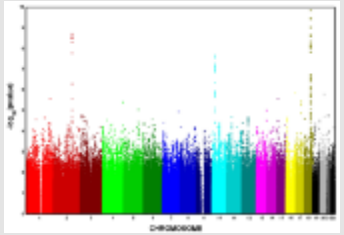
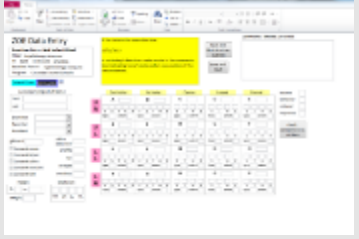





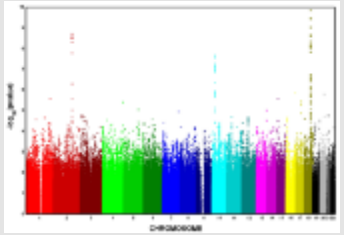
# Understanding Early Childhood Oral Health *via* a Pediatric Precision Health Cohort

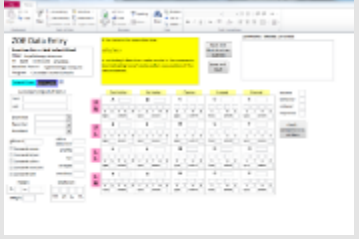
**Kimon Divaris**

Departments of Pediatric Dentistry, School of Dentistry & Epidemiology, Gillings School of Global Public Health, University of North Carolina-Chapel Hill

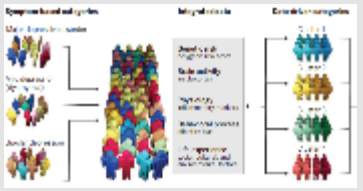
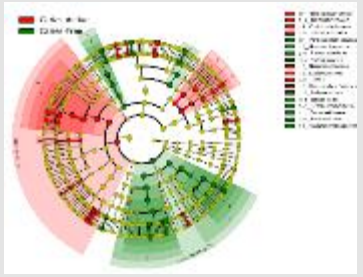
Kimon_Divaris@unc.edu

Supported by NIH/NIDCR U01-DE025046

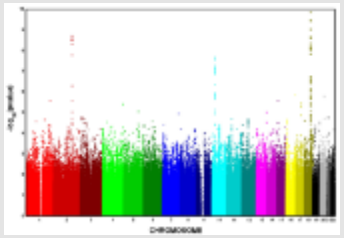



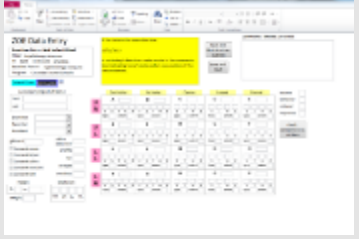


1. Early childhood oral health
2. The ZOE 2.0 study
3. Lessons and early findings
4. What next







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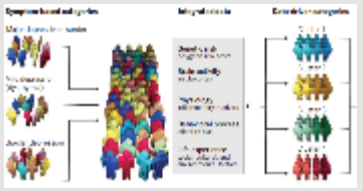
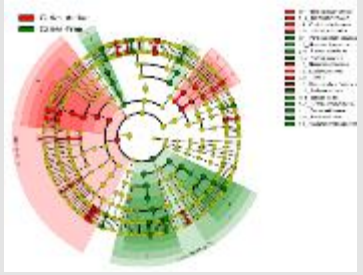
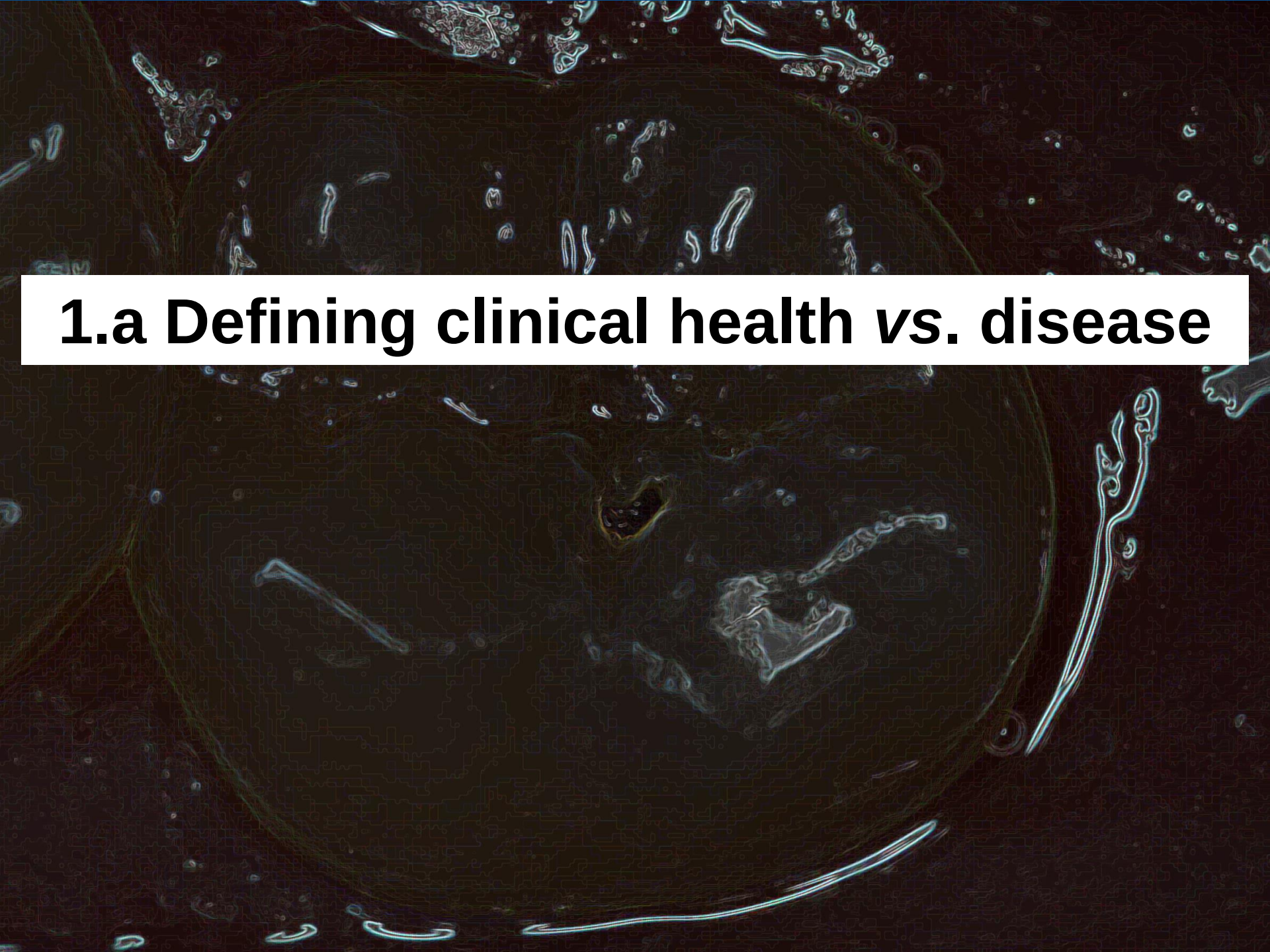



