

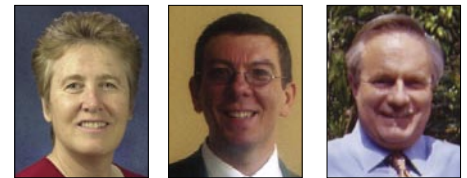
Making Clinical Decisions Using a Clinical Practice Guideline

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 Francesco Chiappelli, PhD; Paolo Prolo, MD; and Richard Stevenson, DDS

ABSTRACT

Clinical practice guidelines are statements developed from best evidence about clinically relevant appropriate care. A simulated patient case is presented to demonstrate how to use a CPG in decision-making in determining a clinical decision. Conceptualized knowledge management software templates are provided to explain a process by which best evidence is retrieved from a primary, centralized network database. Templates describe the process of converting a clinical question into a research question, retrieving best evidence, and performing data analysis for the outcome of individualizing and optimizing a clinical decision. Templates also describe the reciprocation of information to update CPGs by translational researchers who manage and build the primary, centralized network database.

Clinical practice guidelines are statements developed from best evidence about clinically relevant appropriate care. These statements may be about protocols, standards or practice patterns.¹ CPGs are important to the clinician to improve process and health outcomes, whether they are created locally or nationally. CPGs, and the algorithm in which they are contained, organize and sequence care outcomes



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Patent Statement / The content, and any computer software program derived from said content, from this manuscript is covered by provisional patent pending.

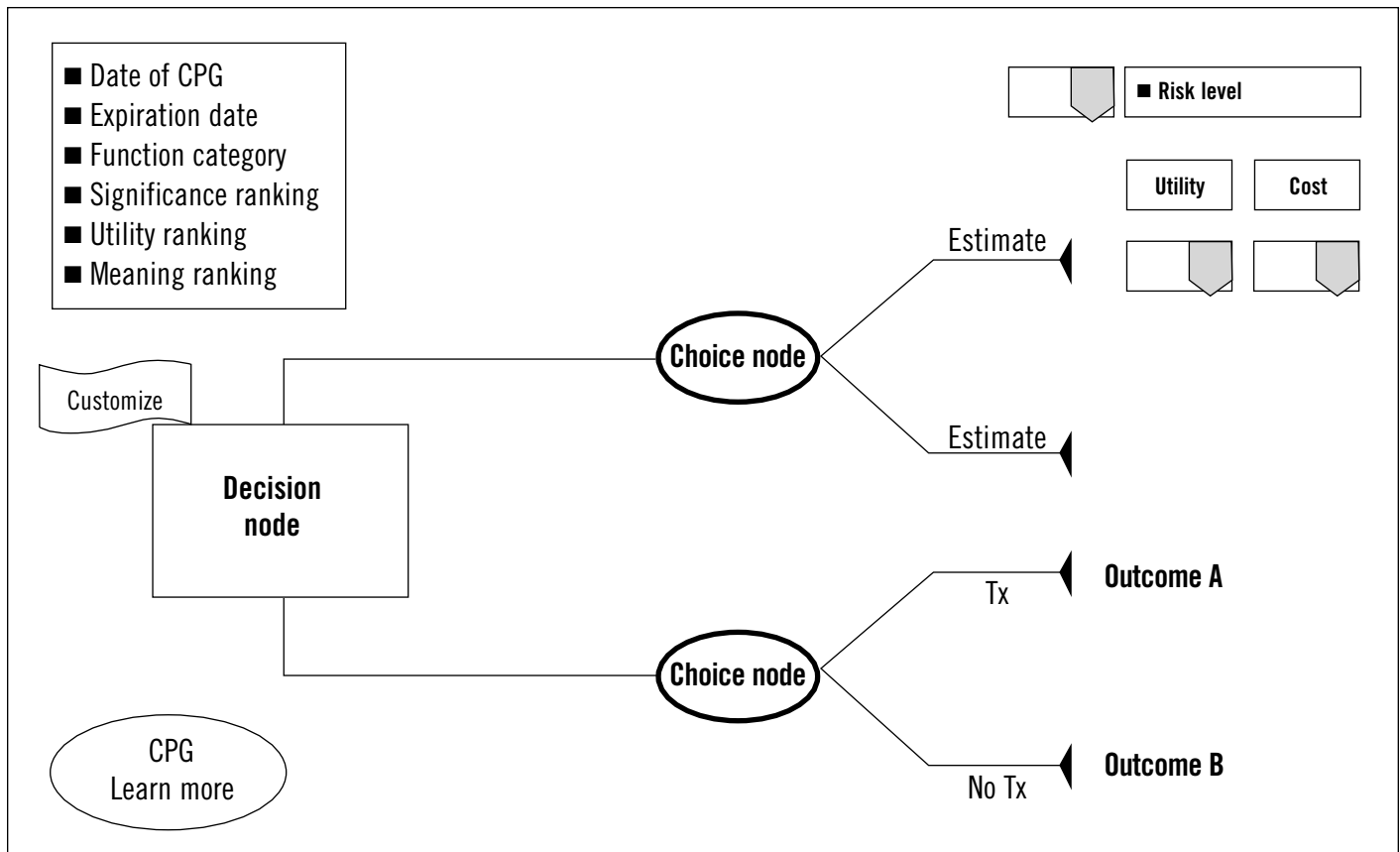


Figure 1. An example of a clinical practice guideline conceptualized for the knowledge management software showing two options and their related outcomes. From the CPG template, the dentist accesses the Customize Clinical Practice Guideline form through the “Customize” (flag) button.

