfield et al., 1981).

## **SELF-CARE DISABILITIES CRITERIA MAP**

A section of a self-care disabilities map developed to assess the quality of care in hospital-based occupational therapy is presented in Figure 1. Most of the criteria are related to the process of care, but Map Items 31 and 32 collect data on patient outcome relevant to the practice of occupational therapy. The *Problems Noted* boxes are not scored but are included to facilitate the branching nature of the map. For example, if the patient does not have a problem with self-care then there is no need for the therapist to introduce a treatment plan to address self-care problems. Therefore, the criteria to the right of this question on the map are not relevant. The abstractor would not search the patient's record to determine whether these criteria were met.

Each criterion in the map is scored with a 1 (*yes*) 0 (*no*) or 9 (*not applicable*). Scores of 9 are not used in the calculating the total score, but are used to assist the abstractor in keeping track of the criteria applied to the patient's record. A total map score is derived by counting the number of *yes* scores for the numerator, and the number of *yes* scores added to the number of *no* scores for the denominator. The resultant fraction is multiplied by 100 to obtain a percentage score for each case. This score is then compared to a standard indicating whether the quality was poor, adequate, or superior. The

Figure 1  
Section of Criteria Map (Self-care Disabilities)



Scoring Key: 1 = Yes (If box is unnumbered score "y")  
 0 = No (If box is unnumbered score "n")  
 9 = Not applicable

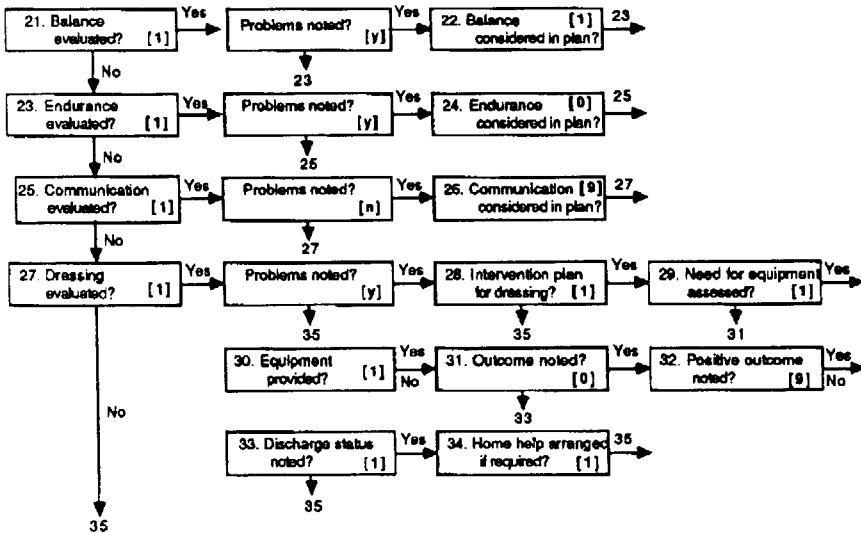
clinician is responsible for setting this standard. In our use of the self-care disabilities map in Nova Scotia, a minimum score of at least 60% was adequate and a score of 80% or better was considered superior.

To illustrate the scoring process a hypothetical patient record has been scored using a section of the self-care disabilities map (Figure 2). Generally speaking, the abstractor moves to the right when a *yes* response has been obtained and moves down with a *no* response. The arrows embedded in the map facilitate this process. Beginning with Map Item 21, the abstractor determined from the patient's record that balance was evaluated by the therapist (score 1 for *yes*). Proceeding to the right as indicated by the arrow, the abstractor found that the patient had a problem with balance (assign y for *yes*). Continuing to the right to Map Item 22, the abstractor determined the balance had been considered in the treatment plan (score 1 for *yes*). Following the arrow to Map Item 23, the abstractor determined that endurance was evaluated by the therapist (score 1 for *yes*), problems were noted (assign y for *yes*), but the problems with endurance were not considered in the patient's treatment plan (score 0 for *no*). Proceeding to Map Item 25, the therapist had assessed

communication ability (score 1 for *yes*) and no problems were identified (assign n for *no*). Map Item 26 was assigned a 9 (*not applicable*), and the abstractor proceeded to Map Item 27 as indicated by the arrow pointing down from the Problems Noted box. The therapist assessed the patient's independence in dressing (score 1 for *yes*), problems were identified (assign y for *yes*), an intervention plan was developed (score 1 for *yes*), and equipment was provided (score 1 for *yes*) but the outcome was not noted (score 0 for *no*). The abstractor assigned Map Item 32 a 9 and proceeded to Map Item 33 as indicated by the arrow. The patient's discharge status was noted (score 1 for *yes*) and home help was required and arranged (score 1 for *yes*).