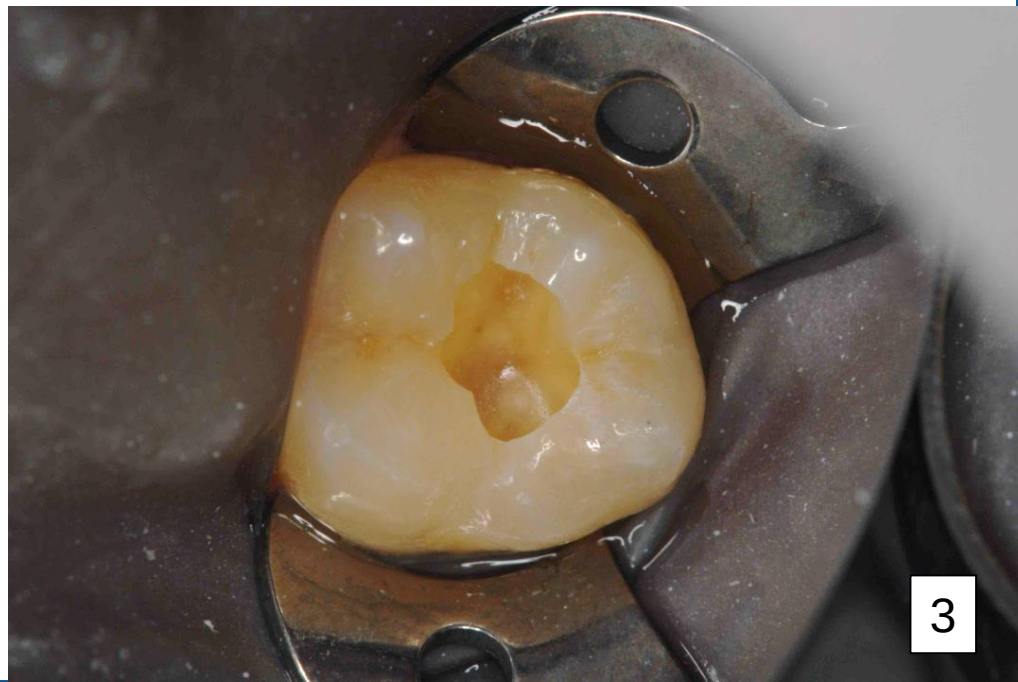



# 1.a Defining clinical health *vs*. disease


1


2


4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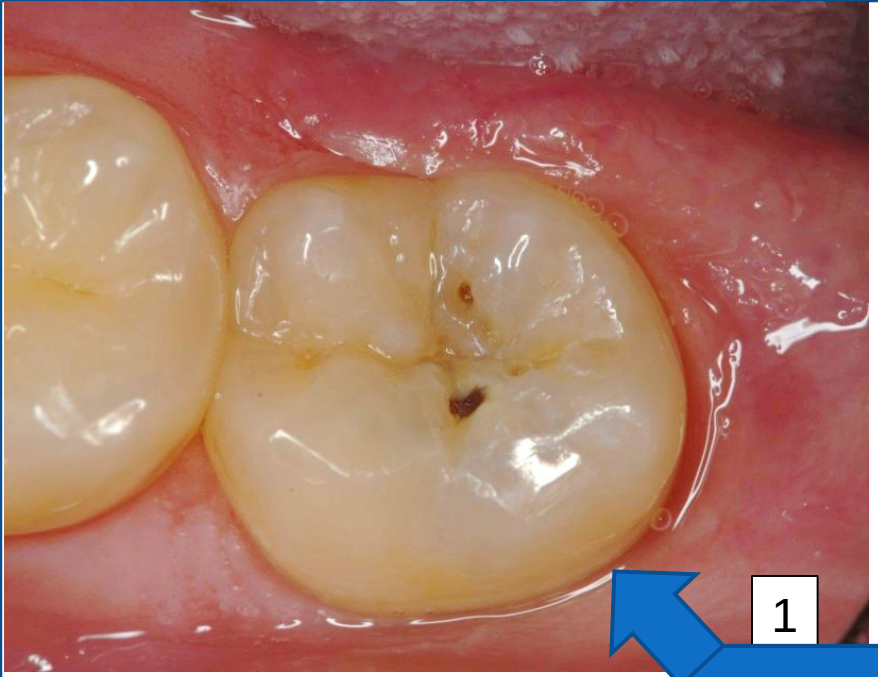
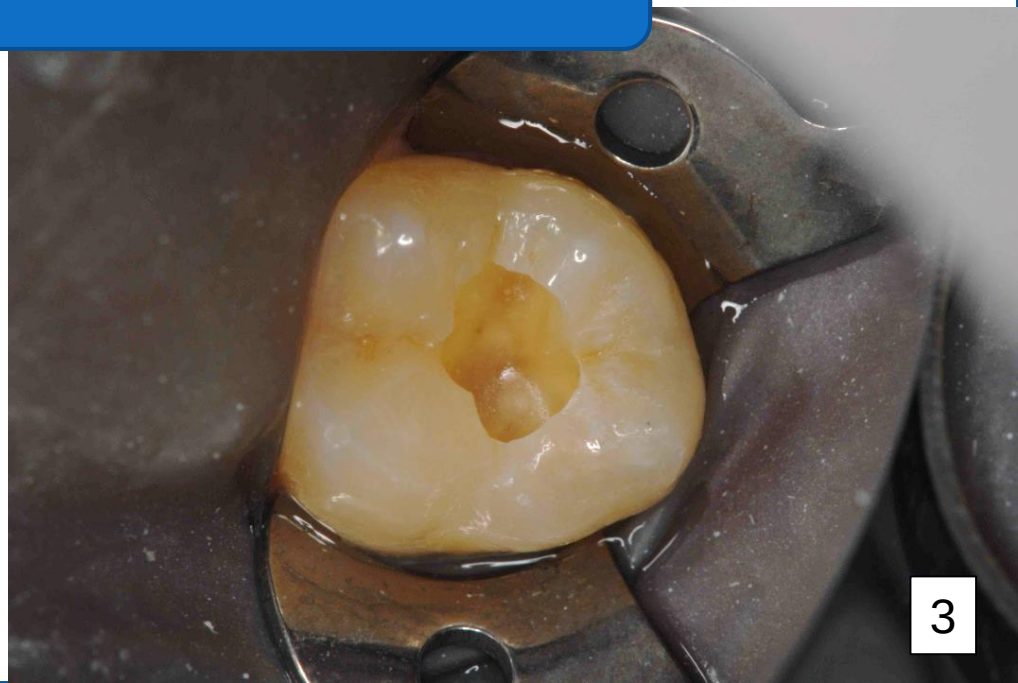
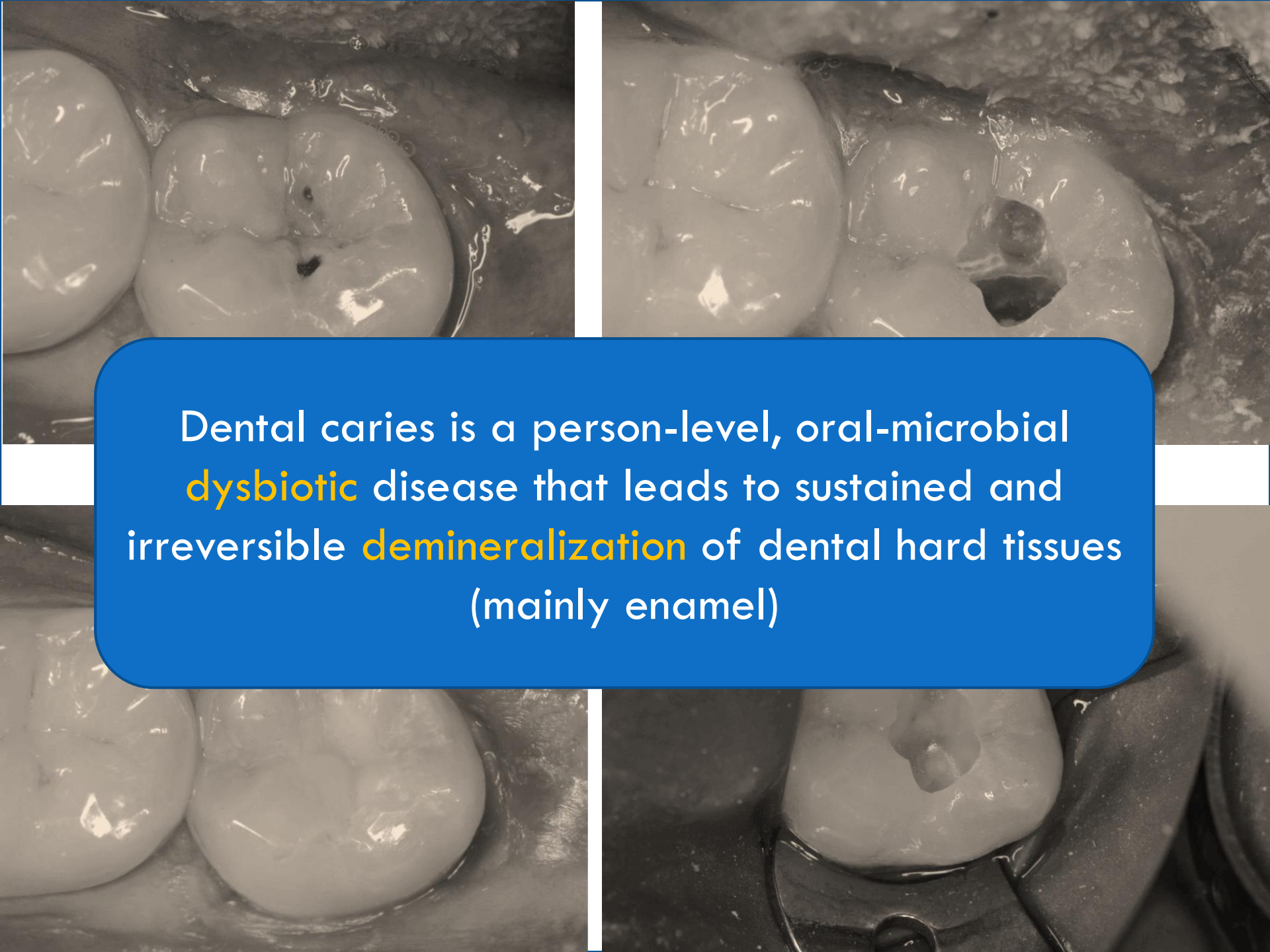