for specific conditions. Thus, the dentist uses the CPG to address specific and narrowly defined patient care issues. CPGs, have been shown to be effective in producing behavioral change in clinicians’ practices and care delivery.²⁻⁵

The purpose of this article is to simulate clinical decision-making processes using a CPG and a conceptualized, knowledge management software for making clinical decisions.

Patient Case


An 87-year-old woman presented for a routine dental examination. The patient’s chief complaint was “a loose bridge.” The history was that the fixed-partial denture was placed several years ago and had been serviceable until two months ago when it became mobile. On the day of the appointment, it was quite loose and seemingly on the verge of coming out.


The patient’s last dental visit was six months ago for a dental prophylaxis. The patient’s last dental examination with bite-wings radiographs was a year ago. The past medical history included a periodic examination with the internist six months ago, a record of no emergency room visits, hospitalizations, or serious illnesses. The current medical condition was osteoarthritis, for which an over-the-counter pain medication is taken on as-needed basis. The patient had no known allergies to drugs, metals, or environmental allergens. The past dental history revealed a near-complete dentition with the removal of all third molars, without incident, and the loss of tooth No. 3, the maxillary right first molar, due to a failed root canal treatment following crowning procedures. The area was rehabilitated with a three-unit fixed-partial denture extending


from tooth No. 2, the right maxillary second molar, to tooth No. 4, the right maxillary second bicuspid.

Other past dental services have been limited to maintenance care, tooth prophylaxis every six months and dental examination every year. The extra and intraoral examinations were noncontributory and all assessments were within normal limits, except for the fracture of both abutments of the right maxillary three-unit fixed prosthesis. The patient managed her own oral self-care twice a day with a regimen that included oral rinses, flossing, and toothbrushing. The social history revealed the patient had recently moved from her primary residence in another state to be closer to her older brother and sister who will celebrate her 98th birthday next month.

Anecdotally, their brother, who is 100 years old, planned the party at





Encryption data 


Practice record 

Patient record 


CUSTOMIZE CLINICAL PRACTICE GUIDELINE




P
Population


Age  Function level  Gender  Race/ethnicity 

Risk level 

I
Intervention



Fill in the primary intervention 

P  Estimate type  **C**  Comparison

Fill in comparison intervention 

Add more comparisons

O
Outcome

Measure type  Fill in outcome 

Clear form **Continue**

Figure 2. The Customize Clinical Practice Guideline form.

the local botanical gardens where his sister works as a docent. The patient is functionally independent, a non-smoker, and a nonalcohol user with no history of substance abuse. The patient presented with a low-risk for dental caries, gingivitis, periodontal disease, and oral tissue dysplasia. The patient demonstrated excellent oral and medical health behaviors. The patient stated: "I want to be buried with all my teeth!"

Clinical Question

The dentist assessed that the fractures to teeth Nos. 2 and 4 were catastrophic. The evaluation was to extract both abutments with the loss of the three-unit prosthesis. To rehabilitate the resultant edentulous area presented several options. The options were to do nothing, rehabilitate with a removable partial denture, or place an implant abutted fixed-partial denture. Clinical judgment recommended rehabilitation with the

placement of two implants and a fixed-partial denture. This treatment would provide optimum chewing effectiveness and efficacy, convenience, and esthetics. However, the dentist was unsure if this rehabilitation was a realistic treatment for a patient who is 87-years old. The clinical question became: Are dental implants in comparison to a removable partial denture more effective in achieving optimum chewing effectiveness and efficacy in an 87-year-old woman?

Encryption data ?

Practice record **==**

Patient record **==**

CUSTOMIZE CLINICAL PRACTICE GUIDELINE ?

P

Population

87 years+ ▼

Independent ▼

Female ▼

Race/ethnicity ▼

Moderate ▼

I

Intervention

Dental implants ?

P

Prediction

Probability ▼

C

Comparison

1st level = No treatment ?

2nd level = Removable partial denture

O

Outcome

Increase ▼

Chewing function ?

Research question: In a population of female subjects, 85 years of age and older and functionally independent, will dental implants compared to no treatment and compared to removable partial treatment increase chewing function?

Clear form

Continue

Figure 3. The clinical inputs to form a clinical question into a research question and create a CPG for the patient case.

