# Oralytics™

## Combining Oral Health Predictive Analytics with Care Management for Fully Integrated Care

Digital health tools, including predictive algorithms, artificial intelligence (AI), intelligent automation (IA), and machine learning (ML), are poised to become critical features of the health care industry. There is broad consensus among health care stakeholders that these tools promise improved proficiency and efficiency with care delivery.[1] Predictive analytics tools require a robust combination of data and analytical expertise, clinical expertise, industry experience, and health care integration knowledge. CareQuest Institute for Oral Health is developing a service, called Oralytics™, that meets these needs head-on.

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## Existing Predictive Analytics Models in Oral Health

Existing predictive analytics in oral health may be classified in one of three major, cross-cutting models, each with its own set of tradeoffs between benefits and risks/burdens: *clinician-centric models, third party–centric models, and patient-centric models*.

**Clinician-centric models:** The development of predictive analytics, particularly AI algorithms, to support clinical decision-making represents the most abundant form of new investments in the field of dentistry. Such applications focus on assisting dentists and specialists in the timely and precise diagnosis of oral-systemic conditions, developing treatment or care management plans, or in the delivery of treatment procedures.[2,3,4,5]

**Third party–centric models:** These are midstream applications of predictive analytics models typically used by stakeholders such as public agencies, insurance companies, health care systems, and biomedical research and drug development companies. These organizations apply the models to transmit claims; reduce waste, fraud, and abuse; stratify health care risks; discover new drugs; and optimize care delivery. They are "third party" because clinicians and patients derive only indirect benefits from such systems. In one such example tied to oral health, a state-level data repository was modeled using AI techniques to recognize gaps in health coverage for children with early childhood caries.[6] As the unmet need for oral health care rises in the face of the COVID-19 pandemic, predictive analytics can be used to gain insight into the socio-demographic and circumstantial factors that predict behaviors and trends that lead to this unmet need.[7]

**Patient-centric models:** The most underexplored area of predictive analytics in oral health consists of models that focus on improving population health. Up to this point, patient-centric models have typically focused on either streamlining or upgrading the patient's experience or enabling remote patient monitoring. Predictive modeling applications typically use patients' historical data to feed, validate, and enhance algorithms to determine future health outcomes. Some dental apps use a buddy system (in which two individuals work together to monitor and improve health) to encourage regular toothbrushing.[8,9] Prototype systems using AI prediction modeling have also been developed to provide self-care recommendations to address and improve periodontal health.[10]

As patients typically volunteer their own health information and self-monitor progress in app-based systems, there is potential to create an automated data collection platform. Population-based predictive models in dentistry have the potential to go beyond the individualized clinical aspect of dentistry and address public health inequities associated with oral health, self-care, and access to dental services, by means of cross-collaboration.

## Limits to Existing Predictive Analytics Models

The application of predictive analytics models has limitations that are important to note. Challenges include:

**The fragmentation of oral health data:** The heterogeneity in the quality and quantity of data used to train and test models creates an unintelligible and unmatched black box for interpretation and extrapolation of findings. While algorithms are shown to have high sensitivity and specificity in their respective outcomes for a specific data set, these models have not been validated in clinical settings, which can limit their application. These barriers also limit the assessment of cost-effectiveness and potential for revenue generation of such AI applications in real-world scenarios.[11] Combined, these issues present a challenge to the wide-scale implementation and uptake of AI models in clinical settings.[12] While the barrier to entry in this sector is lower than normal, there is a need for ongoing work by other researchers or companies to replicate or improve available models.

**Maintaining analytical integrity:** Concerns have been raised that predictive models may aggravate preexisting systemic and social biases by their design and generalizability.[13] These biases can be mitigated by incorporating extensive data sets inclusive of all population demographics, such as race, age, socioeconomic status, and education. Additionally, models can be updated to create just and fair algorithms that represent the populations they are extrapolating to. As the application and uptake of predictive models[14] in day-to-day research increases, there remains a lack of standardized criteria to evaluate these applications. An evaluation framework that standardizes data management can also facilitate comparisons between future AI-related research applications.

**Workforce changes:** Big data can help organizations and individuals overcome some of the biggest challenges in health care. However, reporting and dissemination of that data, in ways that serve individuals at the point of care, remain difficult. This difficulty can be alleviated with more technical and physical support from health care informaticians. These individuals work alongside care teams to provide data and analytical support for the management of electronic health records, practice management systems, performance and incentive reporting, and health outcomes communication. Health care informaticians build their qualifications to effectively handle electronic health records and larger health care data sets to support teams and care delivery, improve quality and efficiency, and reduce costs. Health care informaticians may work within health care delivery, precision medicine, population health management, public health surveillance, and machine learning systems.

Unfortunately, health care informaticians are not traditionally included as members of the interprofessional care team and are rarely integrated into health education activities, even though positive impact has been reported. And while health care informaticians are becoming more common in hospital systems, they have not been widely utilized in oral health, leaving significant gaps in the reporting and dissemination of information.[15]

**Health integration and infrastructure:** There is limited research that has looked at clinical and population-level data for the development of interprofessional and interdisciplinary models meant to guide treatment. As the health care industry is seeing shifts toward integrated value-based care, the expansion of some of these research concepts provides a niche for exploring ways to integrate dentistry into primary care and behavioral health.[16] As strong evidence suggests links between oral health and other systemic and chronic conditions, integrated medical and dental data can be used to highlight alternate pathways of care that could increase access to quality health care services, improve quality of life, and reduce inequities in both oral and medical care in the future.[17,18,19]