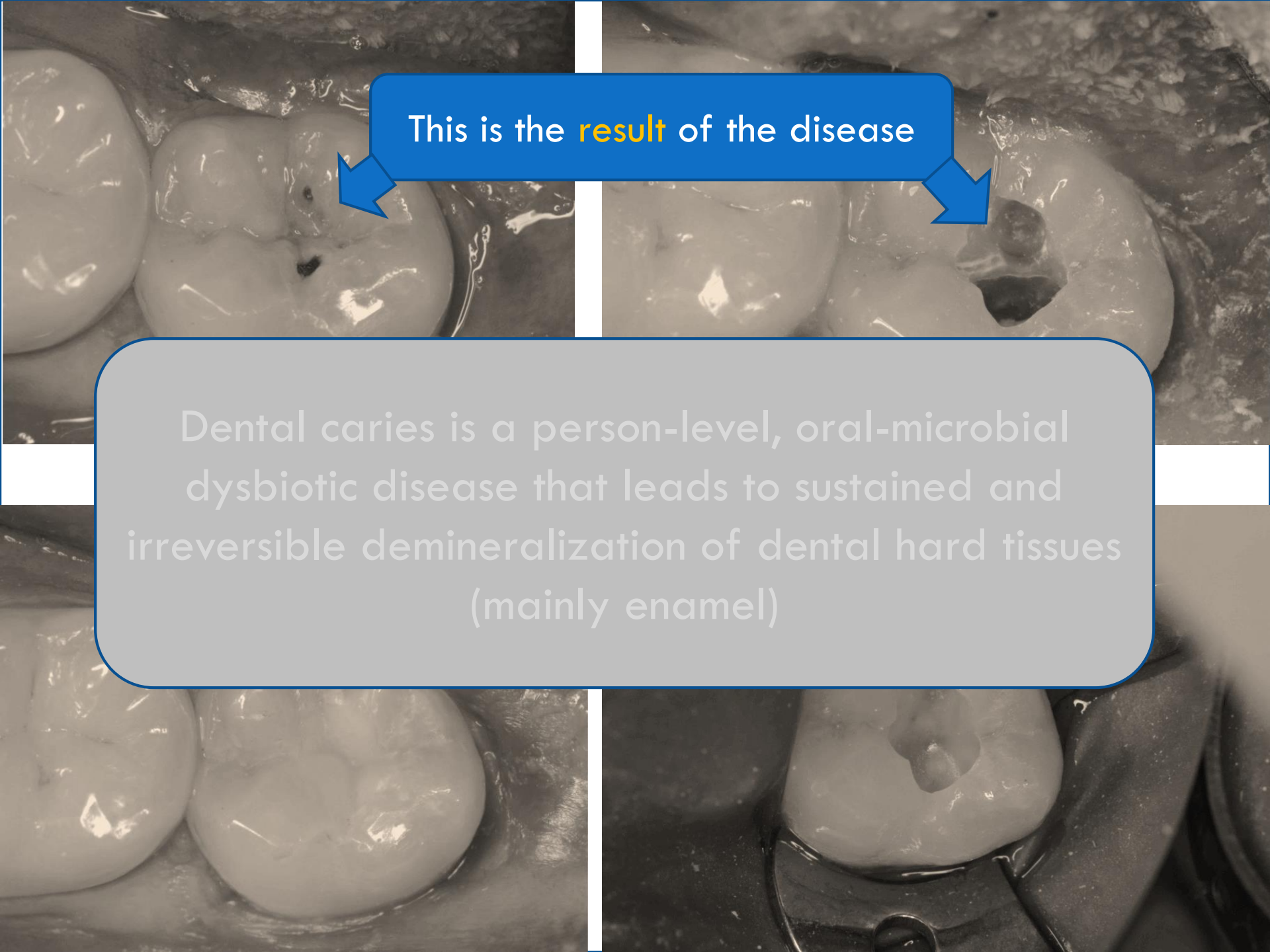


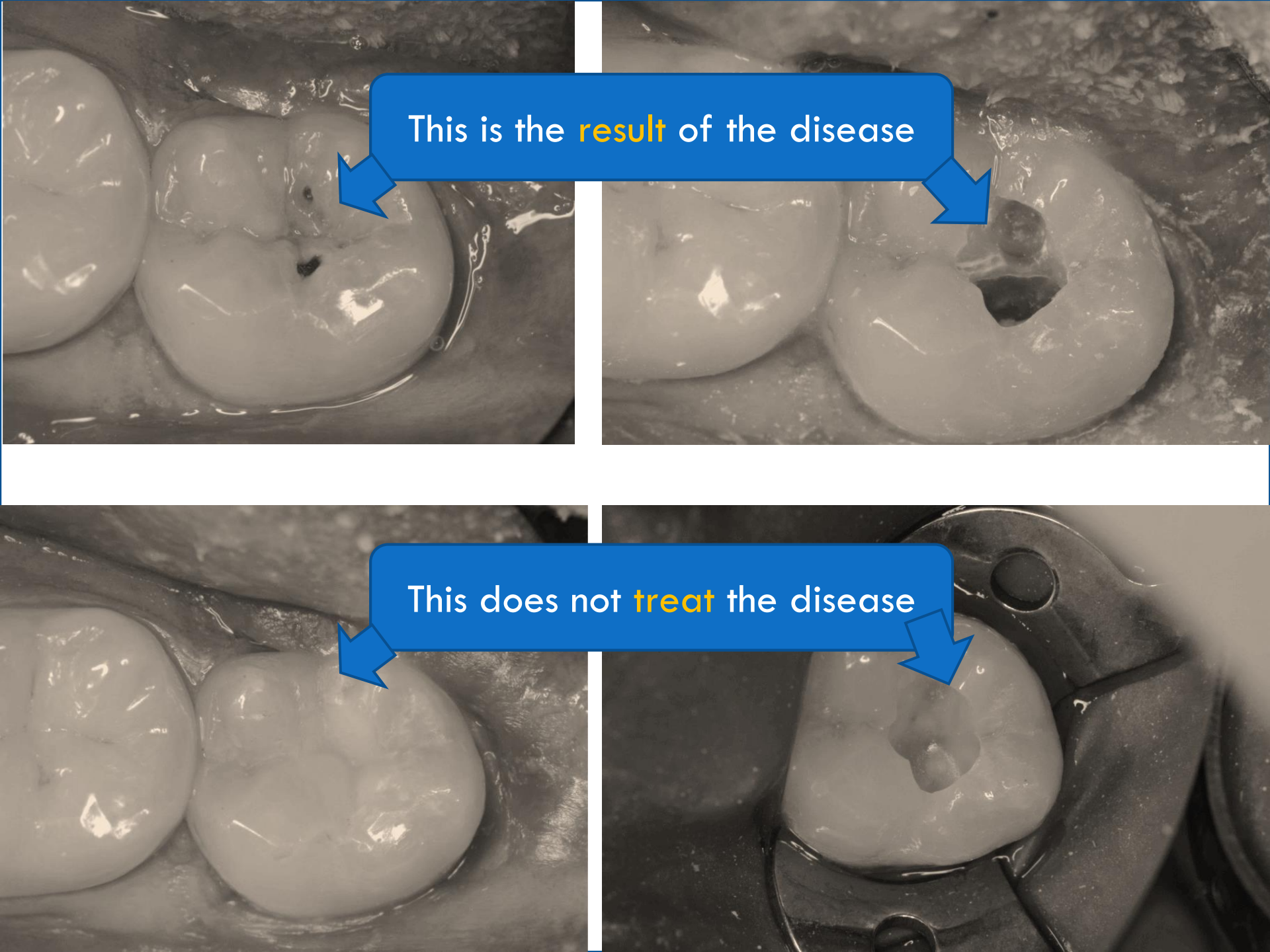
Have we treated the disease?



Dental caries is a person-level, oral-microbial dysbiotic disease that leads to sustained and irreversible demineralization of dental hard tissues (mainly enamel)


This is the result of the disease
Dental caries is a person-level, oral-microbial dysbiotic disease that leads to sustained and irreversible demineralization of dental hard tissues (mainly enamel)


This is the result of the disease
This does not treat the disease

# Dental caries: the *disease*



branes, and but the sequel of the case—the secondary, but not the primary, cause of death. The emaciation and previous history alone remain to guide us; and we are, therefore, forced to the conclusion that it was a case of malnutrition, or, in common parlance, chronic starvation.

---

## WHY DENTAL CARIES IS SO GENERAL, AND HOW TO PREVENT IT.*

By ALEXANDER STEWART, F.R.C.S.Ed.

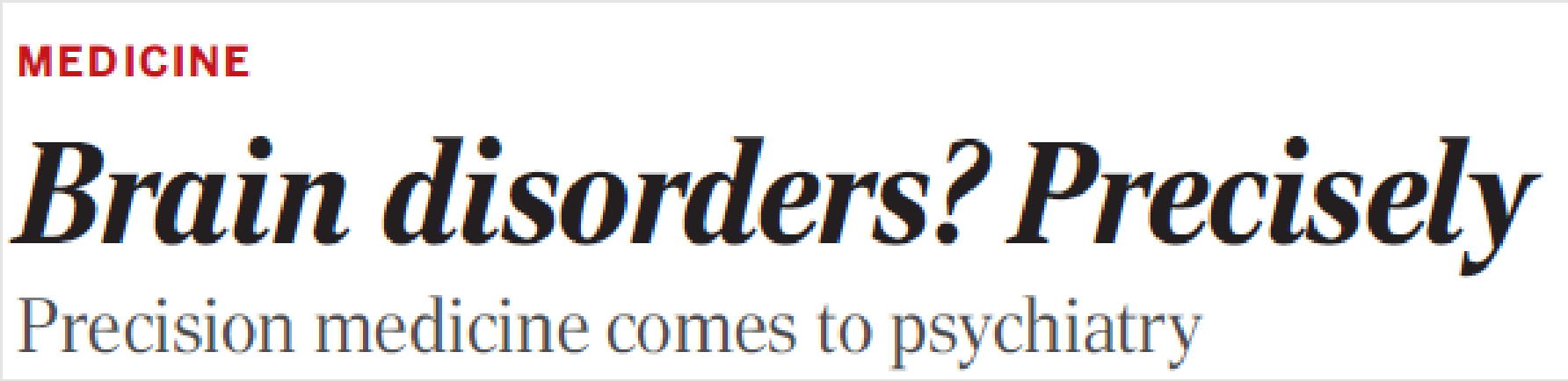
I HAVE endeavoured in this short paper to show that dental caries has but one proximate cause, and can be largely, if not altogether, prevented by means so readily available that they would no doubt come into general use if generally known; and, as the condition of the teeth now enters, or ought to enter, into the consideration of every case of chronic constitutional disease, the general prevention of dental caries is obviously a subject of great practical importance. It should, I think, find a place in every medical text-book; as dental works are not in the hands of the profession generally, and treating fully the cure of dental caries by operative means, they give scant space to its prevention. Further, its operative cure being delegated by them to dental practitioners concerns medical men but little, whereas its prevention as a matter of hygiene concerns them greatly.

Stewart, *BMJ*, 1877

# The fundamentals of *precision* health (care)

## 1.b Dissecting heterogeneity - *precisely*

# The fundamentals of *precision* health (care)

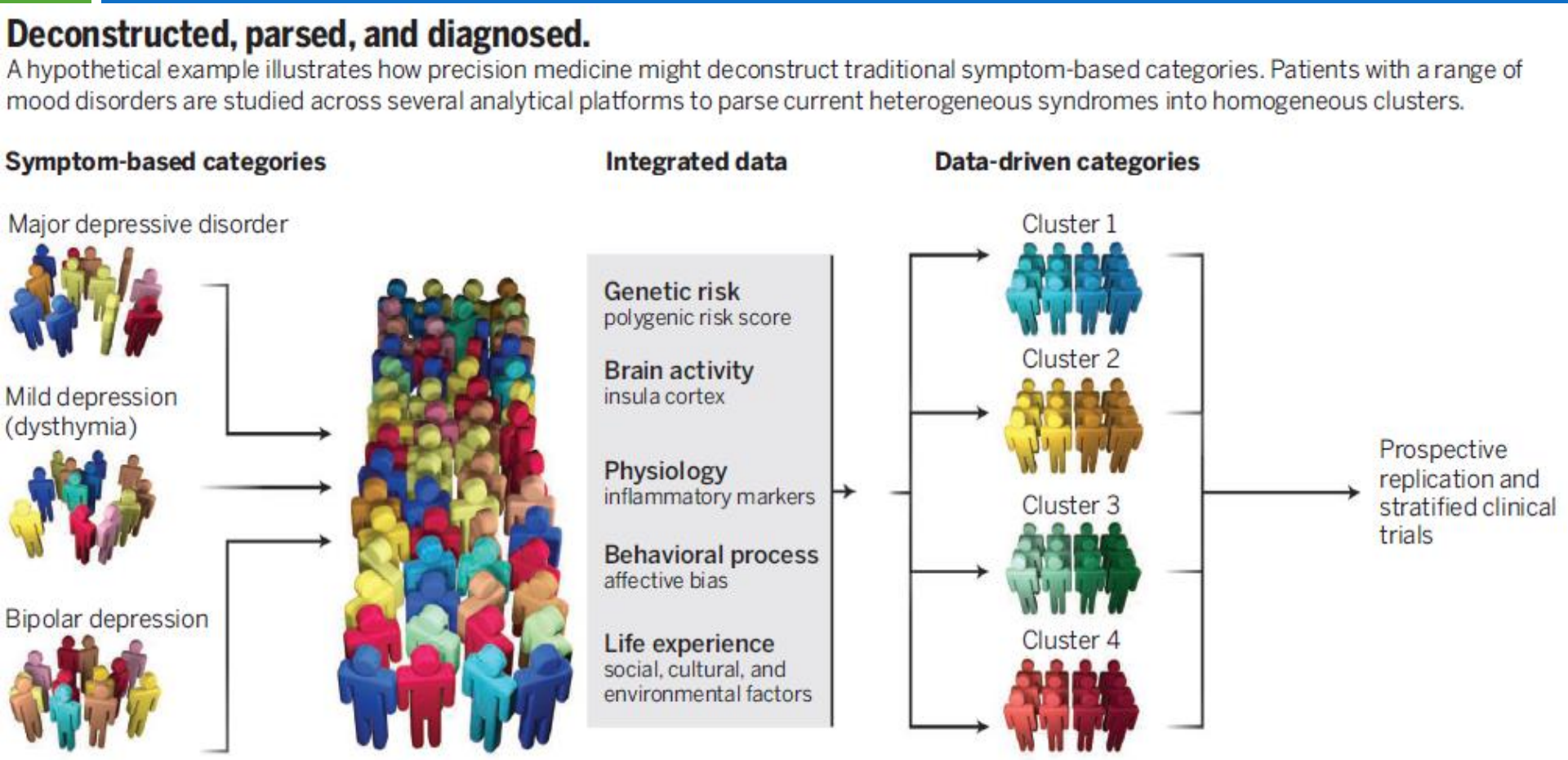

MEDICINE

**Brain disorders? Precisely**

Precision medicine comes to psychiatry

Insel TR, Cuthbert BN. Medicine. Brain disorders? Precisely. *Science*. 2015 May 1;348(6234):499-500.