Clinical Practice Guideline

A conceptualized knowledge management software using a primary, centralized network database of stored best evidence provides the CPG template with which the dentist will use to initiate the clinical question. In the background, the CPG template will access the patient's

electronic chart, extracting all patient attributes, including those derived from the dental interview of past and present histories, intra- and extraoral examinations, and functional assessments.

In the event a CPG addresses the clinical question, this CPG provides baseline probabilities of the treatment outcomes

and utility data under consideration. This data is based on the "average patient." Economic data is accessed from computerized practice schedules. In shared decision-making, the CPG is used as a decision aid with which the dentist and patient may change baseline data in individualizing the CPG to the patient. The revised CPG

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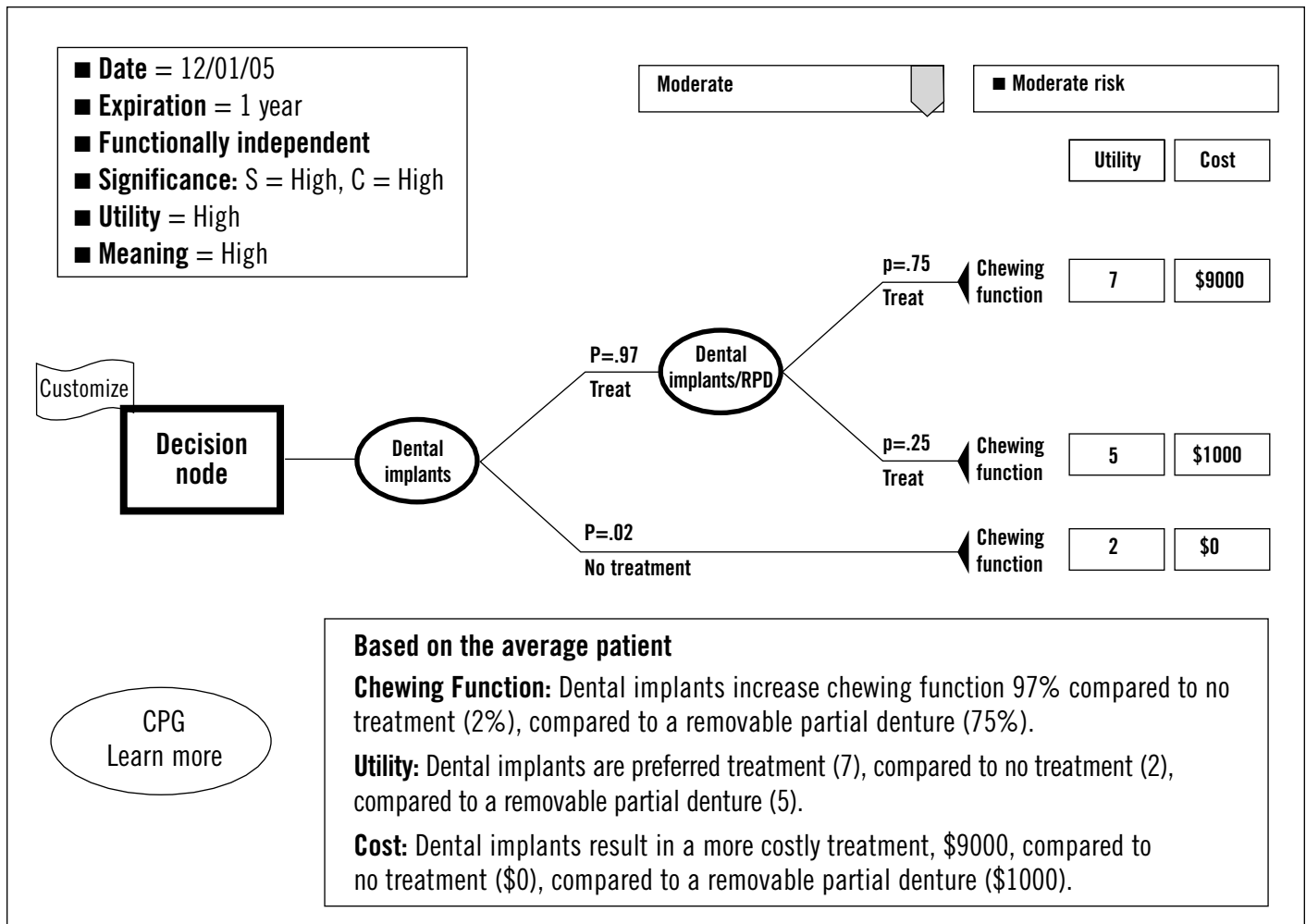


Figure 4. The patient case CPG containing decision data, utilities, and costs in response to the PIC/PO query.

is sent back to the primary network. Along with inputs from other practices and their patients on the same question, the information from the revised CPGs may be gathered along with this patient's inputs. Thus, there is a reciprocation of knowledge that may be used to update the CPG and/or advance new research. The exchange of patient information from the electronic chart to accomplish these responsibilities must abide by Health Insurance Portability and Accountability Act standards. The data ought to be encrypted such that patient identification is protected. Databases, in particular, are obligated to be especially diligent in optimally safeguarding such information. Password protection and user-access methods must be secured and security controls enforced.

