

In Conversation With... Elisabeth Kalenderian, DDS, MPH, PhD and Muhammad F. Walji, PhD

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Editor's Note: Elisabeth Kalenderian, DDS, MPH, PhD is a professor at the University of California at San Francisco (UCSF). In her professional role, she leads research projects focused on using informatics approaches to improve the safety and quality of oral healthcare, with a particular focus on using data for electronic health records. Muhammad F. Walji, PhD is the Associate Dean for Technology Services and Informatics and professor for Diagnostic and Biomedical Sciences at the University of Texas Health Science Center at Houston, School of Dentistry. Additionally, he serves as the Director of the Texas Center for Oral Healthcare Quality and Safety. In his professional role he oversees the BigMouth Dental Data Repository and research projects focused on using informatics approaches to improve the safety and quality of oral healthcare. We spoke to them about the identification and prevention of adverse events in dentistry.

Kendall Hall: Can you please start by telling us about yourself and your current role?

Muhammad Walji: I'm at the University of Texas Health (UT Health) Science Center at Houston in the School of Dentistry. I serve as an Associate Dean for Technology Services and Informatics, where I am also a professor in diagnostic and biomedical sciences. My background is in biomedical informatics and not in dentistry, but I've been with the School of Dentistry since 2007 with a focus on trying to use data and informatics approaches to measure and improve the quality of oral health care. With me is my colleague Elisabeth Kalenderian, and her training is in dental research. She is an oral surgeon by background and is currently with UCSF School of Dentistry.

KH: You mentioned your background is not in dentistry. What drove you from informatics into the area of patient safety in dentistry?

MW: I guess I fell into it through collaborations that I had. I was working with data from electronic health records. The good thing about large academic institutions and many of the 50-60 dental schools in the US is that they all use the same electronic health record platform. When I first joined the School of Dentistry in 2007, there was a need to put that data together for secondary research. All these institutions had invested a lot in the electronic health records platforms, but they weren't really able to use the data beyond clinical care. We formed some collaborations with UCSF, Tufts, UT Health, and Harvard (where Elsbeth was working at the time) to advance this data use. We received funding from a grant with the National Library of Medicine to develop what we now call "BigMouth," which is this large-scale dental data repository that takes structured data from these dental institutions, aggregates it, and makes it available for researchers.

Based on that project, Elsbeth and I developed a shared interest in looking at patient safety and quality. We found that in dentistry, when we were looking at the data, we were discovering some clear patient safety challenges and issues where very little had been done and there was very little knowledge. Elsbeth and I consulted with Dr. Lucian Leape from the Harvard School of Public Health. We got a lot of advice from him and he was very gracious. We described the problem to him and he essentially encouraged us to start at the same place he started - measurement. We were inspired by his Harvard Medical Practice study and the work that came after that and thought, why don't we try and borrow some of those ideas and apply it to dentistry? We focused on just measuring the harm to the patient as the first step and not worrying about who's committing the errors. That's where we got this whole idea of looking at dentistry harm from a system's level and starting off with a blame-free approach to assessing what kind of harms are even occurring in dentistry. With my background more on the electronic health record side, the data side, we saw it as a good opportunity to start mining our electronic health record data.

KH: Let's go back to the "BigMouth" data repository. When you're pulling this data, is it from practices within participating organizations? Are you able to collect data beyond the academic setting and from individual dental offices?

MW: We started at the academic level with the four partner dental institutions. We've now grown to 10 institutions, but they are still all academic institutions. We have data on about 4-4.5 million patients now. We've discovered that by pulling data from these dental institutions we can measure process-focused quality metrics. For example, what percentage of children who are at risk of dental caries actually get a sealant? This is a science-based preventative practice. However, measuring adverse events and interpreting that data takes a lot more effort than measuring whether care processes occur. Often it requires reviewing the narrative notes. Because the institutions we work with use the same electronic health record, we were able to develop various data extraction scripts inspired by the IHI [Institute for Health Improvement] trigger framework. We were able to develop these triggers and pull out various types of potential adverse events via a more automated process. This was then followed by chart reviews, i.e., actually looking through the charts, and an expert panel that would then determine whether an adverse event occurred or not.