# The fundamentals of *precision* health (care)

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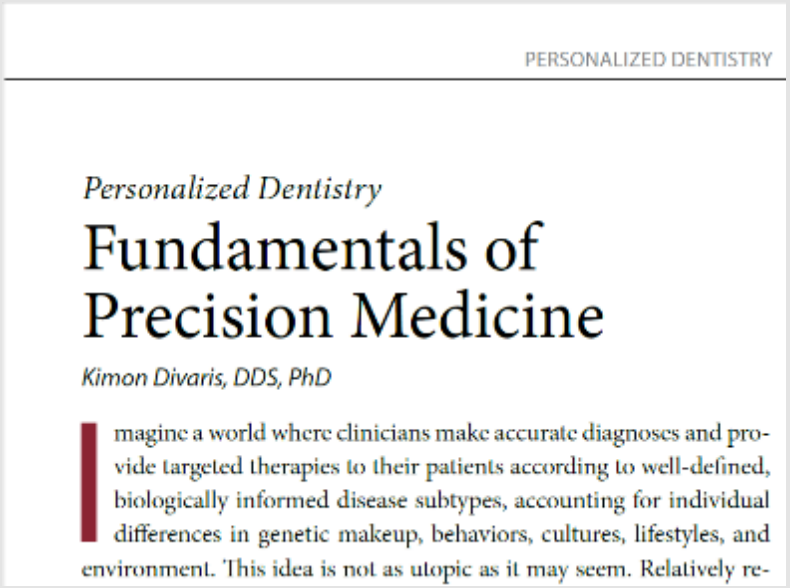
# The fundamentals of *precision* health (care)



PERSONALIZED DENTISTRY

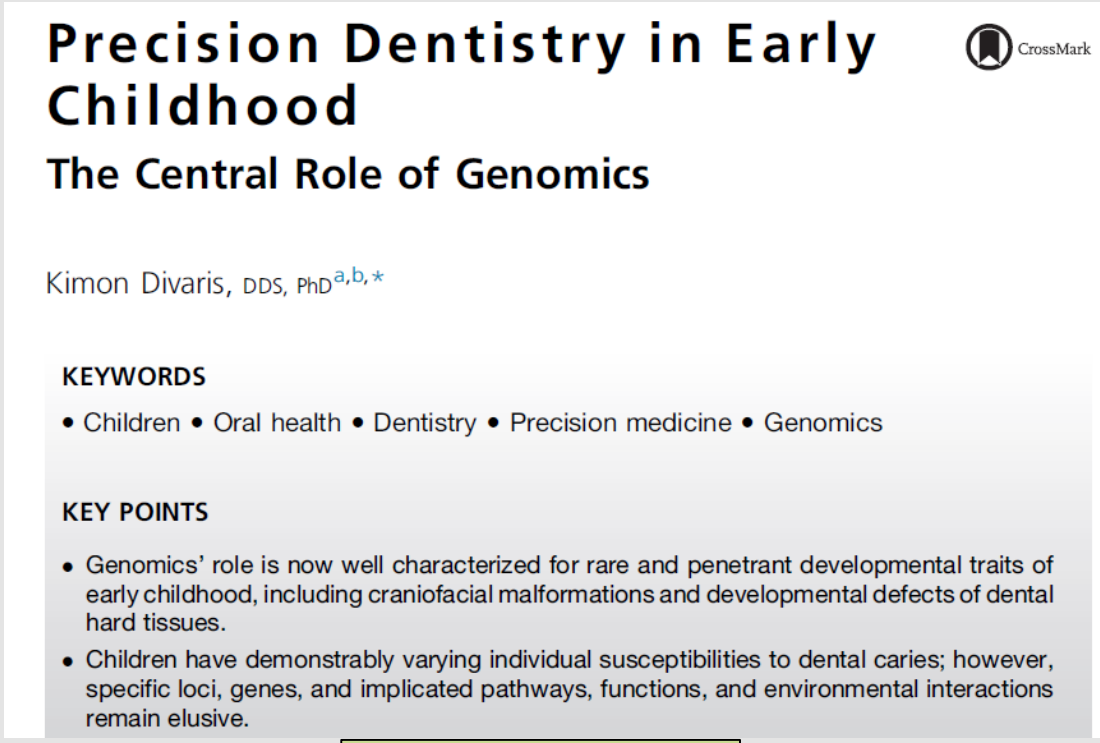
*Personalized Dentistry*

## Fundamentals of Precision Medicine

*Kimon Divaris, DDS, PhD*

Imagine a world where clinicians make accurate diagnoses and provide targeted therapies to their patients according to well-defined, biologically informed disease subtypes, accounting for individual differences in genetic makeup, behaviors, cultures, lifestyles, and environment. This idea is not as utopic as it may seem. Relatively re-

PMID: 29227115



## Precision Dentistry in Early Childhood

### The Central Role of Genomics

Kimon Divaris, DDS, PhD[a,b,*]

**KEYWORDS**

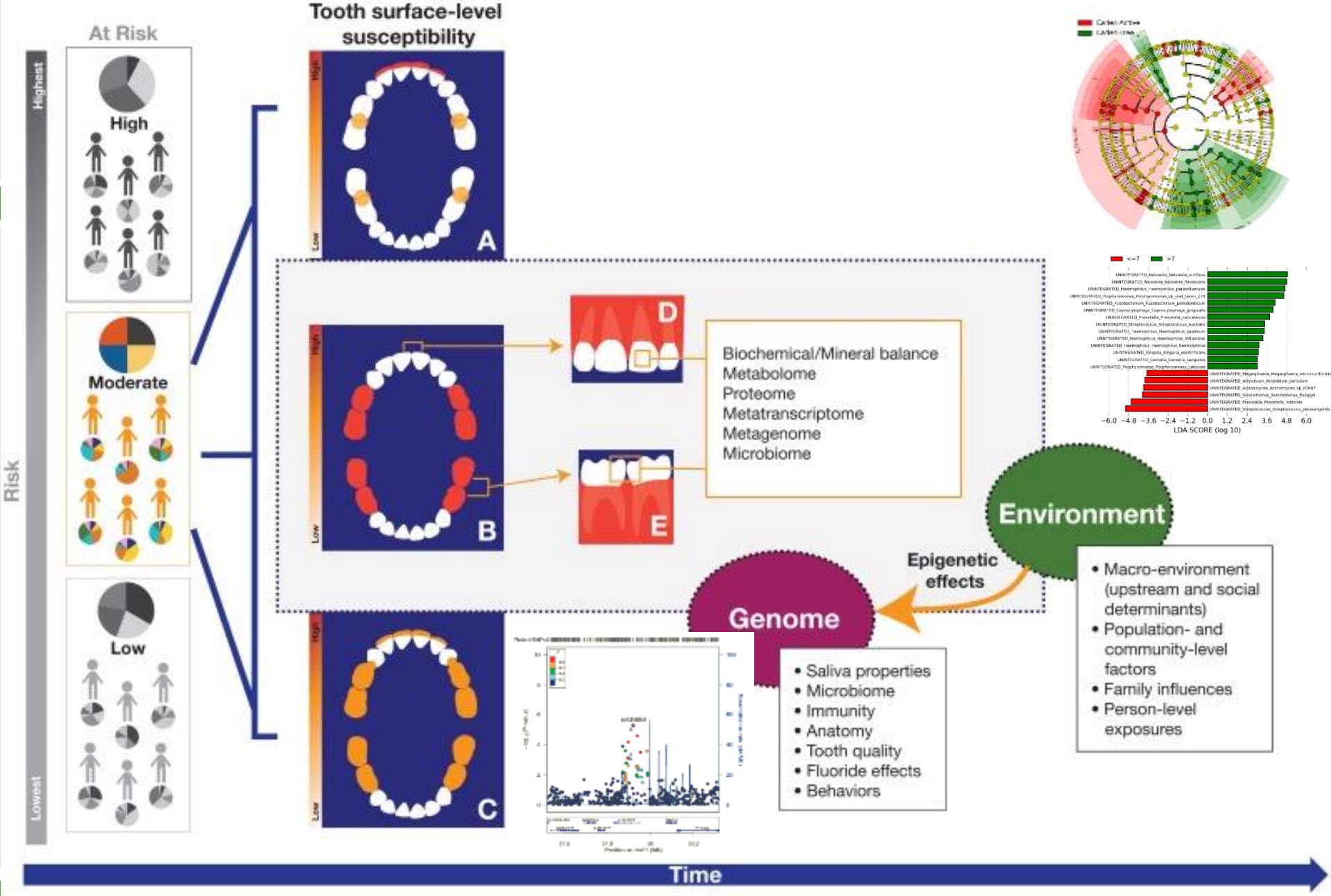
• Children • Oral health • Dentistry • Precision medicine • Genomics

**KEY POINTS**

- Genomics' role is now well characterized for rare and penetrant developmental traits of early childhood, including craniofacial malformations and developmental defects of dental hard tissues.
- Children have demonstrably varying individual susceptibilities to dental caries; however, specific loci, genes, and implicated pathways, functions, and environmental interactions remain elusive.

PMID: 28577641

Divaris K. Fundamentals of Precision Medicine. *Compend Contin Educ Dent*. 2017 Sep;38(8 Suppl):30-32.
Divaris K. Precision Dentistry in Early Childhood: The Central Role of Genomics. *Dent Clin North Am*. 2017 Jul;61(3):619-625.




Divaris K. Predicting Dental Caries Outcomes in Children: A "Risky" Concept. *J Dent Res* 2016 Mar;95(3):248-54.

# The overwhelming influence of upstream factors


## 1.c The social determinants of health

PMID: 24189268

Lee JY, Divaris K. The ethical imperative of addressing oral health disparities: a unifying framework. *J Dent Res*. 2014 Mar;93(3):224-30.

# The overwhelming influence of upstream factors

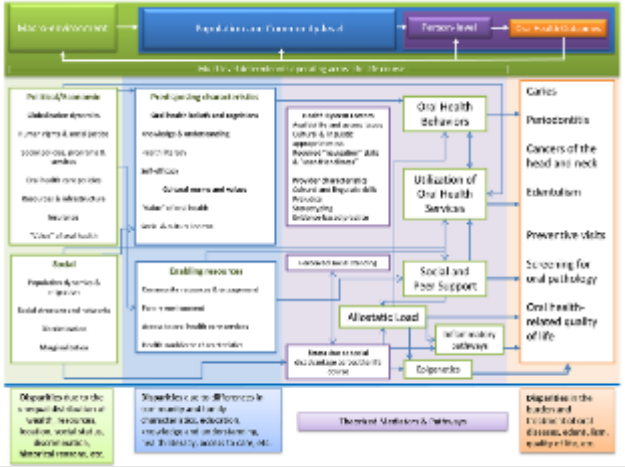
CRITICAL REVIEWS IN ORAL BIOLOGY & MEDICINE

J.Y. Lee* and K. Divaris

The University of North Carolina at Chapel Hill - Department of Pediatric Dentistry, 228 Brauer Hall, Chapel Hill, North Carolina 27599, USA; *corresponding author, jessica_lee@unc.edu

## The Ethical Imperative of Addressing Oral Health Disparities: A Unifying Framework

*J Dent Res* 93(3):224-230, 2014

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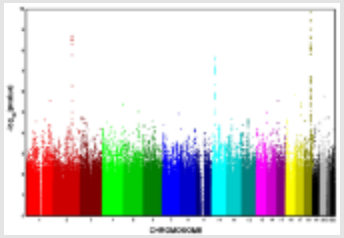

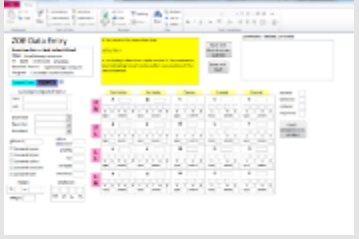

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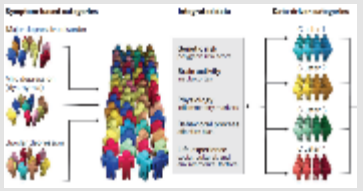
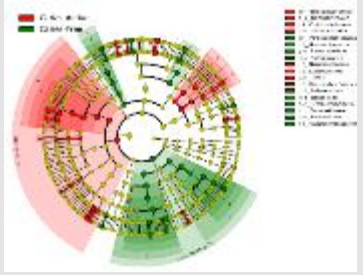




# The ZOE-G4S study


## **Z**ero-**O**ut **E**arly Childhood Caries

## **G**enes **for S**miles (NIH/NIDCR, 2015-2020)

Community-based genetic epidemiologic study of early childhood oral health among preschool children enrolled in HS (ages 3 and 4)

Ultimate goal is the conduct of a trans-ethnic genome-wide association meta-analysis (GWAS) to identify genetic risk factors (loci) for Early Childhood Caries (ECC)

Aim to enroll ~9,000 children over a ~3-year period to achieve a genotype & phenotype sample of ~6,000

# The ZOE-G4S study


Clinical examination domains [~15' duration]:

- Height, weight, BMI
- Saliva sample (for DNA extraction, biobanking and analysis)
- Microbial plaque samples (for biobanking and future studies)
- EO/IO exam (profile, lip competence, OJ/OB, molar/canine relationships)
- Tooth surface-level caries (ICDAS criteria: healthy, pre-cavitated, cavitated) and developmental defects of enamel (simplified epi. DDE index)
- Dental trauma (Ellis' classification)
- Frankl behavior score
- Referral needs (dental home, possible problems, immediate tx needs)

# The ZOE-G4S study


ZOE Clinical Data Entry Application

File | Home | Create | External Data | Database Tools

Views | Clipboard | Sort & Filter | Records | Find | Text Formatting

ZOE Data Entry

## ZOE Data Entry

**Baseline Data - Not to be Edited**

Child Garfield the Cat

ID 3 Birth date 1/1/2005

Program

Center

Enter any additional notes and corrections.

