**SUPPLEMENTAL MATERIAL**

**Supplemental A. Screening Questions and Survey Questions**

**Box 1: Initial Screening Questions**

* Have you been to a dentist (by video call, phone, or in-person) for any reason since **January 2019**?
* Have you ever had dental symptoms or problems (like toothache, swelling, ulcer) that you feel your dentist was **not able to tell you why it started**?
* Have you ever felt that your **dentist made a mistake** with the diagnosis of your dental symptoms or problems?
* Has any dentist ever told you that your **previous dentist made a mistake** with the diagnosis of your dental symptoms or problems?
* Has there ever been a **delay in finding a diagnosis** for your dental symptoms or problems?
* Have you **visited multiple dentists** for the same dental symptoms or problems and received **different opinions** about the diagnosis?
* Have you ever **given up on finding a cause** for your dental symptoms or problems?

**Box 2: Initial Survey Questions**

* In your own words, briefly describe the dental symptoms or problems that you had at the time and what happened
* Do you believe that you ever got the correct diagnosis for your dental symptoms?
* What was the correct diagnosis?
* How long did it take for you to get the correct diagnosis?
* Why do you believe you never got the correct diagnosis?
* Did the mistake with identifying the correct diagnosis for your dental symptoms or problems cause you any harm?

**Supplemental B. Telephone Interview Guide**

Good [Morning/Afternoon/Evening], my name is [name] I’m a research assistant from the University of California, San Francisco. Am I speaking with [name]?

And am I pronouncing that okay?

I am following up after you recently completed our online survey about improving dental diagnosis. You noted on that survey that you might be willing to talk with us about your past dental experience. Are you still interested, and is this a good time to talk?

* If not: What is a good day and time for me to call again?
* Call tomorrow

Sounds good. Now [Name], we will be recording the audio of these interviews. I have to ask you--can you give me permission to begin recording the audio for this interview?

Thank you. I have started recording. Before we get to the questions, I am required to share a short informed consent statement with you.

Were you able to read over the consent document we sent to your email? No problem at all if you didn’t.

* If they did not: That’s completely all right. I do have to then read the following statement for you. I will give you some time after I finish to consider everything I said. Is that all right?

**Consent Statement**

The purpose of this interview is to better understand the quality of diagnosis in dentistry from the perspective of patients, in order to create policies and tools to avoid diagnostic errors.

Your participation is completely voluntary. You do not have to participate in this interview unless you want to. If you decide at any point that you do not want to participate anymore, you can withdraw your consent, just say so, and we will cancel or stop the interview right there. We will be asking you to recall some of your experiences, and that can be emotionally difficult. If you ever want to take a break or want to stop, again, please let me know anytime.

The only risk to you might be if your identity were ever revealed. Of course, we don’t want that to happen either. We will record the audio of the interview, then translate the audio recording into written transcripts that we can analyze. Any personal or identifiable information (names, places, organizations) will be removed from the interview transcripts. Both the transcripts we make from these recordings and the recordings themselves will be kept in a password-protected, secure location. If you are uncomfortable answering a question for fear that you may be identified by the response, please tell me that you would like to skip that question and we will move on to the next one. You can make up names or not mention any names. You yourself can ask me to call you by another name. The only people with full access to the information you provide will be [name], the research assistant, and Dr. Eni Obadan-Udoh, the lead researcher. Besides ourselves, authorized representatives from the University of California and the Robert Wood Johnson Foundation may review research data from this interview to monitor the conduct of this study, but they would only be able to access versions with all of that identifying and personal information completely removed.

The interview is expected to take around 20 to 30 minutes. There are four sections with their own questions. After this interview, we will send an Amazon gift card to your email worth $10. There are no other benefits associated with participating in this study, but what we learn from you, together with the stories of the other interviewees, may help efforts to prevent mistakes in dentistry from happening to others.

If you have any questions after today, you can contact myself or Dr. Eni Obadan-Udoh at [DDFstudy@ucsf.edu](mailto:DDFstudy@ucsf.edu) or at this phone number, 415-799-1217‬.

