The Logic Model for Evidence-Based Clinical Decision Making in Dental Practice

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It is important and timely to facilitate evidence-based decision making that results in better patient outcomes, enhanced research planning, better products, and improved policy development. This article discusses the current status of evidence-based dentistry. It describes the central role of systematic reviews in the process of clinical decision making in evidence-based dental practice. Particular emphasis is given to the correspondence of the 4 fundamental steps of the logic model—inputs, activities, outputs, and impact—to the process of actualizing and evaluating clinical decision making and policies in evidence-based dentistry.

Key Words: Evidence-based Dental Practice, Translational Research, Systematic Review, Logic Decision Making, Formative and Summative Evaluation.

INTRODUCTION: EVIDENCE-BASED DENTISTRY & UTILITY

Evidence-based dental care rests on the consensus of the best available evidence to revise clinical practice guidelines, treatment protocols, and policies. The instruments and the process used to reach that consensus must be scrutinized, evaluated, and standardized, and it is imperative that systematic reviews be of high quality and follow a rigorous, detailed, and tested research synthesis protocol. The quality and reliability of systematic reviews must be ensured because clinical decisions rest on a complex admixture of facts and values. Evidence-based dentistry (EBD) incorporates into clinical decisions for treatment interventions and for updating policies a plethora of well-articulated information about

- the patient’s dental and medical history; wants and needs; exam results, symptoms, x-rays, laboratory tests
- the dentist’s training, expertise, clinical judgment, experience, recommendations
- utility concerns about risk/benefit, and cost/benefit ratio, and related to insurance coverage/private payment
- research evidence, including consensus of the best available research evidence following systematic reviews and meta-analyses (research synthesis [RS] process; revised/recommended clinical practice guidelines [rCPGs], rCPG-derived evidence-based treatment [EBT] interventions, and evidence-based policies [EBPo])

Evidence-based decision-making (EBDM) consists of distinct levels of mastery that include formulating patient-centered questions (Patient-Intervention-Comparison-Outcome [PICO]); searching for and critically appraising the evidence; applying the evidence to practice, ie, evidence-based practice and care; and evaluating the process, ie, evaluating outcomes and policies. In brief, the principles of EBDM guide the decision maker in choosing among alternatives in light of their utilities and possible consequences.

Utility-based decision making rests largely on a rationale centered on utility-maximizing behavior, rather than strictly economic constraints. That is to say, good dentistry
should be driven by the intent of benefiting the patient and of providing the best possible care. Although, clearly, an essential concern of utility-determined decisions pertains to cost, and is expressed as cost-to-benefit ratios. Utility theory is useful because it generates measurable outcomes. Nevertheless, utility-based clinical decision making can be problematic when cognitive dissonance arises between the outcome of the purely probabilistic process and the dentist’s knowledge, information processing, beliefs, preferences, and expertise, whether or not in the context of newly revised clinical practice guidelines resulting from systematic reviews.

LOGIC EVIDENCE-BASED DECISIONS IN DENTAL PRACTICE

Rather than relying on probabilistic conditions, the decision-making process may rest on cognitions and reasoning, such as logic. Evidence-based cognitive decision making is distinguished by the directive phase, where the PICO question is posed; the collection phase, which is concerned with the collection and processing (ie, inclusion/exclusion criteria) of the available evidence; the analysis phase, where the collected body of available evidence is evaluated for the level and quality of the evidence, followed by acceptable sampling and meta-analysis; the dissemination phase, which corresponds to the systematic review format of reporting the evidence-based process; and the reflection phase, the dissemination of the consensus of revised guidelines.

The logic cognition-based models of decision making distinguish “collectors,” “processors,” and “analysts.” In a remarkable parallel, so does the evidence-based paradigm separate those who perform RS and evidence-based research (EBR) to produce the consensus for revised rCPGs from those who integrate consensus statements into EBT and practice (EBPr), and from the policy makers, who integrate normative and summative evaluations into new and improved EBPo to the benefit of the stakeholders (Fig. 1).

The logic model is a prime example of a cognitive model for evidence-based decision making. It was first proposed as a mode of “evaluability assessment,”11,12 and is presently outlined as a general framework for describing the fundamental rational and logic process of decision making that individuals, groups, or organizations may follow. In its simplest form, the logic model presents decision making as a process that consists of 4 distinct, intertwined, and logically flowing categories13 (Fig. 1) that actually mirror the evidence-based process:

1. inputs, which in the evidence-based domain correspond to the identified available research evidence that becomes additive to the decision maker’s experience, expertise, and skills. Inputs incorporate and rest upon needs/wants, situations, priorities based on clinical diagnosis, expertise, coverage, and so forth.

2. activities, which describe the process of sifting through the available research evidence in order to single out the best available evidence on the basis of widely accepted criteria of research methodology, research design, and research data analysis; what needs to be done, what is de facto done as a clinical intervention.

3. outputs, which correspond to the conclusive steps of the evidence-based process that yield a consensus of
the best available evidence by means of acceptable sampling and meta-analysis, and that produce a set of revised criteria for practice decision making based on these results: measurable clinical outcomes.

4. **impacts**, which represent the logical flow from this stepwise progression from short-term, to intermediate, to long-term impacts and consequences of delivering services, and include normative and summative evaluations of outcome quality, validity, and reliability, as well as stockholder’s satisfaction.