The number of *yes* scores ( $n = 10$ ) were then divided by the sum of the number of *yes* scores and the number of *no* scores ( $n = 10 + 2$ ). This fraction

**Figure 2**  
**Scored Example of Criteria Map Section (Self-care Disabilities)**



Scoring Key: 1 = Yes (If box is unnumbered score with "y")  
 0 = No (If box is unnumbered score with "n")  
 9 = Not applicable

Instructions: Proceed to the right when score is yes; proceed down when score is no.

Total Map Score: [number of 1 scores] divided by  
 [number of 1 scores + number of 0 scores] x 100

Score of Sample Map:  $[10/10 + 2] \times 100 = 83.3\%$

is then multiplied by 100 to obtain a case score of 83.3%. The score for this patient's record indicates that the quality of care delivered to this patient was superior.

## USES OF CRITERIA MAPPING

Criteria mapping is not only useful for quality assessment; it also offers program evaluators a new method to add to their existing array. It is amenable to the program evaluation field for the following reasons:

1. Criteria mapping can be program based rather than diagnosis based. The method as originally developed used diagnoses to identify the group of patients' records to be reviewed, but criteria maps have now been developed and used in other areas. Chambers et al. (1984) have developed a map to assess the quality of care for a health problem in long-term care facilities, and Law et al. (in press) have developed a disability-based map to examine the quality of care in hospital-based occupational therapy services.
2. Criteria mapping is a sensitive measure of quality. Research to date suggests that it is a better measure of quality than the traditional approach to assessing quality of care using the patient record. Program evaluators may need an additional method, known to be a sensitive measure of quality, to evaluate programs delivered to individuals.
3. Criteria mapping collects data on both process and outcome, which are both of interest to program evaluators. It thereby eliminates the need for two separate data-collection strategies.
4. Criteria mapping links process to outcome; in other words, if the process of care is good then patient outcomes will also be good. The relationship between process and outcome is an important point for evaluators to consider. If a link between process and outcome is established, it may only be necessary to periodically review process to ensure that a program is operating effectively.

Criteria mapping can be used to assess hospital programs in which multi-disciplinary teams deliver care to a variety of diagnostic groups, but it can also be used outside the health field to judge the quality of any program that relies on a case-based record.

A major benefit of criteria mapping is that map development results in better agreement among staff about program planning and delivery. The map



serves as a focal point for program staff and facilitates communication and agreement on both process and outcome information and the documentation of each. Thus it has value as a prospective planning tool, which can then be used for quality assessment after program implementation.

Hospital-based program evaluation using criteria mapping may take advantage of medical records personnel, who are well trained in abstracting information from medical records. With the introduction of quality-assurance programs in hospitals, many medical records departments hired staff solely for the purpose of conducting chart audits. It is relatively easy for these staff to learn a particular criteria map and to begin to reliably apply the map in a short period of time. Medical-records personnel may also assist in revising and modifying a proposed map before it is used as a program evaluation method.

## LIMITATIONS

The major limitation of any retrospective chart-audit method, including criteria mapping, is its dependence on the completeness of the record. In hospitals, process and outcome data may in general be poorly documented, but outcome data (other than mortality) may suffer most from poor documentation. This problem can be largely overcome on a prospective basis by using the program-planning and delivery map in subsequent assessment of program quality. Even if outcome data are recorded on the chart, the evaluator must carefully examine the source of the information, as professions may differ in their definition of outcomes, which can result in the collection of invalid data. For example, the definition of self-care varies across professions. It may be documented on the chart that the patient is "independent" in self-care. However, physiotherapists, nurses, and occupational therapists differ in their definition of self-care (Ryan, Townsend, & White, 1988). Accepting these data at face value without regard to the source may result in an invalid assessment of outcome.

A second limitation is that the structural characteristics of the program under study are not collected using criteria mapping. "Process of care" in the quality-of-care literature refers only to the activities of care, not to the resources, equipment, or other "inputs" as defined by the field of program evaluation (Shortell & Richardson, 1978). This limitation may be addressed by developing case-based criteria for incorporation into the map or by using a separate data-collection strategy.

A further limitation is the fact that criteria maps require more clinician time to develop than do criteria lists. As a result, it is often difficult to gather

clinicians together for the period of time required to develop a map. Conversely, once the map is developed abstraction time is less than would be required with a criteria list, because there will be fewer cases requiring the application of all the criteria (Greenfield et al., 1975).

## CONCLUSIONS

Criteria mapping is a sensitive measure of quality of care that incorporates the collection of both process and outcome information. Because it addresses both process and outcome, it is amenable to program-based evaluations. Its development serves as a program-planning mechanism fostering communication among team members of the expected standards of care. Furthermore, it takes advantage of existing data available in hospital records and existing staff in the medical records department trained in abstracting data from the hospital record. Its potential use reaches beyond the hospital, as maps may be created for any program that relies on a case-based record.

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