That was a lot, please take a little time right now. Whenever you’re feeling good, let me know if you would like to proceed, or if you have any questions.

Thank you. Well, let’s get started!

**Section 1: Personal Experience**

We are defining diagnosis as the act of identifying a disease from its signs and symptoms. For us, an example of diagnosis might be, like when a patient complains of a tooth ache to a dentist, and then the dentist tells them that the reason for that tooth ache is because they have a cavity or if someone experiences bleeding while brushing, the dentist may tell them they have gingivitis.

Based on this description,

Do you believe that you have experienced an error in diagnosis made by a dentist?

Probes

* Can you tell me more about your experience and why you believe you may have experienced a diagnostic error?
* Could you tell me what happened, starting from the time you realized something wasn’t right?

[Take note of the following as the patient describes the scenario]

1. Presenting symptom(s): What symptoms did you or your dentist notice at the beginning?
   1. Can you describe your symptoms in a little more detail?
2. Initial diagnosis: what did the dentist say was your initial diagnosis?
   1. How did they define your condition for you?
   2. What did they say was the reason for the [insert what patient called the symptom]
3. Initial treatment: What treatment did your dentist perform?
   1. If none, did the dentist say that you needed a specific treatment or procedure?
4. Tests/X-rays performed, if any: Did you have any tests or x-rays performed?
   1. If yes, What were the findings of those tests?
   2. Can you describe how the test was carried out?
   3. If no, did they mention that you would need any tests/additional tests?
5. Subsequent treatment or diagnosis, if any: After that initial diagnosis and initial treatment, were there any other diagnoses and treatments made at a later point? New treatments might indicate new diagnoses or new tests.
   1. Why did they change the treatment?
6. How long ago did this error happen?
7. When was the error was detected? (after how many visits, time duration)
   1. At what point did you notice that something was not right with the initial explanation for your symptoms?
   2. How long was it between treatments?
8. Who detected the error? (same provider, another provider, patient)
   1. Who noticed that something wasn’t right?
9. How was the error detected?
   1. How did you notice that something wasn’t right with the initial diagnosis or treatment that you received?
10. Correct/Final diagnosis: What was the final diagnosis? How did you know that this was the right/correct diagnosis/explanation for your symptoms?
11. Consequences of the mistake/follow-up treatment: Were there any consequences of the initial mistake, or the tests and treatments ordered because of the mistake?

Thank you very much for sharing that story with me. This next section of questions I will ask you are about trying to better understand what might have caused the error, from your perspective.

Section 2: Contributory Factors

* Can you describe anything that might have influenced or helped cause the diagnostic error/mistake at the beginning?

[Probe for each of these factors if not given]. Why do you think it happened?

1. Clinician-related: Did you notice anything about the dentist or the staff that might have contributed to making an error?

* Who do you believe made/ caused the error?
* How was the clinic environment?
* What was their attitude of the providers/staff? How did they act?
* Were you familiar with your dentist or dental staff?

1. Environment-related: Was there anything about the dental office environment that might have contributed to the mistake?
2. System-related: Was there anything about their clinic policies, rules, or system that might have contributed to a diagnostic mistake? What about issue related to your dental insurance?

* Are there any clinic policies that may have contributed to this experience?

1. Patient-related: When you look back, is there anything that you yourself would have done differently? Was there any reason that you can think of why this mistake happened that are specific to you?

* How much did you know about this condition prior to this experience?
* Did you explain all your symptoms to the dentist at the first visit?
* Did your insurance coverage limit the treatment options?
* Patient demographics (age, sex, race/ethnicity, oral health literacy, language barriers)?

1. No-fault: In your opinion, is there a chance that no one has any fault for what happened, or not?
   1. Is there a chance that it was a random error that couldn’t have been prevented?
   2. Would this mistake have happened no matter what?
   3. Do you believe anyone or anything might have had some fault or responsibility?