Save and Find Another Subject

Save and Quit

Comments: limit to 150 words

Date of Exam 2/18/2015

Accompanying Adult Name

First Tim

Last Thomas

Examiner Kimon Divaris

Recorder Leslie Zeldin

Assistant Shijia Hu

gift card 123456

- [x] Consent exam
- [x] Consent ht/wt
- [x] Consent saliva/ plaque
- [x] Consent non ZOE
- [x] Consent NIH

- [x] Saliva

Saliva ID 4444

- [x] plaque

Plaque ID 33333

Height

ft. 3 in. 3

weight 33

| | 2nd Molar | 1st Molar | Canine | Lateral | Central |
|---|---|---|---|---|---|
| UR | A 1: o 0, b 0, l 0, m 0, d 0; type 0, extent 0 | B 2: o 60, b 60, l 60, m 60, d 60; type 3, extent 1 | C 3: b 23, l 12, m 13, d 99; type 2, extent 1 | D 4: b 99, l 99, m 99, d 99; type 9, extent 9 | E 5: b 55, l 55, m 55, d 55; type 9, extent 9 |
| UL | J 1: o 0, b 0, l 0, m 0, d 0; type 3, extent 2 | I 9: o 99, b 99, l 99, m 99, d 99; type 9, extent 9 | H 8: b 99, l 99, m 99, d 99; type 9, extent 9 | G 7: b 99, l 99, m 99, d 99; type 9, extent 9 | F 6: b 99, l 99, m 99, d 99; type 9, extent 9 |
| LL | K 1: o 0, b 0, l 0, m 0, d 0; type 0, extent 0 | L 1: o 0, b 0, l 0, m 0, d 0; type 0, extent 0 | M 1: b 0, l 0, m 0, d 0; type 0, extent 0 | N 1: b 0, l 0, m 0, d 0; type 0, extent 0 | O 1: b 0, l 0, m 0, d 0; type 0, extent 0 |
| LR | T 3: o 12, b 0, l 0, m 21, d 21; type 0, extent 0 | S 3: o 12, b 0, l 0, m 0, d ; type 0, extent 0 | R 3: b 21, l 0, m 0, d 0; type 3, extent 2 | Q 3: b 50, l 0, m 0, d 0; type 0, extent 0 | P 1: b 0, l 0, m 0, d 0; type 0, extent 0 |

trauma 0
behavior 3
referral 3
response 2

check completeness of data

profile 1
lip 2
overjet 2
overbite 50

Occlusion

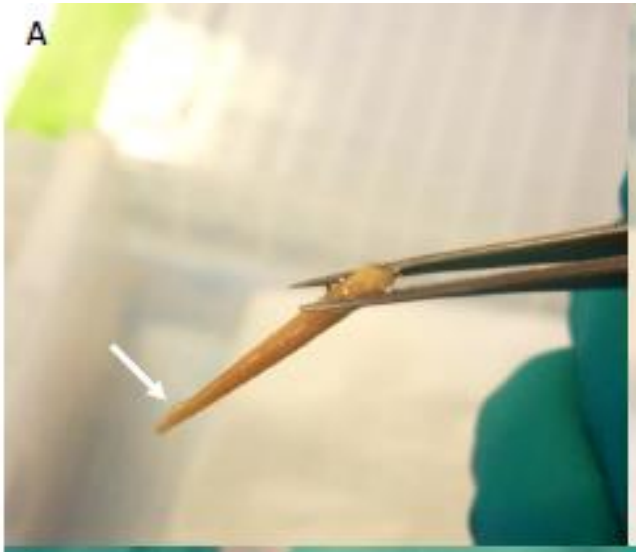
| MR | CR | CL | ML |
|---|---|---|---|
| 2 | 1 | 1 | 1 |

Navigation Pane

# The ZOE-G4S study

# The ZOE-G4S study


# The ZOE-G4S study





## Qualifiers/Observations

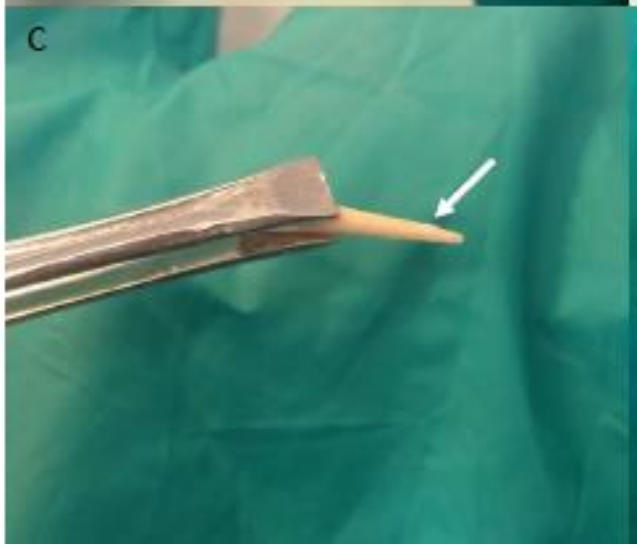
A – Accumulated liquid; further inspection reveals no plaque deposit

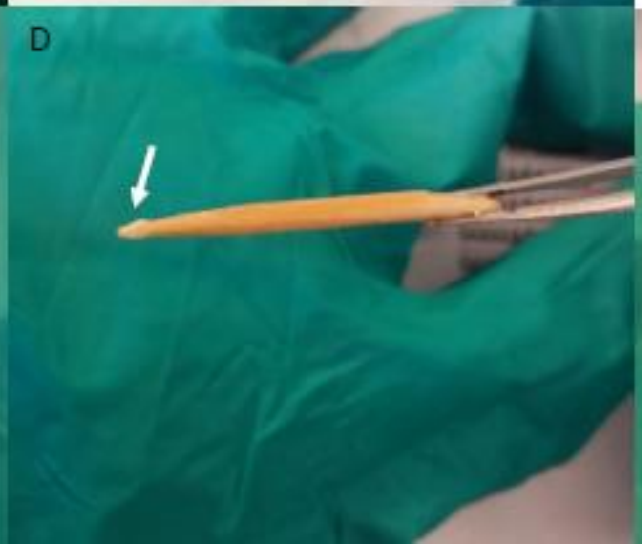
B – *No visible* plaque deposit

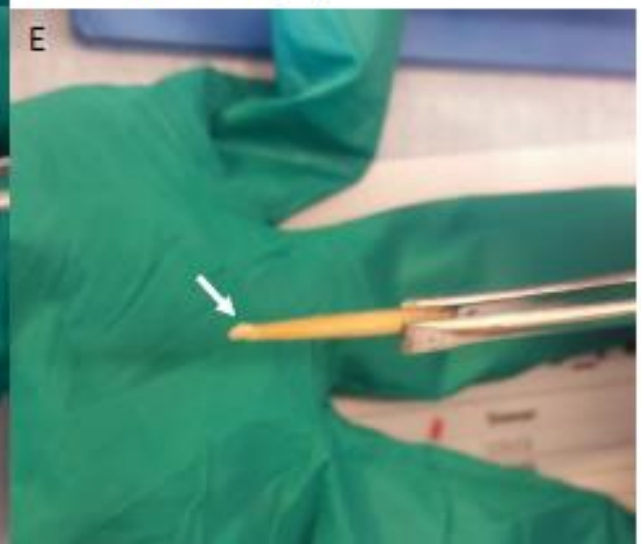
C – *Barely visible* plaque deposit

D – *Visible* plaque deposit

E – *Conspicuous* plaque deposit (note that the deposit is visible from a further distance than the other images)

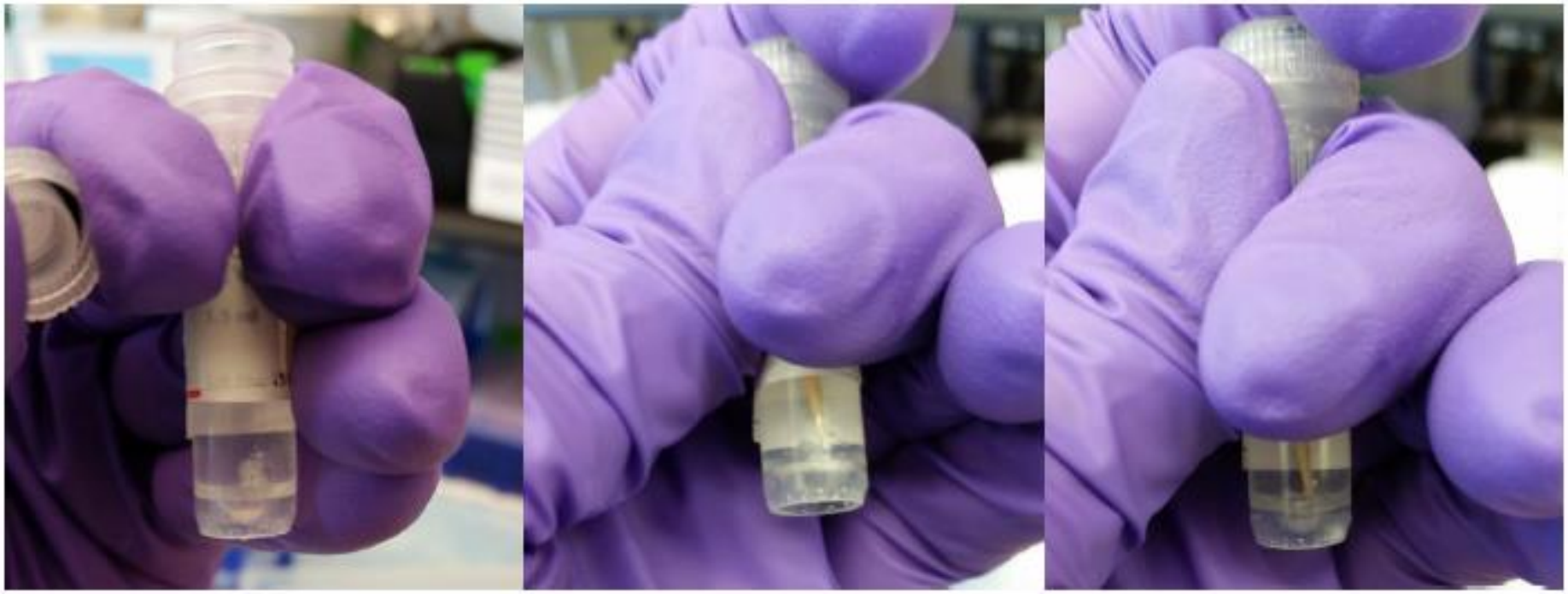


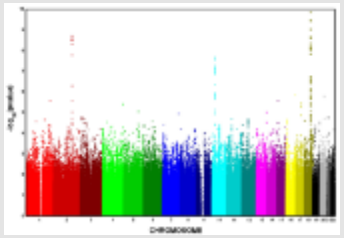



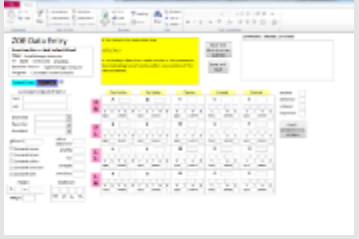



# The ZOE-G4S study

Examples of *conspicuous* pellets in sample vials. *No donor identifiers are present in these images.*