Within this structure, the strength of the logic model lies in the fact that it permits a degree of flexibility that several models do not have.

**EVALUATION IN EBD**

Needs evaluation is primordial in establishing the situation, priorities, and inputs. Process evaluation quantifies the progression of the activities and outputs stages. Outcomes evaluation ranks the validity and the reliability of the short-term and intermediate products of the process. Intermediate and long-term summative impacts also need to be evaluated.14 That is to say, formative and summative evaluations15 are obtained at key capstone time points in order to ensure steady progress toward obtaining anticipated outputs and desired outcomes, and, in the final analysis, providing justification for testing the model experimentally in any given situation in the first place.

At the RS stage of EBR, the available evidence is evaluated following established criteria and standards of research design, such as the consolidated standards of randomized trials (CONSORT), methodology, and data analysis.1,8 Validated instruments for this purpose include the Jadad scale;16 the Wong-revised scale;17 the appraisal of guidelines, research, and evaluation– Europe (AGREE) instrument;18 the quality assessment of diagnostic accuracy studies (QUADAS; 30); and the strength of recommendation taxonomy grading (SORT).10 This initial process results in systematic reviews and meta-analyses, which must be evaluated as well along established standards and with validated tools (eg, assessment of systematic reviews, AMSTAR19,20). In a similar fashion, EBPr calls for standards and instruments of evaluation. One such approach is provided by the grades of recommendation, assessment, development, and evaluation,21-23 a validated approach for going from research evidence to clinical intervention, and for assessing the quality of evidence for diagnostic recommendations. This tool addresses issues of concern to patients, clinicians, and, to some extent, policy makers, and provides a sound evaluative assessment of EBT in terms of the quality of evidence for each outcome; the relative importance of outcomes; the overall quality of evidence; the balance of benefits, harms, and costs; and considers the strength of recommendation and the overall value of implementation.

The final stage of EBPr that concerns EBPo still requires the validation of an evaluative instrument that may extend and expand GRADE to include assessment of policies, because a key feature of an evidence-based practice environment is that it must support and promote the use of best evidence by requiring clinical practice
policies and procedures to be evidence based. The expanded version of GRADE (Ex-GRADE), which we, at present, are endeavoring to validate, includes the fundamental elements of policy evaluation that have been current in health care practice for the past decade.

In brief, the strength of the logic model for its application to evidence-based decision making rests in its inherent property to formulate in quantifiable terms the emerging situation, the required action-response, and the concrete results. The model provides invaluable normative and summative evaluation of the evidence as part of a framework for describing the relationships among investments/inputs, activities, and results. It also yields a concrete approach for integrating planning, implementation, evaluation, and reporting.

CONCLUSIONS

Clinical problems in dentistry must be reliably diagnosed and treated as per practice guidelines approved by the professional body, and uniquely required for the case and recommended by the specialty in whose domain the case falls. But, not all domains of clinical dentistry can be handled in an evidence-based paradigm.

Evidence-based decision making is based on the application of the scientific method for the conscientious, explicit, and judicious use of current best evidence, evaluated by a systematic process of the level and the quality of the research evidence. Systematic reviews provide a tool to apply stringent scientific strategies to quantify the quality of the accumulated research evidence and limit bias. They use and integrate both acceptable analysis and meta-analysis to establish the level of overall significance of the gathered evidence, and are vastly different in purpose and format from narrative reviews and health technology assessments.

The consensus of the total best available evidence is obtained and used cogently in making clinical decisions that pertain to the dental care of each individual patient. But one fundamental question remains: how do we “translate” the evidence derived from group data, as commonly obtained in research studies and synthesized in systematic reviews and meta-analyses, to have any degree of pertinence and direct applicability to the individual patient?

In its simplest elaboration, as in its most complex iteration, the logic model of decision making has fundamental strengths that set it apart from other models. From the perspective of the initial consideration of the task, it permits us to forge a master plan that “sees” the end, that does more than simply consider inputs or tasks, but that visualizes and focuses on the ultimate outcomes and the results to be gained. The logic model is a proactive approach to identify the optimal procedural steps to achieve the desired results, and to prove the working hypothesis under study. For any given decision-making process, working hypotheses must be clearly stated in the context of the logic model at each step, and tested and verified by means of quantifiable, reliable, and valid performance measures. It permits focus on accountability for investment based on long-term outcomes.

Furthermore, the logic model, which does not need to be linear, provides sound indicators of finality, in terms of output and outcome measures of performance (ie, work hours, manpower), as well as success. Short-term and intermediate as well as long-term outcomes are clearly identifiable, which permits us to set criteria for immediate and for mission success far in the future. An example of the application of the logic model in the evidence-based decision-making process is presented, as a hypothetical example, in Flow Diagram 1. In these cases, intermediate or shorter-term outcomes may be identified that provide an indication of progress toward the ultimate long-term outcome. Therefore, and most importantly, the logic model has, intertwined within each of its steps, reliable formative and summative evaluative protocols that can be integrated at every step.

In summary, it may be argued that the logic model is a timely response to the call by Spring for “…a good theory of integrative, collaborative health decision-making….”

REFERENCES