* No fault, anatomical variation?
* In your opinion, was what happened to you a preventable thing, or not? Was this event preventable?
  1. Follow-up if needs some explanation: Why do you say so?

Thank you for all of those details. The third section of questions is still thinking about [diagnostic errors] and focuses on the impact of the diagnosis error on you.

Section 3: Impact

* How did this experience impact you or parts of your life? In any way.

[Probe for each of these factors if not given]

1. Oral health status: Did this affect your oral health in any way?

* Did you need additional services (extra fillings, crowns, bridges, implants, tooth loss, surgery or other invasive procedure, hospitalization, emergency room, medications)?

1. Daily living: speaking, eating, sleeping?: Did this affect how you did things every day or your lifestyle in any way?
2. Cost: Out of pocket payment, time off work, job/income loss, loss of productivity, time wasted?: Did this impact your financial situation in any way?
3. Dental care-seeking behavior: Since this happened, has this impacted your decision or family members decision to have/seek dental care?
4. Mental health: Were there any effects on your emotional health or your psychological health? Were there any emotional or psychological consequences that happened because of this mistake?
5. Perception of dentists/dental care system: Has your opinion of dentists or the dental care system been affected by this experience? How so?

* How do you feel about dentists?
* How has this affected your opinion of dentists?
* Do all dentists make mistakes?
* Are all dentists bad people?
* Motivated by money/profit?

1. Have there been any positive impacts of this experience?

Got it. We can move on to the last section of questions.

Section 4: Miscellaneous

* Apart from sharing this experience with us (the research team), did you share this experience with anyone else?

Probes:

* If no, why not?

Potential follow-up: how did they react?

Potential follow-up: did you end up going back and talking with the first dentist (dentist who made the mistake)

* Would you have wanted a way to document or report this experience?

Probes:

* Would you have liked [dentist] to know what happened in the end?
* If you could go back to the time after the dentist made the error in their diagnosis, what action would you have liked to see happen, if any?
* How would you have liked to see this incident handled?
* Would you have wanted to have some avenue to report this incident?
* Would you have liked an opportunity to inform the dentist or an official organization of the mistake?
* If yes: What would be your ideal way to document or report this experience? What would be your ideal documentation/reporting system?
* What recommendations do you have to prevent this from happening to other patients? It can be recommendations for patients / dentists / or anyone you think is important?

Probes:

* What are the opportunities for improvement?
* How/what can we learn from your experience?
* Is there anything else about this experience that you would like to share with us?

Closing

Thank you very much time and your story. We really appreciate it, I really appreciate it.

We will get that [$10 Amazon gift card] to you [ ]

* Potential: Would you prefer a gift card to somewhere else (Target, Wal-Mart)

Thank you again. I hope you have a great rest of your day!