This has great importance if researchers are to access information to further study changes in practice, behaviors, and oral health trends.

Dentist Role

From the electronic chart, the dentist assesses the CPG template by clicking on an icon located in the patient's electronic chart. After which the dentist clicks on the flag icon link "Customize" and the Customize Clinical Practice Guideline form appears (Figures 1 and 2). The form assists the dentist in accessing the evidence-based dentistry database of the primary network. The form is organized to structure the clinical question into a research question. This structure is in the form of a PIC/PO question. PIC/PO is an

abbreviation for population (P), intervention (I), comparison (C) or prediction (P), and outcome (O). As such, the research question includes the population studied, the interventions that are compared or the intervention to be predicted, and the outcome that is to be measured. If there are multiple comparisons, a link "Add more comparisons" may be assessed to specify levels of comparisons. Each level has its link to the place in the CPG where the comparison is to be made. For this patient case, the dentist accesses the "P" dropdown menus to choose those attributes that apply to the clinical question. The population is inclusive of that data for female, age 87 and older, functionally independent, and a moderate risk-taker (Figure 3).

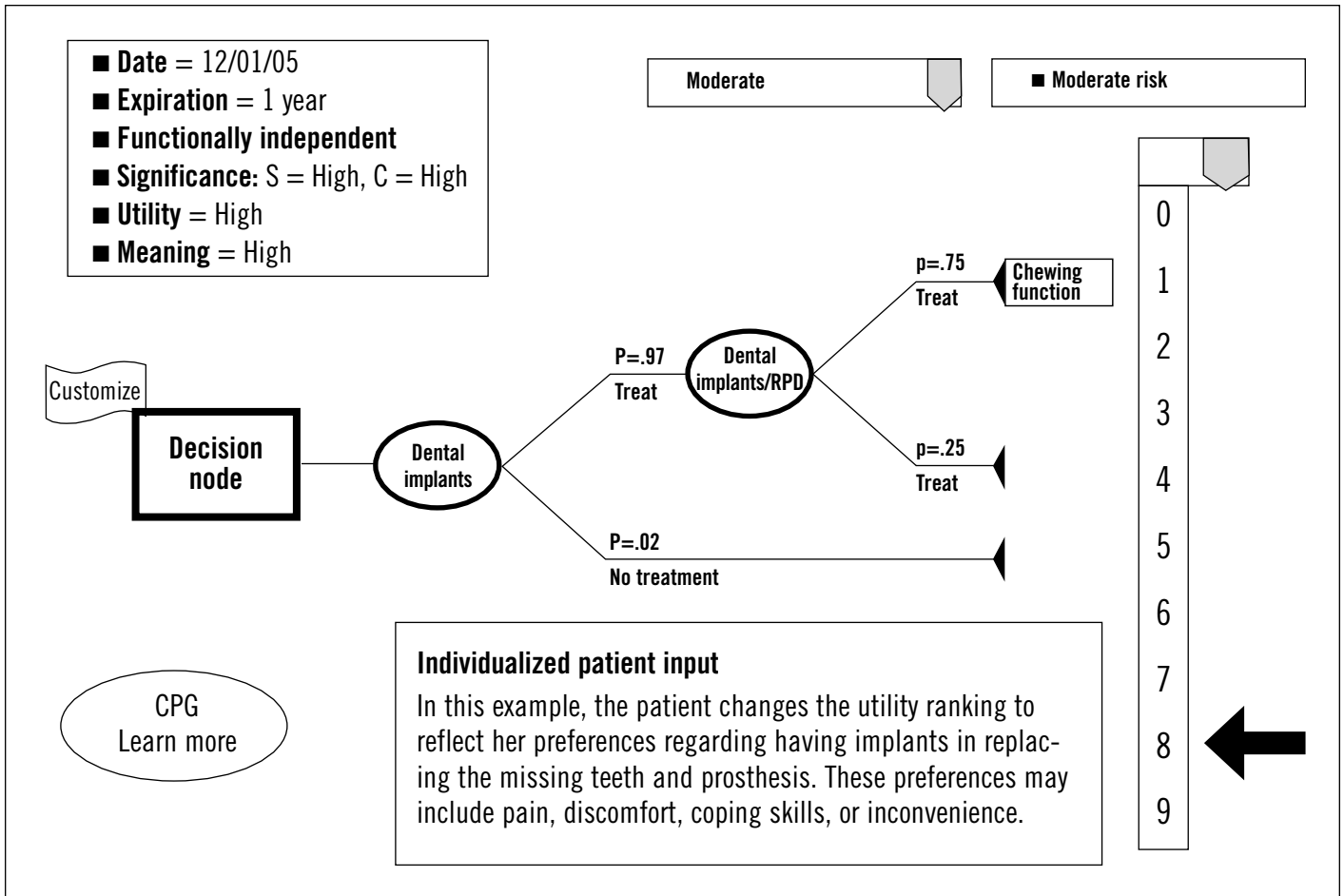


Figure 5. An example of the patient changing “average patient” utility ranking to individualize the CPG to the patient.