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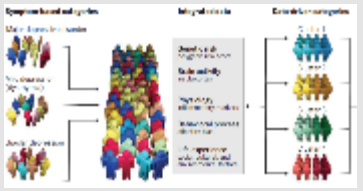
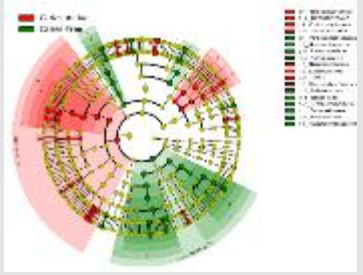
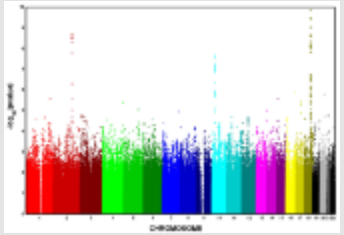
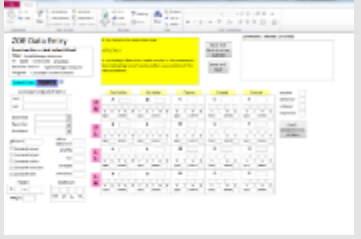



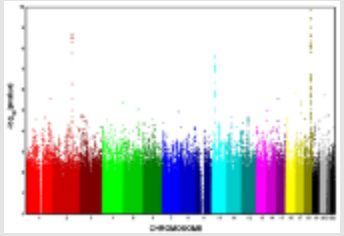
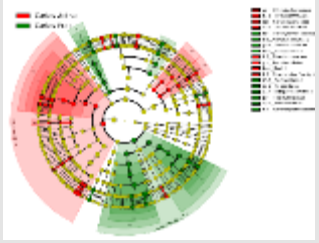


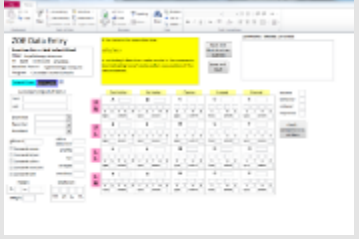




# Lessons and early findings

1. Logistics
2. Community engagement
3. Examiner calibration
4. Dental caries, obesity, trauma, dental home
5. Water testing – fluoride
6. Genomics
7. Methodological contributions
8. Biofilm insights
9. Community perspectives

**Lessons and early findings**

1. **Logistics**
2. Community engagement
3. Examiner calibration
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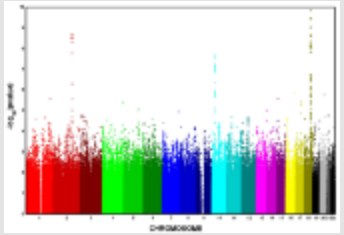
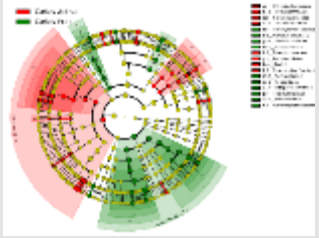
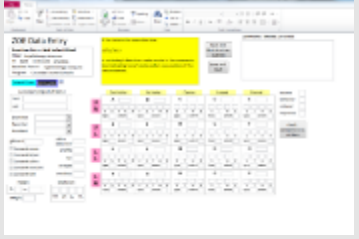
[1] Ginnis *et al*. **Measurement** of early childhood oral health for research purposes: **dental caries experience and developmental defects of the enamel** in the primary dentition. *Methods Mol Biol*. 2018 forthcoming

[2] Agler *et al*. Protocols, methods and tools for **genome-wide association studies (GWAS) of dental traits**. *Methods Mol Biol*. 2018 forthcoming

[3] Divaris *et al*. The **supragingival biofilm** in early childhood caries: clinical and laboratory protocols and bioinformatics pipelines supporting oral **metagenomics, metatranscriptomics and metabolomics** studies of the oral microbiome. *Methods Mol Biol*. 2018 forthcoming

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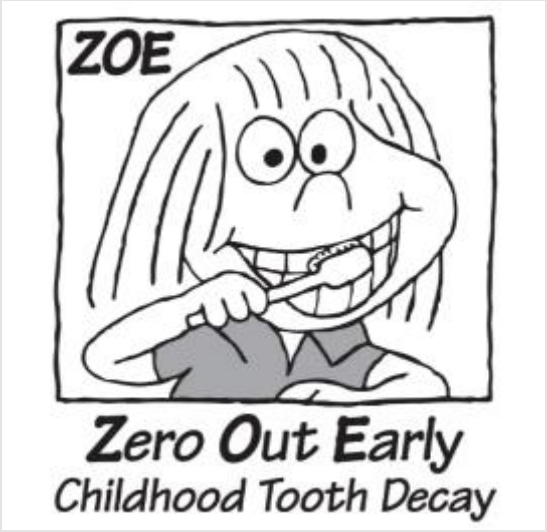
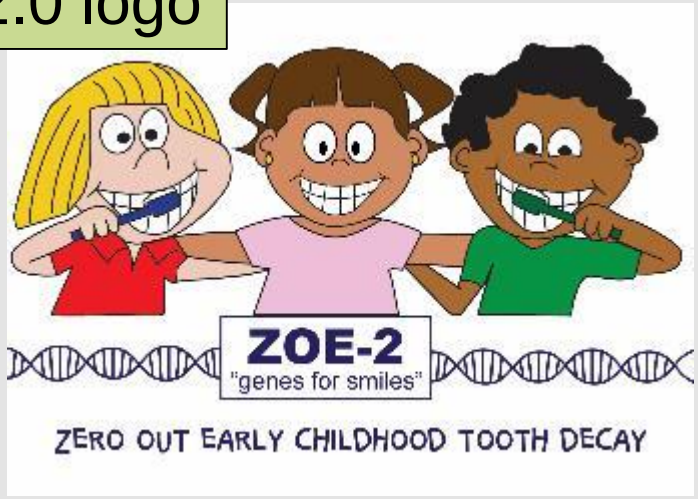
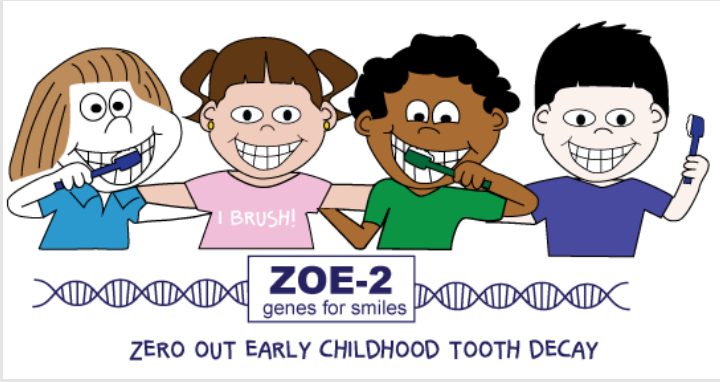
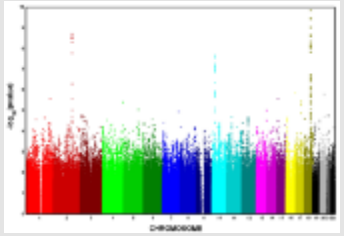
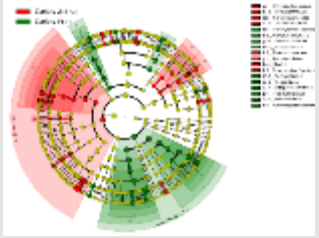
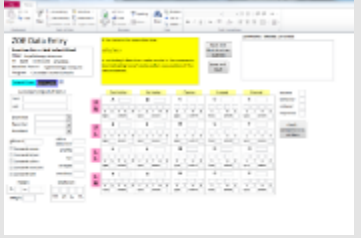
The ZOE 2.0 logo



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# The Partnerships

[redacted] I just want to thank you and the team for such an awesome job.

Due to the connection that our Nutrition Manager, [redacted] with your organization about Dental Health, we were given a wonderful opportunity to form, I hope, a prosperous and lasting partnership.

The ZOE-2.0 Project Team really made the experience very smooth and instrumental for the children. Some children had never seen a dentist. So, to have your team come into our facilities and perform those dental screenings made children feel safe and comfortable.

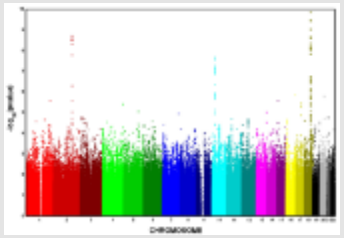
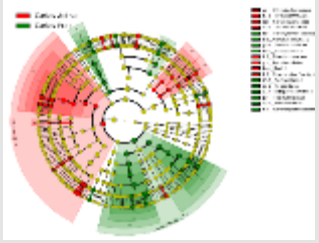
The parents were pleased as well; and for the ones that needed some extra care, took the written advice given them from the screening.

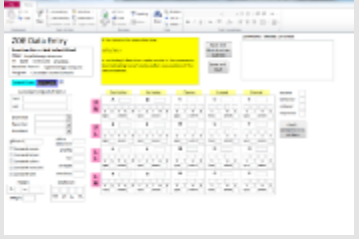
I would certainly encourage other programs to form a partnership with this project. The staff is awesome. They worked with our schedule/timeline. They were courteous, friendly, and professionally down to earth. They were proficient in what they did, and they even had a staff member that could speak to our Hispanic children in their language. The children received a dental health baggie with dental supplies (toothpaste, tooth brush, and instructions on brushing). Parents received an incentive as well. It was well worth this wonderful Team coming and screening our children in their own environment.

I could not have asked for a better Team to have come to my centers and perform the many tasks they did in such a caring and timely manner. My hats are off to them.

Finally, if at all possible, we would love for this Team to do this again next season and even schedule some screenings mid-year to catch some children they may enroll after school has started. We would forever be grateful to them. Hope to see ZOE-2.0 Project next season.