**Protecting privacy:** It is also important to focus on data privacy and safety issues as research progresses in the application of predictive analytics to dentistry. Solutions to these data privacy and safety issues include ensuring that uses are transparent to all stakeholders as well as ongoing auditing and human review of predicted outcomes.[20]

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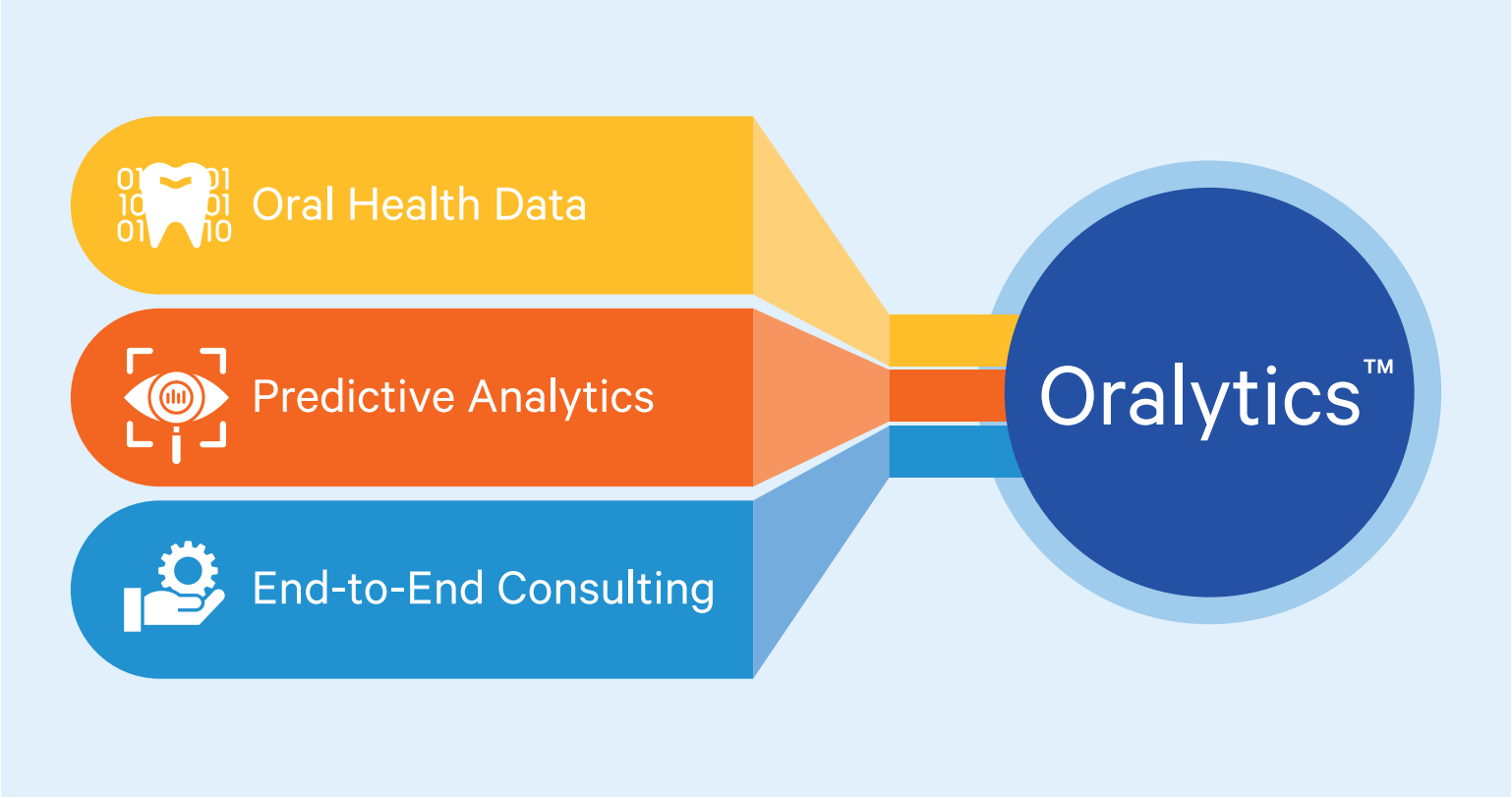


## The Role of Oralytics™

Oralytics™ uses technology to put the mouth back into the body. It is intended to provide an easy-to-use health integration service that combines oral health data and predictive analytics to identify an individual's risk of having a systemic disease, such as diabetes. Oralytics offers a unique suite of services to provide end-to-end guidance on individualized care and population health management. This service can result in improved predictability of care costs and, ultimately, improved patient and population health. Oralytics provides an adaptable structure and menu of options that can function in clinician-centric, third party–centric, and patient-centric models to offer guidance for payors, providers, patients, and other health organizations to customize care management approaches. This allows support for their unique operational and care delivery needs while improving the health of the population.

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Oralytics™ is distinctive because it builds on the mounting body of evidence demonstrating links between oral health, systemic health, and chronic conditions to identify and drive interventions that have the potential to increase access to health care services, improve quality of life, and reduce inequities. Oralytics can serve an important function in the marketplace by further demonstrating the value of oral health in overall care management activities. A recent survey of dental providers conducted by CareQuest Institute found that over half of all dental providers would be more willing to screen patients for systemic and chronic conditions if there were tools in place to identify patients at increased risk for disease. Overall health improvement is at Oralytics' core in both identifying risk as well as mitigating it through integrated care models and intervention planning rooted in value-based care. Finally, Oralytics is designed to address long-standing systemic health disparities by placing the patient at the center of an integrated health system that serves those most in need.[21]

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