CareQuest
Institute for Oral Health ®

RESEARCH REPORT

Large-Scale Dental Data Collection

Lessons Learned and Opportunities Gained

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Acknowledgments

Introduction

In the current United States health care system, transformational business and patient care models are emerging that focus on the value paradigm and highlight goals of the "Quadruple Aim." The Quadruple Aim, described first by Bodenheimer and Sinsky,[1] emphasizes four focus areas: improving the patient care experience; improving health care teams' satisfaction with work; improving the health of populations; and reducing the per capita cost of health care. As the health care system evolves, there are both opportunities and challenges for patient care, professional training, new practice methodologies, and care team communication. Born out of this ongoing evolution, CareQuest Institute for Oral Health's health improvement initiatives have demonstrated early promise, with positive patient outcomes and reductions in the total cost of care.[2]

In May 2020, CareQuest Institute initiated a single-state learning community pilot program in Massachusetts to support the state's Federally Qualified Health Center (FQHC) dental practices through their COVID-19 recovery process. The program was called the COVID-19 Oral Health Recovery and Transformation Learning Community. This learning community tested elements of the Three Domain Framework, with an emphasis on COVID-19 recovery. The Three Domain Framework was developed by CareQuest Institute to facilitate a move from a "drill and fill" restorative dentistry mindset to a

prevention- and value-based system of dental care delivery. The framework focuses on minimally invasive care, integrated and personalized treatment, and the use of teledentistry in oral disease prevention.[3]

The Community Oral Health Transformation (COrHT) Learning Community was built upon knowledge gained from the Massachusetts COVID-19 Oral Health Recovery and Transformation Learning Community and aimed to support the transformation of the oral health care delivery system. This installment included a total of ten community health centers (CHCs) located in Ohio and Arizona, with five CHCs located in each state.

As the health care system evolves, there are both opportunities and challenges for patient care, professional training, new practice methodologies, and care team communication.

The COrHT Learning Community utilized the Three Domain Framework to offer participants a variety of resources to adapt to the changing dental care delivery system. With these resources — including monthly telephone calls, access to subject matter experts, and a private virtual learning environment where peer interaction was encouraged — participants identified problem areas and strategized to implement needed changes.[4] Monthly call topics included: introducing the Three Domain Framework, population health management, teleprevention, minimally invasive care, and personalized and integrated care. Monthly community calls included the FQHC dental teams, representatives from the Ohio and Arizona primary care associations, CareQuest Institute staff, and subject matter experts. The calls were intended to share guidance and facilitate knowledge transfers on the topics. Finally, COrHT piloted a data collection and reporting strategy around key clinical and operational metrics that would give insight into clinics' readiness to adopt a value-based model of oral health care and improve data ingestion processes for future collaborative projects.[5] In previous CareQuest Institute initiatives, data reporting was reliant on self-reported measures. Although this gave clinics the ability to work freely within their electronic health record (EHR) capabilities, the effort required for the clinics to calculate measures was extremely time-consuming. This process also limited the ability to view underlying data and understand any issues that might be occurring. Results from this installment of COrHT showed that changes were needed in data collection to unpack the underlying data and to have the ability to clean, manage, and analyze the data appropriately.

The COrHT data collection process included obtaining both clinical and operational metrics directly from EHRs to gain insight into how the clinics were delivering care. This process supported the capability to draw inferences regarding readiness for an industry shift away from a fee-for-service, production-focused model of care delivery to one of prevention and value-based care. EHR data from dental clinics provides unique opportunities for understanding comprehensive care as well as novel challenges to the policies and standards for data governance and data collection, which may affect data reporting.

Data Collection and Extraction

One requirement for clinics to be part of the COrHT Learning Community was the ability to provide monthly data extractions from each CHC's dental and medical EHR system. The intention behind the data collection was to measure goals of the COrHT initiative, calculating measurements, performing analyses, developing a dashboard of the measures, and communicating within CareQuest Institute and external teams. Between October 2020 and September 2021, data were pulled monthly from the 10 participating CHCs, which used three different EHR systems (Dentrix, NextGen, and EPIC).

Requested deidentified data from the participating CHCs included medical and dental claims and patient demographic information. The claims data consisted of dates of service, procedure codes, diagnosis codes, tooth number(s) and surface(s) treated, treating provider information, charge type, charge status, and charge amount. The patient demographic data included age, gender, race, sexual orientation, insurance type, smoking status, homeless status, presence of a language barrier, and migrant worker status.

A data template was provided to each CHC to be used for the monthly data extraction. Metrics were derived from the dental procedure codes that were submitted through the monthly data extracts. These metrics were based on the Three Domain Framework and were chosen to gauge any uptick in teleprevention, minimally invasive care, and integrated and personalized care. Table 1 shows the full list of metrics and the methodology for calculation. Each clinic's metrics were shared with them through a dashboard, with the goal of tracking how the initiative was improving the clinic's care delivery in real time.