Sincerely,

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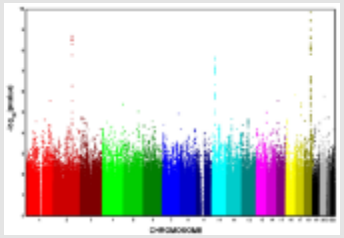
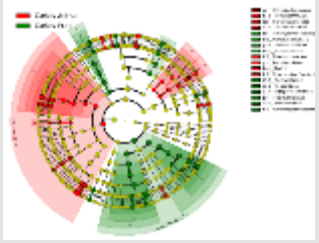
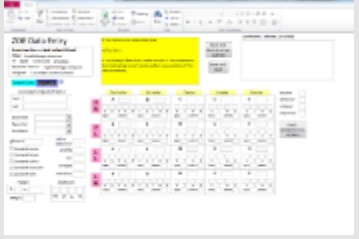
## Measuring Preschool-age Children's ICDAS-based Caries Experience: Examiner's Training and Calibration

Ferreira Zandona AG, Ginnis J, Cantrell J, Meyer BD, Slade GD, Divaris K
*Abstract, AADR meeting, Fr. Lauderdale, March 2018*

236 children, 20,317 tooth surfaces for **inter**-examiner agreement
median weighted *kappa* = **0.75**

64 children, 5,178 surfaces for **intra**-examiner agreement
median weight *kappa* = **0.79**

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**Dental caries prevalence (≥1 established/severe lesion, restoration, etc.) = 48% [first 2,490 participants]**

**Anthropometry:**

**Normal weight: 69%**

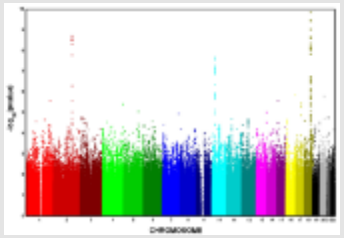
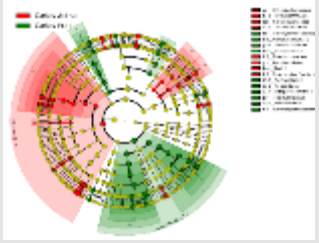
**Overweight: 13%**

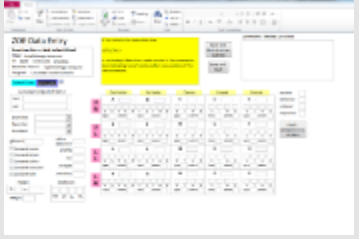
**Obese: 9%**

**Underweight: 9%**

**Evidence of traumatic dental injury prevalence (pulp exposure, tooth displacement, necrosis, tooth loss)= 4% [first 1,546 participants]**

**Reported dental home = 81%**

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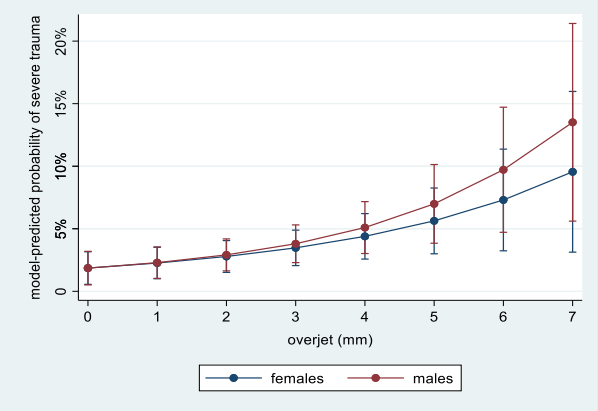
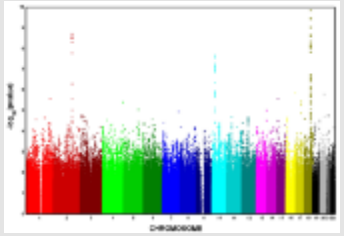
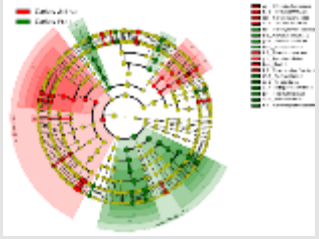
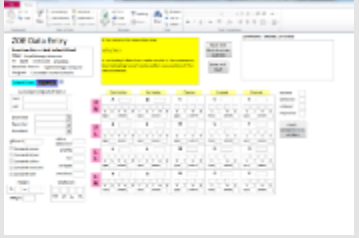
## Association between overjet (mm) and traumatic dental injury



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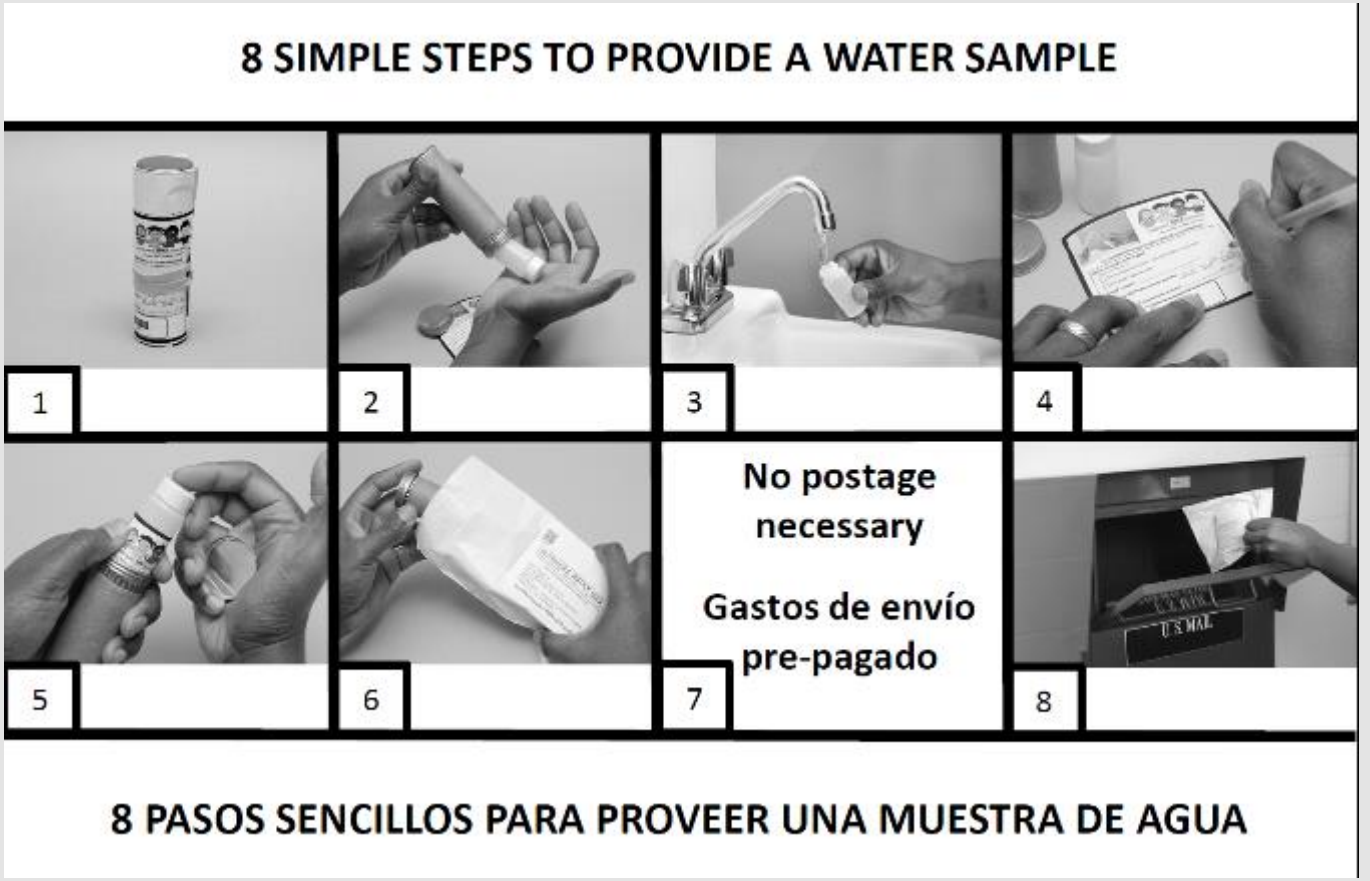


NC Department of Health and Human Services

# North Carolina State Laboratory Public Health
## Environmental Sciences - Inorganic Chemistry

North Carolina Public Health

**InOrganic Sample Results**

Click on the sample numbers to view the results.

| #. | Name | Sample# | Collection Date | Collected By | Reported Date |
|---|---|---|---|---|---|
| 1. | [redacted] | [redacted] | 1/10/2018 | 'NA' | 1/24/2018 |
| 2. | | | 12/24/2017 | 'NA' | 1/24/2018 |
| 3. | | | 12/13/2017 | 'NA' | 1/24/2018 |
| 4. | | | 1/11/2018 | 'NA' | 1/24/2018 |
| 5. | | | 1/12/2018 | 'NA' | 1/24/2018 |
| 6. | | | 1/11/2018 | 'NA' | 1/24/2018 |
| 7. | | | 1/12/2018 | 'NA' | 1/24/2018 |
| 8. | | | 12/13/2017 | 'NA' | 1/24/2018 |
| 9. | | | 11/28/2017 | 'NA' | 1/24/2018 |
| 10. | | | 1/9/2018 | 'NA' | 1/24/2018 |

StarLiMS ID: [redacted]

Date Collected: [redacted]

Date Received: 11/02/17

Time Collected: [redacted]

Collected By:

Sample Type:

Sample Source: Well Water

Sampling Point: [redacted]

Temp. at Receipt:

Date of Birth:

GPS #:

Sample Description:

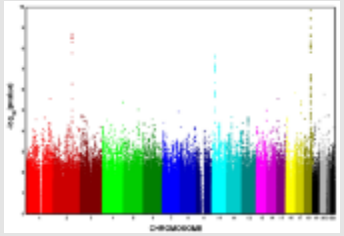
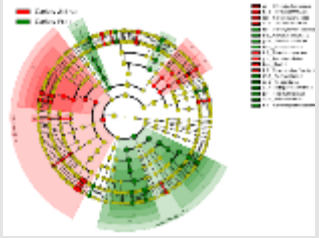
Comment: 9.19 mg/L Nitrate-N detected in this sample. Please contact ;your local county health department if you would like additional testing for nitrate.