**Supplemental C.** Codes and Sub-codes for Patient Interviews

1. **Patient Experience Domain**

|  |  |  |
| --- | --- | --- |
| **THEME** | **CODES** | **SUBCODES** |
| Clinical Presentation | Patient Symptoms | Swollen/inflamed/tender gums |
|  |  | Toothache/pain within oral cavity |
|  |  | Facial pain (outside of oral cavity) |
|  |  | Facial swelling |
|  |  | Loose tooth/teeth |
|  |  | Chipped/cracked tooth |
|  |  | Bleeding within oral cavity |
|  |  | Lost tooth/teeth |
|  |  | Tooth discoloration |
|  |  | Tooth sensitivity |
|  |  | Asymptomatic |
|  |  |  |
| Initial Diagnosis and Treatment | Initial Diagnosis | Dental abscess/infection |
|  |  | Caries |
|  |  | Gingivitis/periodontal disease |
|  |  | Pulp necrosis |
|  |  | Aggressive teeth brushing trauma |
|  |  | Chipped/cracked tooth |
|  |  | Psychogenic pain |
|  |  | None given |
|  |  | No pathology/disease |
|  |  |  |
|  | Initial Tests Performed | X-rays |
|  |  | CBCT |
|  |  | Thermal pulp test |
|  |  | Percussion test |
|  |  | CAT scan/MRI |
|  |  |  |
|  | Initial Treatment Provided | Dental filling |
|  |  | New medication (or adjustment to former medication regimen) |
|  |  | Deep dental cleaning |
|  |  | Root canal |
|  |  | Prescribed improvement in oral hygiene |
|  |  | Dental crown |
|  |  | Tooth extraction |
|  |  | Diet alterations |
|  |  | Therapeutic mouthwash |
|  |  | Therapeutic toothpaste |
|  |  | Silver point removal |
|  |  | Referral to dental specialist |
|  |  | Referral to medical specialist |
|  |  |  |
|  | Duration of DE | 1 day - 1 week |
|  |  | >1 week – 1 month |
|  |  | >1 month – 6 months |
|  |  | >6 months – 1 year |
|  |  | >1 year – 5 years |
|  |  | >5 years |
|  |  |  |
| Sequalae | Sequalae | Prolonged suffering |
|  |  | Disease progression |
|  |  | Development of new symptoms/comorbidities |
|  |  | 2 or more referrals/second opinions |
|  |  | Subsequent diagnostic errors |
|  |  | Palliative treatment |
|  |  | Delayed care/treatment |
|  |  | Self-medicated |
|  |  |  |
|  |  |  |
| Correct Diagnosis | Correct Diagnosis | Unresolved/ no definitive diagnosis |
|  |  | Pulp necrosis |
|  |  | Dental abscess |
|  |  | Periodontal/gum disease |
|  |  | No pathology/disease |
|  |  | Caries/decay under filling |
|  |  | Cracked/chipped/fractured tooth |
|  |  | Failed endo treatment |
|  |  | Failed implant/failed partials |
|  |  | Impacted molar/tooth crowding |
|  |  | Maxillary sinusitis |
|  |  | Soft tissue inflammation/infection |
|  |  | Trigeminal neuralgia |
|  |  | Anatomical trait/unique variation |
|  |  |  |
|  | Tests That Led to Correct Diagnosis | X-rays |
|  |  | Patient history/clinical exam |
|  |  | Pulp test |
|  |  | CBCT |
|  |  |  |
|  | Healthcare Professional Who Determined Correct Diagnosis | General dentist (other than dentist who made DE) |
|  |  | Endodontist |
|  |  | Oral surgeon |
|  |  | Dental student/resident |
|  |  | Dentist who made DE |
|  |  | Dental hygienist |
|  |  | Medical physician (MD) |
|  |  | Periodontist |
|  |  |  |
|  | Correct Treatment Provided | Root canal |
|  |  | New medication (or adjustment to former medication regimen) |
|  |  | Tooth crown/cap |
|  |  | Tooth/implant extraction |
|  |  | Bone graft/periodontal surgery |
|  |  | Dentures/protheses |
|  |  | Implant |
|  |  | Prescribed improvement in oral hygiene |
|  |  | Quadrant surgery |
|  |  | Therapeutic mouthwash/toothpaste |
|  |  |  |
| Non-Diagnostic Error | Concurrent Treatment Error | Treatment error |
|  |  |  |

