Purpose: The purpose of this white paper is to describe the various types of electronic oral health risk assessment tools and forms currently in use and to summarize their essential characteristics. The white paper will also recommend areas within this product category where standardization may be appropriate.

Background: In recent years the dental profession has demonstrated increased interest in the use of clinical risk assessment tools. Oral conditions for which risk assessment tools are currently available include dental caries, periodontal disease, and oral cancer. A risk assessment instrument determines an individual patient’s risk level plus the factors that contribute to risk for a specific oral condition from the patient’s clinical, demographic, and behavioral data. In contrast to diagnosis, which describes a current condition, risk assessment provides information unique to the patient about the likelihood of a future condition and its causes.

Risk assessment provides information that is used to plan treatment that is directed not only at the current condition but at preventing certain conditions or sequelae that may occur at a future date. In this way risk assessment can also affect a patient's systemic health and quality of life. Risk assessment is valuable as an aid to inform, educate, and motivate a patient. These may also support risk management for the healthcare professional.

Risk assessment tools assign weighted values to information about the patient which then estimates their relative influence on the status or progression of oral diseases. When based on best-available scientific evidence, these tools can assist clinicians in educating and motivating patients and selecting appropriate interventions to prevent or remediate oral disease. Third party payers can use risk assessment to assist with making appropriate benefit determinations for an individual beneficiary, provide consumer decision support for new purchasers, and as a factor to measure plan performance.

Risk assessment tools are currently available to patients and clinicians. Risk assessment methodologies utilize specific facts about the patient and describe how the information is used to determine a patient’s risk. Some risk assessment methodologies include the judgment of the clinician as a modifier of objective observations. Some risk assessment methods produce highly variable results or are time consuming to use, which reduces the utility for their intended purpose. Risk assessment methods include manual and software enabled approaches. In contrast to a manual method of risk assessment, a software-driven approach can be designed to provide greater precision by using an algorithm embedded in the software that uses standardized measurements for its factors and provides convenience by utilizing data in the patient’s electronic dental record (EDR).
Risk assessment outputs can be represented descriptively, pictorially, and/or by numerical scores. While risk suggests a condition’s future status, a description of the current status provides a baseline for future measurement. Pictorial representation may allow easy comparisons for patients to determine if risk has changed. When risk and severity status are reported using scores, they can provide oral health practitioners with measures analogous to the numerical measures used in medicine to help manage chronic conditions such as diabetes (blood glucose and hemoglobin A1c) and heart disease (serum cholesterol and triglycerides). The patient and clinician can use these scores over time as decision support tools to measure the effectiveness of preventive and therapeutic interventions used to manage chronic diseases such as caries and periodontal disease. Scores can also provide a qualitative assessment of health or quality of life (e.g., excellent, good, fair, poor). Patient educational materials can then be linked to an individual's disease status and risk.

A number of manual risk assessment tools have been developed related to dental caries. The Caries Risk Assessment Form published in 2007 in the Journal of the California Dental Association is a widely used example. It has been modified and adopted by many dental and hygiene schools. Some schools have computerized the method for their dental clinics. While a caries risk assessment form has been supported by at least one state dental association, The American Dental Association (ADA) and the American Association of Pediatric Dentists (AAPD) have both promulgated their own risk assessment tools and caries management guidelines. Most of these applications are provided in an open source format and can be downloaded at no cost from professional association websites.

Electronic risk assessment tools for caries include the Cariogram, developed at the University of Malmo in Sweden which has been available at no cost on the internet since 1997. Other proprietary online tools are available that assess caries risk using tools that are based on the Caries Management by Risk Assessment (CAMBRA) model. Some of these products also offer electronic tools for periodontal disease and oral cancer, which are currently used in a number of dental hygiene and dental schools.

**DESCRIBING RISK ASSESSMENT SOFTWARE**

Oral health risk assessment software can be described according to the source of the information and the conditions the tool is designed to assess.

**DESCRIPTION OF RISK ASSESSMENT TOOLS BY SOURCE OF INFORMATION:**

**Self-assessment Tools:** These tools allow the individual to enter information about themselves or their minor children using a computer interface. The resulting scores or qualitative descriptors can then help the individual make informed choices about their oral health, including decisions to modify personal behaviors, to seek care from a dentist, to purchase dental benefit products, or to select oral health care products.
Self-assessment tools can also be used to conduct population-based oral health risk assessments to help employers, researchers, or other groups understand the oral health needs of a population. The result of an oral health risk assessment can help the plan purchaser make better informed choices about dental benefits and allow the dental benefit provider to develop plan designs that better meet the needs of beneficiaries. When done in combination with a medical health risk assessment, it may be possible to identify individuals with co-morbid conditions such as periodontal disease and diabetes and implement strategies to improve both medical and dental outcomes.

Professional Risk Assessment Tools: Professional risk assessment tools use clinical findings (e.g., number of restorations, carious lesions, attachment loss, bleeding, etc.) and patient reported information such as diet, home-care, smoking, medications, health history, patient compliance, etc., that are collected by oral healthcare professionals. These tools may also utilize information collected from a patient's self-assessment. The software's algorithm then provides numerical scores or qualitative measures that can support decision-making on issues including primary prevention recommendations, treatment protocols, or benefit plan designs.