Each CHC received a data management guide that included expectations and guidelines regarding methods for extracting and transferring data, specific requested data fields, and staffing responsibilities to improve data collection. Based on the data management guide, CHCs were required to identify a data manager who was responsible for data reporting and served as the point of contact for data-related activities. The data manager also worked with CareQuest Institute staff members to extract and transfer the data as part of the project deliverables.

Data transfers were conducted through a secure file transfer protocol and stored by Amazon Web Services Simple Storage Service (AWS S3). Authentication was provided by Okta, and FileZilla was used to transfer files. A detailed workflow was provided by AWS to ensure success.[6] Figure 1 displays the process of data sharing.

Data Analysis and Reporting

Data sets were collected monthly from AWS S3 and stored on a secure server. Although a template was provided, data were not collected in a standardized manner across clinics and required extensive cleaning and management after extraction. Metrics were calculated using the dental claims data from the collected datasets. The metrics calculated included the total number of dental visits as well as the percentage of patients who: received oral health services via a telehealth encounter, received a telehealth encounter, completed a caries risk assessment, received primary and secondary procedures, received periodontal treatments, did not appear for their appointments, and/or attended for an emergency visit. Data were cleaned and metrics calculated using SAS Enterprise Guide.

Table 2 shows the total number of CHCs that reported each demographic variable of interest. Gender, insurance, and race were the most reported demographic data points, while migrant worker status, language barrier, and sexual orientation were the least commonly reported. Eighty percent of the CHCs reported at least five of the requested demographic data points, while one CHC did not report any.

A deidentified dashboard was created for each clinic using Tableau to show changes in metrics over time. An example dashboard is shown in Figure 2. Data were presented in a table format as well as line charts so that clinics could easily see changes over time for each metric. The dashboards allowed the CHCs as well as CareQuest Institute to understand how the topics taught on their monthly calls were being implemented. Each clinic was able to access its own dashboard, which displayed its metrics as well as cumulative metrics from the initiative.

The CareQuest Institute improvement initiatives, including COrHT, support participating individuals, teams, and organizations in making necessary organizational changes utilizing data dashboards. The CareQuest Institute team interprets each clinic's dashboard and collaborates with the clinic to help develop goals, plans, and measurement processes that limit disruption to clinical practice. As noted above, CareQuest Institute COrHT team leaders often included subject matter experts on the monthly calls to help participants better understand how to reach the goals of the COrHT Learning Community from a clinical perspective. The data dashboards are essential tool that maintains participant engagement and support improvement.[5]

Lessons Learned and Recommendations

The COrHT Learning Community improved greatly upon past electronic health record data collection, but there were still lessons to be learned. Although the clinics received a data template, they provided variables in a variety of different configurations. Inconsistent naming schemes, variable formats, and longitudinal discrepancies, including sending incompatible monthly data, made automation difficult, resulting in challenges in cleaning data efficiently. Without incentives for the clinics to provide data in a timely fashion, the timing of data submission was not consistent across clinics. In addition, it was determined that adequate training of clinic staff in best practices and maintenance of adequate staffing levels were required to ensure accurate data collection, and these were not always attainable. All of these factors contributed to longer lead times to obtain EHR data than initially anticipated.

One feasible solution would be implementing dental data exchange standards, such as Health Level Seven (HL7®). These standards offer a streamlined approach to receive EHR data in a timely manner as well as improving overall quality in those data extractions. Health care data empower health care teams, informs public policy, and changes behavior. To improve oral health outcomes, we need to improve the way we collect, share, and use health care data. Integrated and interoperable oral health information technology is the connective tissue needed to achieve better health outcomes, enable value-based payment opportunities, and shepherd in a new era of disease surveillance and care coordination. It is essential that dental providers, payors, and technology vendors be held to the same standard of data collection and interoperability as the rest of the health care system. Through the adoption of dental data exchange standards such as the HL7 CDA® R2 Implementation Guide: Dental Data Exchange, R1 and HL7 FHIR® Implementation Guide: Dental Data Exchange, Release 1 – US Realm, providers, patients, and payors will have unparalleled access to digital oral health information.[7]

We encourage incentives and programs designed to accelerate the participation of dental stakeholders in answering the call of the 21st Century Cures Act.[8] We also advocate such measures to meet the mandates outlined in the Office of the National Coordinator (ONC) for Health Information Technology final rule, "Interoperability, Information Blocking, and the ONC Health IT Certification Program,"[9] and the Centers for Medicare and Medicaid Services (CMS) final rule, "Interoperability and Patient Access."[10] Furthermore, we encourage the continued development of policy and program mandates that establish requirements for the exchange of oral health care data, especially for those who serve rural, underserved, or marginalized populations. We believe these efforts are a keystone in the effort to reduce oral health disparities and expand person-centered, whole-person care.