1. **Contributory Factors Domain**

|  |  |  |
| --- | --- | --- |
| **THEME** | **CODES** | **SUBCODES** |
| Clinical Influence | Poor communication |  |
|  | Inadequate time with patient |  |
|  | Financial incentives |  |
|  | Inadequate knowledge |  |
|  | Inexperience |  |
|  | High patient volume |  |
|  | Failure to refer to outside practice |  |
|  | Age-related (too young or too old) |  |
|  | Outdated practices/methods |  |
|  | Overreliance on heuristics |  |
|  | Poor adherence to practice standards |  |
|  | Provider bias |  |
|  |  |  |
| Patient Influences | Lack of self-advocacy |  |
|  | Poor choice of provider/clinic |  |
|  | Lack of dental health literacy |  |
|  | Failure to follow-up in timely manner |  |
|  | Failure to seek second opinion |  |
|  | Failure to check dentist’s credentials/reviews |  |
|  | Patient-doctor relationship complication |  |
|  | Poor oral hygiene |  |
|  |  |  |
| System Influences | Insurance challenges |  |
|  | Scheduling challenges |  |
|  | Outdated or inappropriate equipment |  |
|  | Dental practice quotas |  |
|  | Dependence on outside labs |  |
|  | High staff turnover and/or understaffed |  |
|  | Lack of dental trainee support (dental students/residents) |  |
|  | COVID-related limitations |  |
|  | Overcrowded space |  |
|  | Poor access to resources/financial constraints |  |
|  |  |  |
| Fault Attribution | Fault Attribution | Patient |
|  |  | Dentist who made DE |
|  |  | Dentist other than one who made DE |
|  |  | No-fault error |
|  |  |  |
| DE Prevention | DE Prevention | Yes |
|  |  | No |
|  |  | Unsure |
|  |  |  |
|  |  |  |
|  |  |  |

1. **DDF Impact Domain**

|  |  |  |
| --- | --- | --- |
| **THEME** | **CODES** | **SUBCODES** |
| Care-Seeking Behavior | Care-Seeking Behavior | More cautious when selecting a dentist |
|  |  | Desire to change primary dentist |
|  |  | Improved care-seeking behavior of family and friends |
|  |  | Increased self-advocacy |
|  |  | Improved compliance with regular preventative dental care/cleanings |
|  |  | Improved dental health literacy |
|  |  | Less likely to seek dental care |
|  |  | More likely to seek dental care from larger/academic institutions |
|  |  | More willing to seek second opinions in the future |
|  |  |  |
| Financial Implications | Financial Stress |  |
|  | Job Loss/Decreased Productivity |  |
|  | Required Additional Services |  |
|  |  |  |
| Quality of Life | Negative Impact on Activities of Daily Living (ADL) |  |
|  | Increased Emotional Distress/Mental Health Challenges |  |
|  | Development of Additional Health Comorbidities |  |
|  | Improved Oral Hygiene |  |
|  |  |  |
| Perceptions | Positive Perceptions of Dentists |  |
|  | Negative Perception of Dentists |  |

1. **Strategies to Reduce DDFs Domain**

|  |  |  |
| --- | --- | --- |
| **THEME** | **CODES** | **SUBCODES** |
| Community Awareness and Reporting | Sharing Story of DE | Family, friends, and coworkers |
|  |  | Dentist responsible for DE |
|  |  | Dentist who detected DE |
|  |  | Social media/online/published media |
|  |  | Dental office staff members (other than dentist) |
|  |  |  |
|  | Desire to Report | Yes |
|  |  | No |
|  |  |  |
|  | Preferred Reporting Method | Dental office responsible for DE |
|  |  | State Dental Board/ADA/PHSA/ Department of Labor |
|  |  | Online Reviews/forums/apps |
|  |  | Patient Record Documentation |
|  |  | Formal lawsuit |
|  |  | Dental schools/training institutions |
|  |  | Insurance companies |
|  |  | Research studies on DE |
|  |  |  |
| Advice for Patients | Practice self-advocacy |  |
|  | Rely on reviews and references when choosing a dentist |  |
|  | Improve your dental health literacy |  |
|  | Practice caution/seek out second opinions |  |
|  | Practice preventative dental care/good oral hygiene |  |
|  | Report DE when they occur |  |
|  | Spread awareness by sharing your DE story |  |
|  | Consider receiving care from academic institutions/ larger institutions |  |
|  | Be mindful of financial incentives dental offices may benefit from |  |
|  | Avoid procrastination with seeking dental care |  |
|  |  |  |
| Advice for Dentists | Practice good chair-side manners |  |
|  | Provide a detailed diagnostic work-up |  |
|  | Uphold ethical, evidence-based practices |  |
|  | Demonstrate self-awareness of limitations/know when to refer |  |
|  | Maintain an organized dental practice |  |
|  | Provide adequate patient education |  |
|  | Practice and encourage more preventative measures |  |