We also work with larger dental group practices that have the informatics infrastructure to do these sort of things. One example is [HealthPartners in Minnesota](#). The advantage to working with them is that they have a very large number of inpatient and outpatient records on the medical side, as well as a number of dental clinics, and they use the same electronic health record platform across both the medical and dental enterprises. They were able to take our triggers and use them to get a sense of adverse events in the clinics.

So, to answer your question around “BigMouth” – what we have focused on are the larger academic dental institutions. However, we are also working on trying to get some of these large dental group practices involved, like HealthPartners and another large accountable dental care organizations situated in the Pacific Northwest. HealthPartners, for instance, is more of a traditional capitated dental care practice with over 50 offices in the Pacific Northwest that all use the same EHR.

When it comes to the small practices, dentistry is still quite siloed. A lot of the care occurs in smaller one or two person practices and they don't really have a robust infrastructure. They may use computers for scheduling an appointment, but not much yet for charting and writing notes, etc. I think that's one barrier. Recently the American Dental Association initiated a project like “BigMouth” that targets private practices. They are beginning to work on getting data for quality measurement from these private dental practices that use common practice management systems. They won't yet be able to look at adverse events in a big way, but at least they will be able to shift in that direction. I think that is really encouraging.

KH: When thinking about the triggers, do the individual private practices have a true electronic health record where eventually an electronic clinical quality measure could be crafted using that EHR data? It sounds like it's more of a practice management software, which might be different.

MW: In the large academic institutions like ours, we have a full-scale electronic health record just like you do in medicine. For many of the large institutions that are already using the EPIC electronic health record, they are able to use a module called Wisdom for dental care and all of their data will be together. We have another grant from NIDCR [National Institute of Dental and Craniofacial Research] to develop a set of electronic quality measures. We've been working on that project for the last 5 years or so. We've been able to develop and measure important metrics in both dental caries and periodontal diseases, including both process measures as well as outcome measures. It is quite novel in dentistry to be able to track a patient's health over time for those two big dental diseases, and even more so to be able to assess the adverse events.

One of the things we've been able to push through is that in dentistry there was no standardized, accepted terminology for dental diagnoses. It's a very procedure driven profession. When you go to an oral health care provider, they will examine you and say, you need this procedure (e.g., a root canal, extraction, etc.) but not document in your record why. That is not to say a diagnosis is not made by the provider, it is just not recorded in a structured manner as it is not required for billing purposes (as is the case in medicine). As such, the diagnosis may only be recorded in the note in an unstructured manner. When we developed

“BigMouth,” that was a big challenge because we had all this procedure data but had no idea why people were doing these procedures. So, we actually developed a diagnostic terminology, which we documented in a number of papers. Long story short, it functions as an interface terminology and it has now been harmonized with the American Dental Association’s SNODENT framework, which is situated within the SNOMED framework. So far, only these large academic and some of our private practice partners use this diagnostic terminology. They understand that without it, they can’t drive or measure quality. We haven’t yet been successful in getting this out into practice because the drivers just aren’t there yet. It’s changing, the very fact that the American Dental Association has bought into it is really good, but adoption is definitely very slow.

KH: Well you’re kind of retrofitting, right? It’s not evolving organically with the profession, like it did in the rest of medicine, where the development of the EHR and coding practices have been growing in tandem over the past 20 years or so.

MW: That is a good point. The dental world also wasn’t impacted much by Meaningful Use. I think that was a problem too.

KH: Do you think there needs to be more emphasis placed on merging medicine and dentistry? It being placed off to the side seems to be a stumbling block to progress.

MW: Absolutely, but this is also a fight that has two strong sides to it. It has been advantageous for the dental profession to be their own silo of limited regulation and oversight. Additionally, a big problem in dentistry is the limited government payer coverage. There’s definitely been a lot of debate around this since I have been in the field. I am not sure how close we are to that merger but I know dental schools are talking about *what* it is we trying to train and to think about the overarching health of the patient. Dentists are generally good procedurally, but may not have that full picture of the patient health in mind. Hopefully we will get more towards a consideration of total health.