For the “I” menu text box, the dentist types the primary intervention, or in this case, the primary option dental implants. From the “P/C” menu, the dentist selects the radio button next to the “Estimate” dropdown menu from which she or he selects probability. The dentist also selects the radio button next to “Comparison.” Since there are multiple comparisons, the dentist selects the primary comparison, no treatment, and the secondary comparison, removable partial denture. If the clinical question queries a prediction for outcomes of independent interventions, then the “Comparison” radio button is left unselected. Lastly, for the “O” menu, the dentist selects the measure type and types in the text box the outcome to be measured. In this patient’s case, the measure is “increase”

and the outcome is “chewing function.” From these inputs, the research question developed from the clinical question appears at the bottom of the form. The question mark provides access to a description box to help dentists with his or her input. Once the research question is acceptable, the dentist clicks the “Continue” button. When the dentist sends a CPG request using the PIC/PO form, a search is conducted using the centralized database to link best evidence to the resultant CPG. The CPG is then displayed with the requested information (Figure 4).

For the dentist, the left upper corner box provides data on the quality of the CPG. By clicking on the link in the lower left corner, the dentist accesses the systematic review(s) that developed best evidence. This link accesses the CPG’s origi-

nal data, published articles, abstracts, or other user defined formats. Then, the dentist may investigate the evidence that produced this quality assessment.

Patient Role

The CPG presents the probabilities of increased chewing function in comparison to dental implants and no treatment and in comparison to dental implants and a removable partial denture. Additionally, the CPG provides the utilities for both comparisons and total costs for each treatment. These values are for the “average patient.” The patient may input his or her preference of one procedure compared to another, or consider his or her preferences in the context of the “average patient” (Figure 5). The risk level relates to the patient’s willingness to accept that the rehabilitation may not be