EHR data from dental clinics provide unique opportunities for better understanding comprehensive health care. The oral health care research community must have a deep understanding of the data infrastructure needs that will support data collection and reporting. It is crucial to determine the appropriate level of pay-for-reporting and pay-for-quality incentives to ensure that clinics are successful in providing high-quality and timely data extracts and improving the overall health care delivery system.

Health care data empower health care teams, informs public policy, and changes behavior. To improve oral health outcomes, we need to improve the way we collect, share, and use health care data.

References

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Appendix

Table 1. COrHT List of Metrics

Metric	Numerator	Denominator
Percent of patients receiving oral health services via a telehealth encounter	Total number of counseling and case management dental codes	Total number of dental telehealth visits
Percent of telehealth encounters	Total number of dental telehealth visits	Total number of dental visits
Percent of patients with caries risk assessed	Total number of patients with a caries risk assessment and documentation	Total number of dental visits
Percent of patients with primary and secondary procedures	Total number of patients with prophylaxis, fluoride varnish, and sealants	Total number of dental visits
Percent of patients with periodontal maintenance	Total number of periodontal maintenance codes	Total number of dental visits
Percent of appointments that are broken	Total number of cancelled and no-show appointments	Total of scheduled dental appointments
Percent of appointments that are emergency visits	Total number of emergency dental visits	Total number of dental visits

Table 2. Reported Demographic Fields by Clinic

Demographics	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6	Clinic 7	Clinic 8	Clinic 9	Clinic 10	Total Reported Fields
Homeless Status	X	X						X	X		4
Migrant Worker	X								X		2
Language Barrier	X								X		2
Race	X	X	X	X	X		X	X	X		8
Ethnicity	X							X			2
Sexual Orientation	X										1
Smoking		X						X	X		3
Insurance	X	X	X	X	X	X	X	X	X		8
Gender	X	X	X	X	X	X	X	X	X		9
Age			X	X	X	X	X	X	X		7
Last Medical Visit			X	X	X		X	X			5
Overall Reported	8	5	5	5	5	3	5	8	8	0	

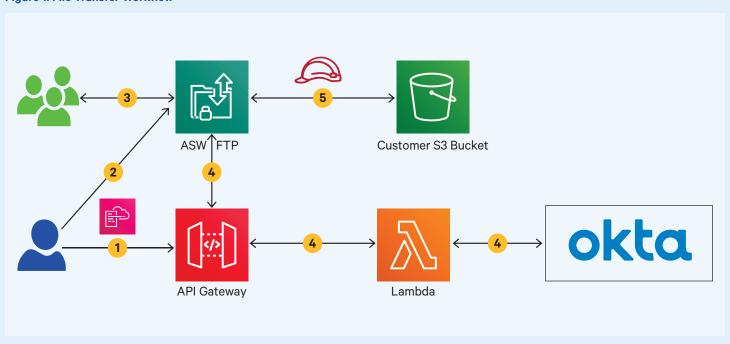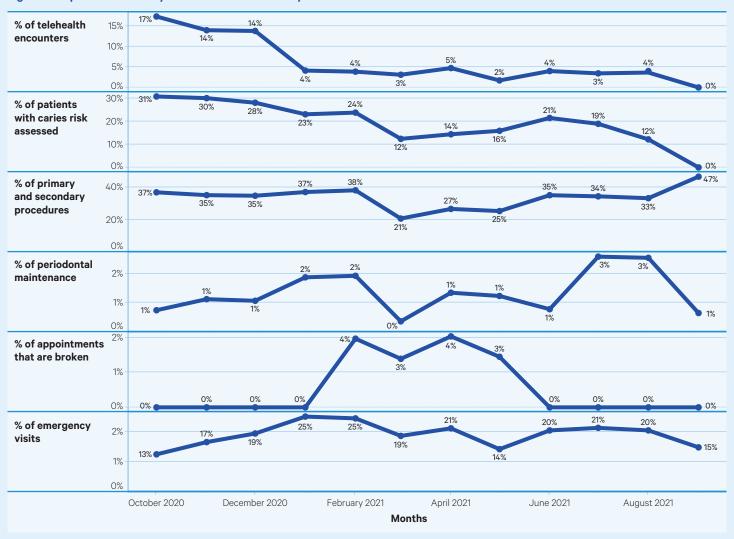**Figure 1. File Transfer Workflow**

Figure 1. File Transfer Workflow

Figure 2. Reported Metrics by Month for All Community Health Centers