KH: This is a good point to pivot to the epidemiology of these errors. You talked about the limited oversight; do you see that as being one of the conditions that allows for these adverse events to be happening? There’s not that regulation imposed and people aren’t looking for it or required to track it.

MW: I’m sure that’s part of it, I think one of the main drivers is culture awareness. For our most recent AHRQ funded projects we are doing interviews with providers and when you ask them about their patient safety concerns, generally it relates to infection control. There isn’t this broader perspective of what do we even mean by patient safety? I just don’t think that there’s that awareness yet.

KH: We recently spoke with another researcher who was doing work around [antibiotic and opioid stewardship in dentistry](#) and one of the things that struck me was her description of infection control as being something that is engrained in dental training. Whereas if you go to medical school, you don’t

necessarily get that infection control instruction. So maybe it's a case of you don't recognize what you're not exposed to - you're not necessarily told to be aware of the opioid use disorder piece or the antibiotic stewardship piece or all of these other patient safety concerns.

MW: Absolutely, I agree with you. I also think it's the siloed care. If you're not working in a practice where you do have peer comparison and those sort of opportunities for joint oversight on a peer-review, I think that's a challenge among many practicing dentists.

KH: What are some of the other types of adverse events you see and where are there opportunities to improve practice?

MW: One of the first things that we did was that we asked dentists to name the kinds of bad things they think could happen to patients. Obviously, we know about the ones that are litigated or in the newspaper, such as for patient death. Thankfully, that is very rare in dentistry. But there are also things like wrong tooth extraction, which people mentioned but don't seem to come up that much in our research. From the work we are doing with the triggers or through electronic health record random chart reviews, we seem to have three or four recurring themes. The top one is pain. This is pain that it is unanticipated, or more than would be anticipated, after a dental procedure. Other ones that we have found to be recurring are hard tissue damage and soft tissue injury as well. Finally, the fourth one is nerve injury. These are the four big categories of adverse events.

When you categorize these as temporary harm, permanent harm, or requiring hospitalization or transfer to an emergency department, what we are finding is mainly that most of the harms that we're identifying through record review are considered temporary. There are some that are more permanent, normally those are related to the hard tissue damage, where there's issue with the bone or tooth, or something like that, which cannot be recovered. We also went through an exercise when we did our random chart review to try to determine whether we thought identified adverse events were preventable or not. We think that over 60% of the harms that we are finding, mainly temporary but sometimes permanent, would be preventable. These harms are seen quite frequently and there's great opportunity there to potentially prevent them from happening. We believe they must be a concern to the patients.

I'll just add that the other thing that we were expecting to find was a lot of (foreign body) aspirations. Those are a focus of dental education and the types of events for which we would expect to do more of a root cause analysis, but we didn't frequently pick those up either. We have recently applied for a grant to look at sedation and general anesthesia related adverse events. We may find small things that are more traditionally in errors in the medical settings.

KH: If you are developing trigger tools for these types of events, are you biased by the setting in which you're working? Particularly if the academic centers having potentially more information available or if you're able to find these more subtle, or not as egregious, events because you have a high volume of data?

MW: I certainly think that's a possibility. We've done the work using the triggers and we also had some funding from AHRQ to look at trying to estimate the incidence of the AE's. For that project, we work with two academic institutions and partners on the non-academic side. They have the infrastructure but they also have a number of affiliated small practices. So, this is a little more analogous to a private practice setting. Strikingly, we are finding similar types and distribution of adverse events.

Elsbeth Kalenderian: I think our intent is to be able to have an approach that is applicable for the general dentist and to work with not just academic institutions, but also with larger dental organizations, such as HealthPartners, that are well organized with established record systems. They have a real eye for quality improvement and patient safety. They have a Vice President of Quality Improvement, or at least a good understanding of what it is that needs to be done, the importance, and the willingness and interest to spend time and money on it. Our point of view has very much been that if we only try to implement in the very small independent dental offices, it will take a lifetime. It behooves us to really look at the larger organizations that we believe are more ready for quality improvement and building patient safety systems. They have the electronic health record that is more than just front and back systems for patient demographics and billing. Very often, when you go to the dentist they say oh yeah I have electronic health record. However, in reality, they don't have a chair side record and everything that happens during the visit is actually still being done on paper.