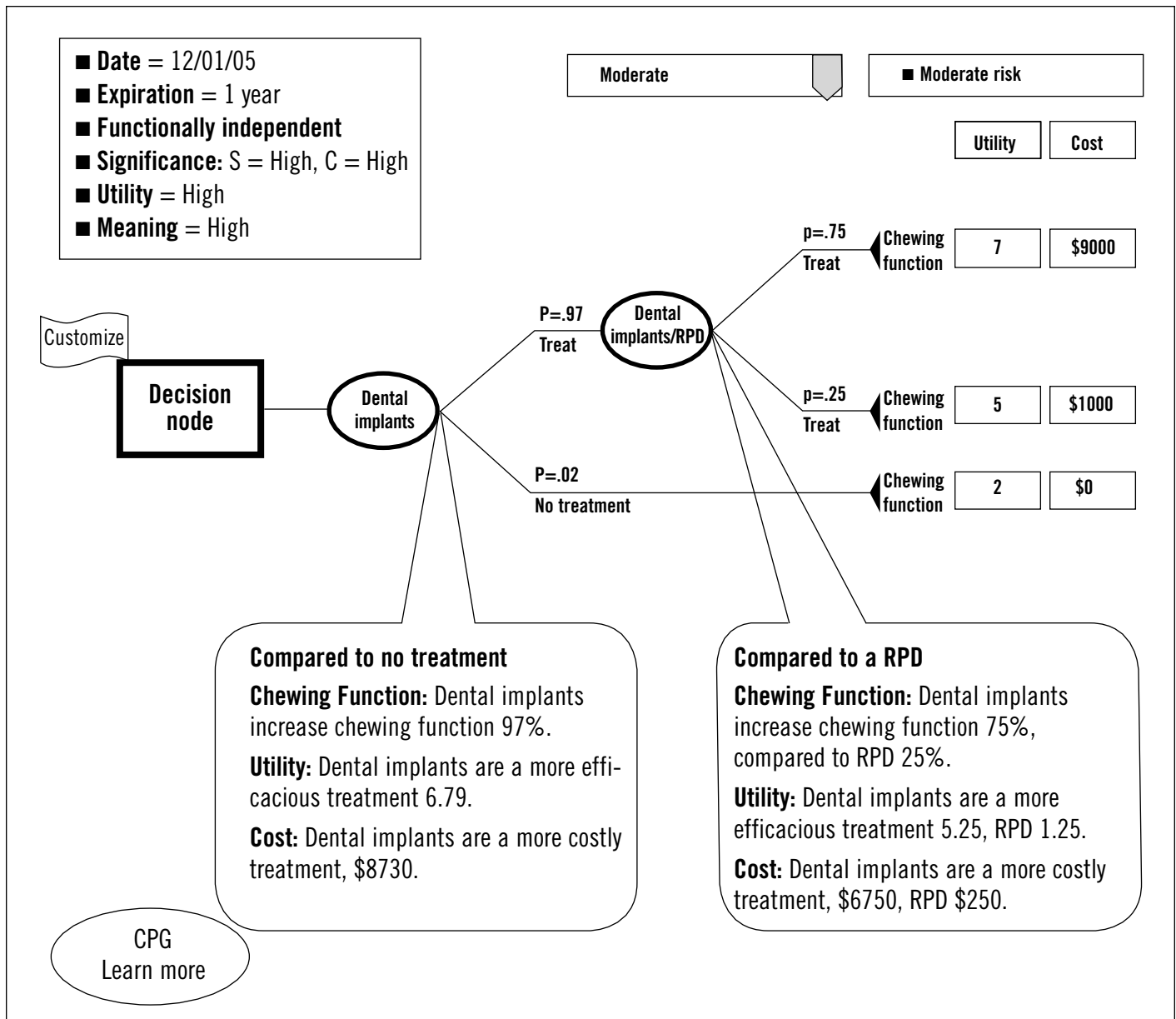


Figure 6. The patient case CPG showing the data analysis for the two options.

successful; high-risk tolerance indicates that the patient would accept a treatment with uncertain outcomes, a high risk of failure or short-term prognostications; a moderate-risk tolerance (risk-neutral) indicates a patient who is equipoised or will accept treatments that have a reasonable and acceptable range of uncertainty; and a low-risk tolerance indicates a patient who will not accept uncertain outcomes and chooses options with low variability. The patient may adjust risk tolerance levels or change utility inputs

to test personal preferences or expand on the dentist-patient relationship dialogue in developing the informed consent leading to the treatment decision.

Decision Analysis

Decision analysis combines probability data with utility and cost data.^{6,7} The use of probability data is to show which choice is better. Utility and cost data integrate personal realities into the analysis. While probability data determines effectiveness, utility data determines efficacy.

Utility data is quantified on a scale from zero to nine. Utility data indicates that treatments may cause pain, discomfort, challenge coping skills, or inconvenience. Patients may just not value treatment benefits. Thus, combining utility with probability data will indicate the value the “average patient” places on the treatment option. The resultant combined data informs patients of their options and allows them to weigh evidence to come up with a decision that is best and sensitive to their needs and goals. This has