Risk assessment products that integrate findings related to the patient's oral and systemic health can facilitate identifying conditions and factors that require inter-professional management of co-morbid conditions such as diabetes and periodontal disease by medical and dental healthcare professionals. Risk assessment data can also be used by third party payers to provide health benefit administrators and other appropriate entities with performance data that can be used to modify plan designs or to support accountable care organization initiatives.

EXAMPLES OF RISK ASSESSMENT TOOLS BY CONDITIONS ASSESSED

Dental Caries: Caries risk can be estimated using a number of variables including diet (e.g., frequency of sugar consumption), exposure to systemic and topical fluoride, home care practices, history of caries and restorations, lesion activity, and family history. Other clinical observation such as enumeration of cariogenic bacteria or the amount and buffering capacity of saliva may also be considered.

Periodontal Disease: Periodontal disease risk can be estimated using patient history of smoking; history of periodontal therapy or previous periodontal treatment; periodontal probing depths and attachment loss; bone loss; furcation involvement; mobility; bleeding on probing; exudate, recession and mucogingival defects; soft tissue phenotype/biotype; genetic susceptibility; medical conditions associated with periodontal disease such as diabetes or pregnancy; and laboratory tests for immunological markers or periodontal pathogens.

Oropharyngeal Cancer: Risk for cancers of the mouth, pharynx, and lips can be estimated using known risk factors such as smoking, alcohol consumption, age, exposure to human papilloma virus, and UV radiation.
Oral Health Quality of Life: Oral health quality of life risk can be estimated using risk assessment of oral health conditions that impact quality of life.

INTEGRATION WITH ELECTRONIC DENTAL RECORDS (EDRs) AND OTHER HEALTHCARE INFORMATIC SYSTEMS

Ideally, professional risk assessment tools would be integrated into EDRs and practice management systems to plan treatment and manage care of an individual patient and analyze a practice’s patient-care outcomes. Additionally, both professional and self-assessment tools could be integrated into dental claims processing systems. For dental benefit products sold online or on healthcare exchanges, self-assessment tools could provide prospective purchasers with information to help them choose the products that best meet their needs. Dental practices could also use self-assessment tools to motivate patients to seek or continue needed dental care. Manufacturers and retailers of dental homecare products may also be able to use self-assessment tools to guide consumers in the purchase of products to meet their individual needs.

OPPORTUNITY FOR STANDARDIZATION

There are currently no standards for these products. Standards for oral health risk assessment could include the format, validation, and other essential characteristics of its input and output elements, especially since they may be used by other systems and for a multitude of purposes. Additionally, standards established for risk assessment should not only be compatible with, but should be developed together with, standards that describe a condition’s current severity status (i.e., health assessment).

ESSENTIAL CHARACTERISTICS OF RISK AND HEALTH ASSESSMENT SOFTWARE

Privacy and Security: At a minimum, electronic oral health risk and health assessment tools must be HIPAA compliant. If the oral health and risk assessment tool collects and stores patient data, the information must either be de-identified or encrypted and stored in compliance with HIPAA regulations.

Understandability: The output of the assessment tools should provide information about health status and risk that are easily understood by both dental professionals and patients. For this reason, output should include a numeric score or other measure that can unambiguously be compared to a previous assessment to describe and/or graphically illustrate change over time.

Responsiveness: The output values of the assessment tools should be responsive both to deterioration in status, as well as improvement in status.

User Interface/Ease of Use: The user interface should be intuitive and use written materials and graphics prepared at an appropriate level of health literacy.
Clinical Utility: An assessment tool for routine use should be quick and easy to use. Non-routine, costly, or time-consuming tests that do not promote routine use and that have value only for a select proportion of patients should not be included in a basic risk assessment, but could be included in more sophisticated risk reclassification assessment tools. Evidence of accuracy (i.e., actual outcome at a future date is correctly predicted) and precision (i.e., reproducibility) of an assessment is desirable. A tool should provide a level of calibration that corresponds to distinctly different treatment choices.

Clinical decision support that encourages the implementation of the tool is desirable. The output/report should be presented in a simple format that provides actionable information that preserves professional judgment and promotes acceptance and compliance of treatment by the patient. Additionally, educational materials, recommendations, and consumer and/or clinical decision support should reflect consensus best practices for clinical or homecare interventions. Clinical decision support that aids in the management of a patient’s care is desirable.

Evidence Based Dentistry: If the tool generates scores or other indicators of relative risk or severity for clinical conditions, the scores or qualitative measures generated by the algorithm should reflect the best currently available scientific consensus regarding that condition. When provided, educational materials, recommendations, consumer and/or clinical decision support should also reflect consensus best practices for clinical or homecare interventions.

Validation: Ideally, risk assessment tools should be clinically validated. This is especially so for tools that may influence clinical decision making or dental benefit determinations. Absent validation, a risk assessment tool should be consistent with the current scientific knowledge regarding risk factors for oral conditions.

Summary: Electronic risk assessment tools can assist dental practitioners in clinical decision making, provide easily understood measures of oral health status for patients, and enable third party payers to provide benefits based on the individual needs of patients. The development of basic standards for risk assessment software programs under the ANSI/ADA Standards Committee for Dental Informatics can enhance the utility of these products and encourage interoperable platforms for exchange of information.

A logical next step in the standardization process would be to develop a technical report that surveys currently available risk assessment products and identifies a set of essential characteristics for the product category. It may then be possible to create standards for collecting and reporting risk assessment data that will permit interoperability of risk assessment tools as components of the EDR.