KH: Going back to our discussion about specific adverse events, we had talked about infection control practices being something in the forefront for practitioners when they're doing this work. We talked about pain, but are there areas that you're seeing that are right for targeted improvement?

EK: Yes, we weren't really finding AEs around infections or aspiration, which all the dentists are worried about. Our biggest AE is pain. Then our next two or three big AEs are hard tissue damage, which is very specific to dentistry, and then soft tissue injury and nerve injury. Those are really our very specific AEs and they are very related to the fact that we are using a high speed drill or a very sharp scalpel in a very small area. So it's really very specific to hand skills or a sudden movement. For example, if we are taking out a tooth and take out the bottom of the sinus, we might call it a hard tissue damage because we have taken bone out. Soft tissue damage may be caused by drilling into the tongue or by cutting the cheek. Or if a patient accidentally bites on their lip, or something like that. These are all obviously very specific to dentistry.

KH: How do you bridge that disconnect between what dentists are expecting, or what they're concerned about, and the kind of events that are actually occurring and where they need to start working on interventions?

EK: Part of it I think is really about education. What you are afraid of and what is in reality happening are two different things. For being so afraid about asphyxiation or aspiration, dentists are doing a good job protecting patients. The biggest AE is pain and while pain may be normal, we need to change the perspective that focuses on ensuring our patients are in a manageable amount, not an enormous amount,

of pain. It's not that they shouldn't be afraid of the things that they think they should be, it's also that we need to focus on the actual AEs and knowing what those AEs are.

KH: In dental schools, are you doing patient safety education in terms of like talking about culture and quality improvement and measurement, and similar concepts that now trickle down into medical education.

MW: I think it depends. For example, at UTHealth during their first semester our dental students take a module on quality improvement and a module on patient safety in dentistry. They get exposed to our standards of care to measure quality, which are modeled on the six dimensions from the IOM. Then they have a rotation in their third and fourth years with our quality improvement coordinator. They get to see their own chart documentation completeness, they get their own quality measurements, we talk about root cause analyses. We're beginning to try to expose them to this area. I don't think we're there yet, but I think we're beginning to raise awareness. The other side of the equation is that you need to have calibrated faculty that talk the same language and I don't think we are there yet either. We have to work with the faculty and get them up to speed on these concepts too.

EK: I know when I was at Harvard, I taught a number of quality improvement and patient safety classes. But I would say at UCSF it has been far less successful in getting the education to all the students. I have trouble getting some traction, but I'm not giving up because the dental center/school is getting more integrated with the medical side. So, I believe that at some point we'll get there. Sometimes it just takes a long time.

KH: The link to Bob Wachter at UCSF is a great one to leverage for mentorship and learnings, similar to the link you made to Lucian Leape. I also think that that one of the things you're talking about is education. One of the bridges often between education and patient safety is the use of simulation. I'm just wondering if there are opportunities to use simulation or if you're already using it as means to introduce the concepts?

MW: On our side, we are beginning to do that. One of the things we learned from a culture survey we did was that the two areas that we were particularly weak in are communicating about error disclosure conversations with patients and then just open communication with the dental team. The good thing is that simulations are very integrated into the dentistry curriculum, but it is very procedural. There are some institutions that do simulations around how to communicate with patients, how to take history for instance. We are beginning to have at least practiced disclosure conversations in that simulated environment before the students get out onto the floor. The difference between medical and dental school that I learned when I came into the school is that the dentists are hands on from the second, third, fourth year with patients. They need to get up to speed really, really quickly, procedurally, cognitively, and you know all of these other side skills they need to have to communicate with their patients.

EK: I would say simulation is similar at Harvard. We do a ton of simulations from the first year, simulating how to take a medical history and how to have a difficult conversation.

KH: Is there anything that you would like to mention or talk about that we haven't discuss at this point.

EK: It's been a pleasure to have this conversation. We were really charged by Lucian Leape when we first started, he was the chair of our patient advisory committee and he's really the one who said if you want to do this then you know there are a number of things you need to do, and one of them is to promise that you will stick with it. I think we are making him very proud in doing that.