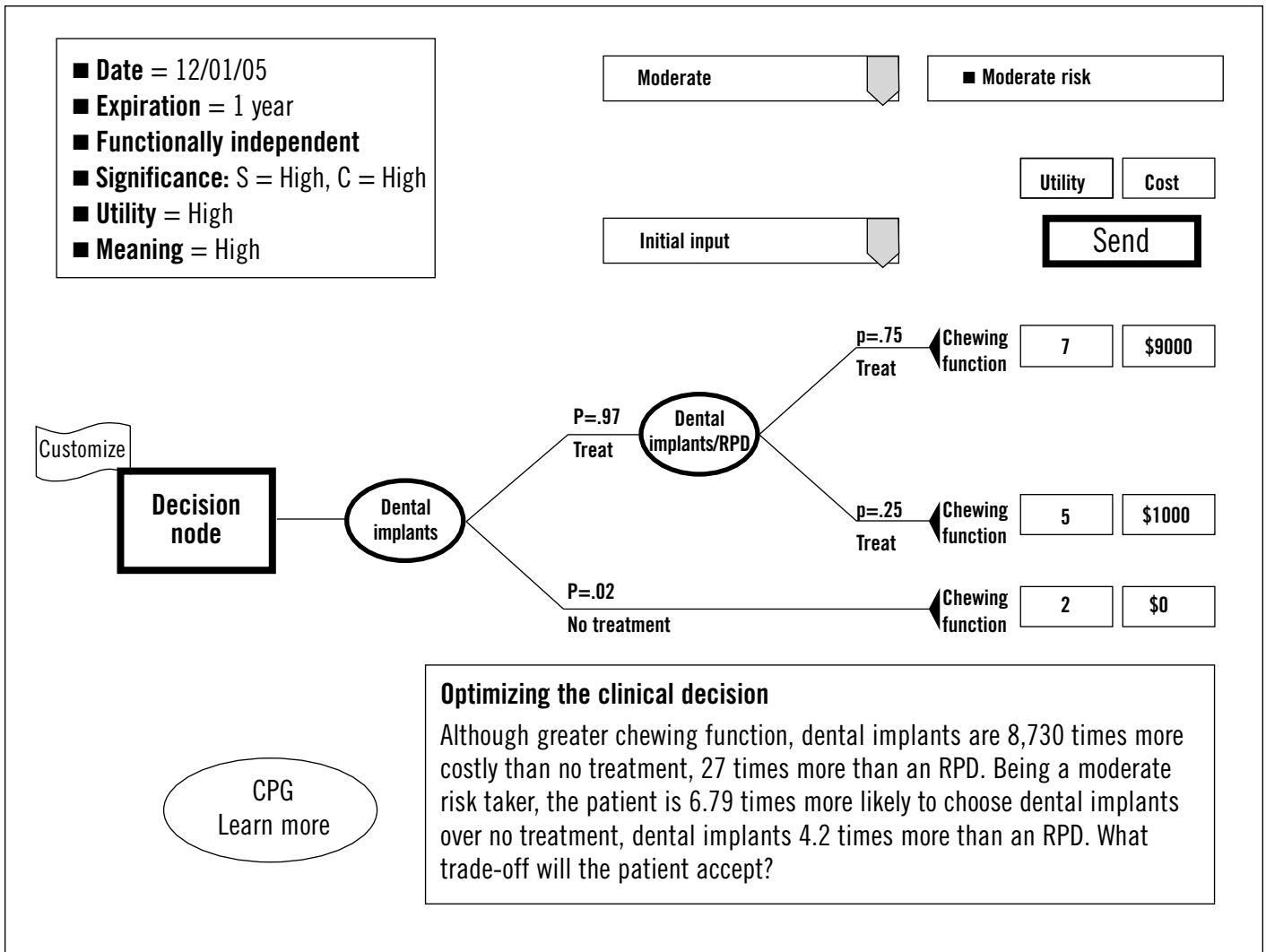


Figure 7. Summarizing the decision and utility data in optimizing the CPG in arriving at the clinical decision.

the additional advantage of identifying for both the dentist and patient sensitive aspects of particular importance to the patient in decision-making. Flexibility is also important because patients may vary in their risk-taking behaviors over time.

In this patient's case, the CPG provides two choices: Accept or deny treatment. If the choice is to accept treatment, there are two options: a dental implant or a removable partial denture. Decision data indicates that a dental implant increases chewing function (97 percent) compared to a removable partial denture (25 percent). Utility data indicates that a dental implant is preferred, 7, higher than

a RPD, 5. Cost data, however, indicates that a dental implant is more expensive, \$9,000 than a RPD, \$1,000. If the choice is to not accept treatment, there is no cost, no real expected value. In analyzing between a dental implant and RPD, a dental implant has a greater expected utility (0.75 x 7 = 5.25), or is preferred, to a RPD (0.25 x 5 = 1.25); a dental implant has a greater expected value (0.75 x \$9,000 = \$6,750), or the most valuable option, to a RPD (0.25 x \$1,000 = \$250) (Figure 6). Thus, a dental implant provides the best weighted benefit; it is the optimized choice for tooth replacement. When comparing treatment with a dental

implant to no treatment, the weighted expected utility of treatment is 7 (5.75 + 1.25), the weighted expected costs is \$7,400 (\$6,750 + \$250). For no treatment, the weighted expected utility is 0.04, the weighted expected cost is zero. Thus, for the "average patient" who has a moderate risk tolerance, the optimal clinical decision is to select treatment, restoring the tooth with a dental implant (Figure 7).

The results are printable for patient retrieval and study. This patient, or dentist, may change the inputs, risk tolerance level and, within seconds, the new resultant analysis is displayed for discussion, the calculation and analyses of

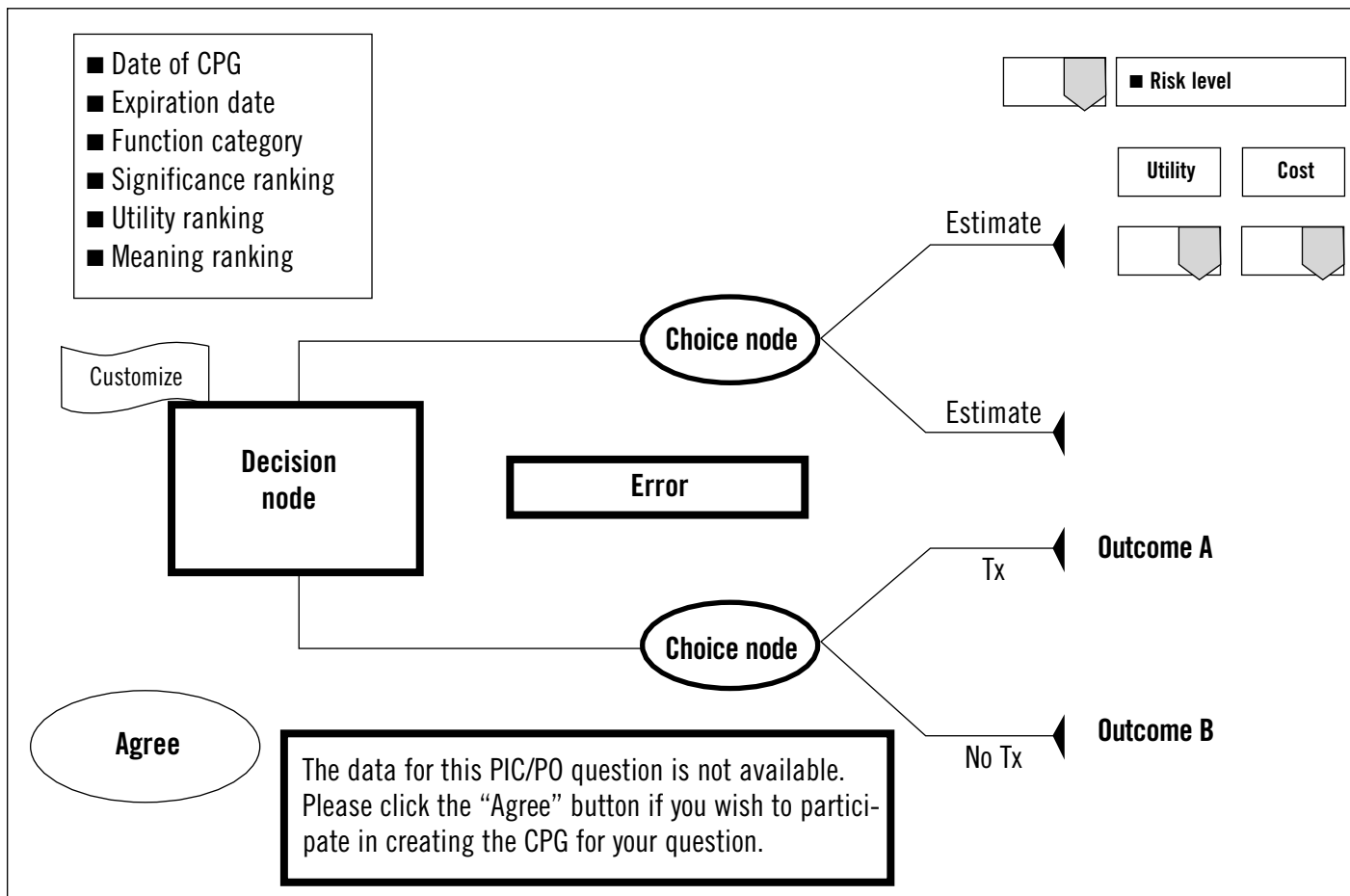


Figure 8. The CPG template when no best evidence is available from the centralized database in response to a PIC/PO query.

which takes place in the background. The clinical decision is finalized when data is individualized to this patient and the trade-off between costs and preferences are made. Once the clinical decision has been finalized, patient changes to the utility data are inputted and the “Send” button is clicked. On follow-up at the next yearly periodic dental examination, the dentist monitors patient compliance or success with treatment and changes this patient’s previously determined probabilities, if needed. The new data is sent to the primary network by again clicking on the “Send” button. Next to the “Send” button is a dropdown menu to indicate if the analysis is a result of the initial analysis or the analysis at first, second, etc., or follow-up. This revised data may be used to update the CPG and/or advance new research.

The Translational Researcher

In the event that probability and/or utility data is not available, the dentist is presented with an error message that requests his or her participation in developing the CPG (Figure 8). The dentist’s participation regards the research question and the clinical significance of the data subsequently determined from the systematic review using the dentist’s PIC/PO question (Figure 9). With or without the dentist’s agreement, the translational researcher conducts a systematic review to supply the needed information.

The translational researcher may produce quantitative and/or qualitative best evidence. Quantitative research provides parametric estimates of treatments, therapies, and other practice components and processes. Qualitative research provides measures of attitudes, beliefs, and prefer-

ences (utilities) of both practitioners and patients. Understanding behaviors brings an efficacy of care component to the clinical decision. In other words, patients may perceive the effectiveness of care differently depending on their life processes, and this meaning may change over time. Costs are specific to the practice’s schedules. Because data is collected nationally, regionally, and locally, the CPG may present data based on the level of locale.

Once the systematic review has been completed, the evidence is inputted into the database of the primary network. Best evidence is associated with a date of the CPG, expiration date determined by the translational researcher, function and risk levels, utility rankings, and statistical, clinical, and meaning in practice significance. Finally, publication of the systematic review is linked to the CPG.

■ Date = 01/01/06

Moderate

■ Moderate risk

Feedback – Clinical Significance

Customize

Decision node

Dental implants

P=.97

Treat

Dental implants/RPD

p=.75

Treat

Chewing function

p=.25

Treat

P=.02

No treatment

0

1

2

3

4

5

6

7

8

9

←

Send

Please rank the significance in your practice of the chewing function of dental implants compared to RPD. Please click “Send” when done.

Figure 9. The form that queries the dentist in response evaluating the clinical significance of a CPG.

Conclusion

An example patient case provided a foundation upon which to illustrate how to use a CPG. Conceptual knowledge management software templates are used to demonstrate queries and responses to queries for information needed in decision-making. The information included decision and utility data from a primary, centralized network database and cost data from the practice cost schedule. When best evidence was not available, forms were explained to guide the dentist's participation in validating the clinical significance of a new CPG. From the patient case, decision analysis was presented in arriving at an individualized and optimized clinical decision. CDA

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