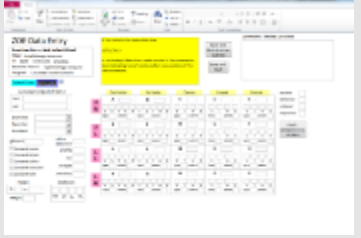
**Fluoride (Profile)**

| Analyte | Result | Allowable Limit | Unit | Qualifier(s) |
|---|---|---|---|---|
| Fluoride | < 0.20 | 4.00 | mg/L | |

**Report Date:** 11/15/2017

**Reported By:** [redacted]

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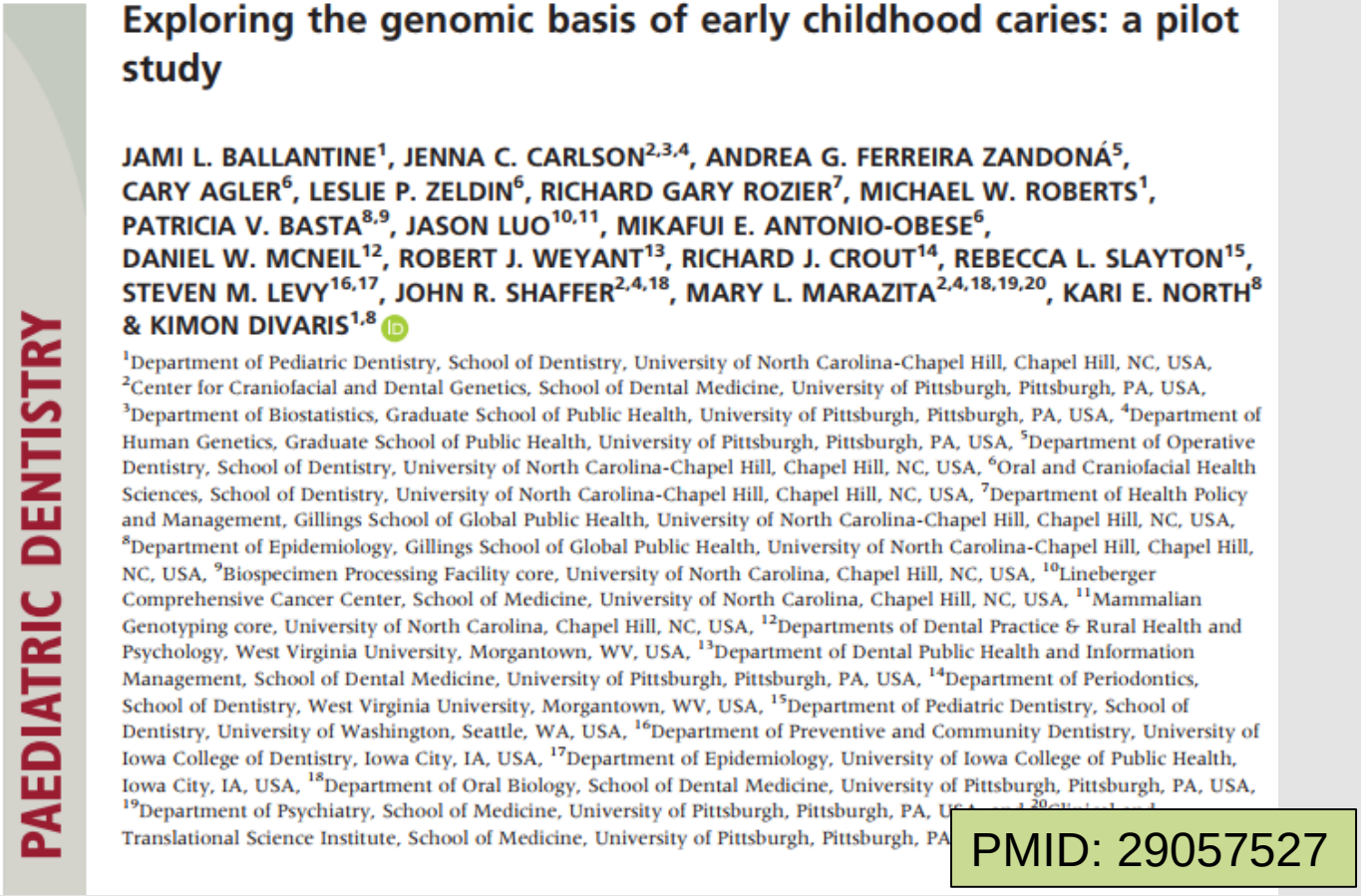


PAEDIATRIC DENTISTRY

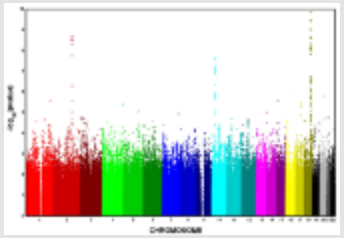
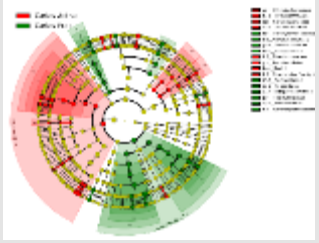
# Exploring the genomic basis of early childhood caries: a pilot study

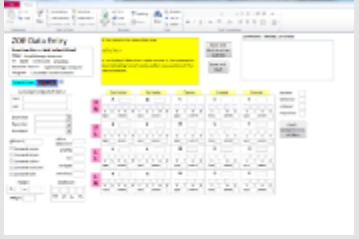
JAMI L. BALLANTINE[1], JENNA C. CARLSON[2,3,4], ANDREA G. FERREIRA ZANDONÁ[5], CARY AGLER[6], LESLIE P. ZELDIN[6], RICHARD GARY ROZIER[7], MICHAEL W. ROBERTS[1], PATRICIA V. BASTA[8,9], JASON LUO[10,11], MIKAFUI E. ANTONIO-OBESE[6], DANIEL W. MCNEIL[12], ROBERT J. WEYANT[13], RICHARD J. CROUT[14], REBECCA L. SLAYTON[15], STEVEN M. LEVY[16,17], JOHN R. SHAFFER[2,4,18], MARY L. MARAZITA[2,4,18,19,20], KARI E. NORTH[8] & KIMON DIVARIS[1,8]

[1]Department of Pediatric Dentistry, School of Dentistry, University of North Carolina-Chapel Hill, Chapel Hill, NC, USA, [2]Center for Craniofacial and Dental Genetics, School of Dental Medicine, University of Pittsburgh, Pittsburgh, PA, USA, [3]Department of Biostatistics, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, PA, USA, [4]Department of Human Genetics, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, PA, USA, [5]Department of Operative Dentistry, School of Dentistry, University of North Carolina-Chapel Hill, Chapel Hill, NC, USA, [6]Oral and Craniofacial Health Sciences, School of Dentistry, University of North Carolina-Chapel Hill, Chapel Hill, NC, USA, [7]Department of Health Policy and Management, Gillings School of Global Public Health, University of North Carolina-Chapel Hill, Chapel Hill, NC, USA, [8]Department of Epidemiology, Gillings School of Global Public Health, University of North Carolina-Chapel Hill, Chapel Hill, NC, USA, [9]Biospecimen Processing Facility core, University of North Carolina, Chapel Hill, NC, USA, [10]Lineberger Comprehensive Cancer Center, School of Medicine, University of North Carolina, Chapel Hill, NC, USA, [11]Mammalian Genotyping core, University of North Carolina, Chapel Hill, NC, USA, [12]Departments of Dental Practice & Rural Health and Psychology, West Virginia University, Morgantown, WV, USA, [13]Department of Dental Public Health and Information Management, School of Dental Medicine, University of Pittsburgh, Pittsburgh, PA, USA, [14]Department of Periodontics, School of Dentistry, West Virginia University, Morgantown, WV, USA, [15]Department of Pediatric Dentistry, School of Dentistry, University of Washington, Seattle, WA, USA, [16]Department of Preventive and Community Dentistry, University of Iowa College of Dentistry, Iowa City, IA, USA, [17]Department of Epidemiology, University of Iowa College of Public Health, Iowa City, IA, USA, [18]Department of Oral Biology, School of Dental Medicine, University of Pittsburgh, Pittsburgh, PA, USA, [19]Department of Psychiatry, School of Medicine, University of Pittsburgh, Pittsburgh, PA, U[20]Clinical and Translational Science Institute, School of Medicine, University of Pittsburgh, Pittsburgh, PA

PMID: 29057527

Ballantine JL, *et al*. Exploring the genomic basis of early childhood caries: a pilot study. *Int J Paediatr Dent*. 2017 Oct 23.

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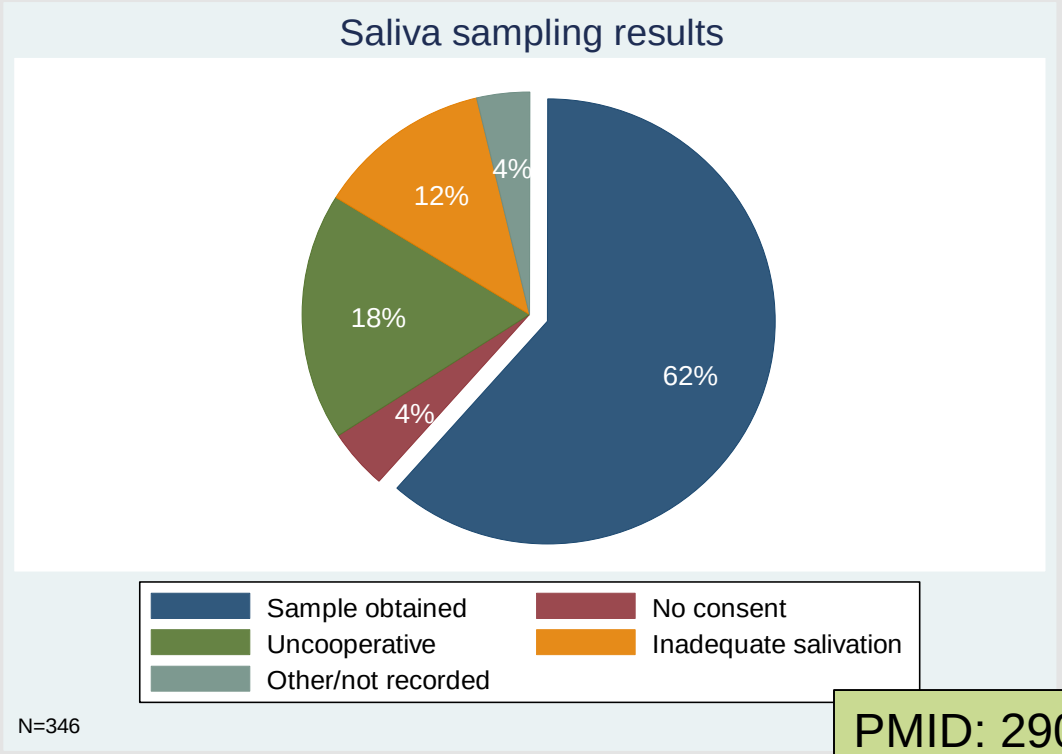


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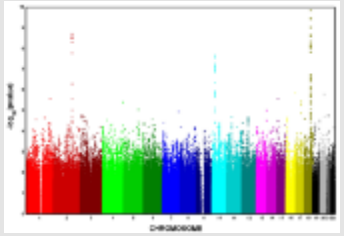
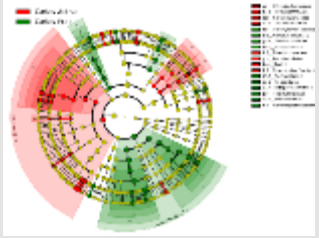


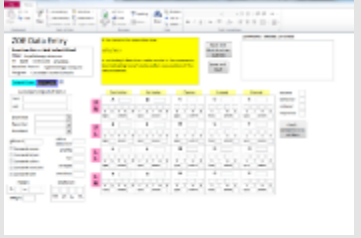

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Statistics in Medicine

Research Article

Received 14 February 2015, Accepted 20 October 2015 Published online 15 November 2015 in Wiley Online Library

(wileyonlinelibrary.com) DOI: 10.1002/sim.6804

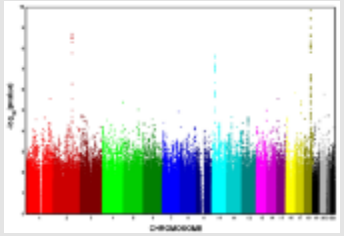
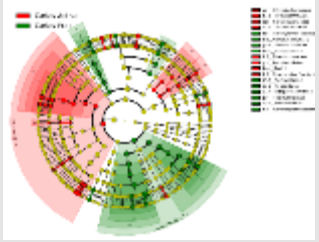
# Marginalized zero-inflated negative binomial regression with application to dental caries

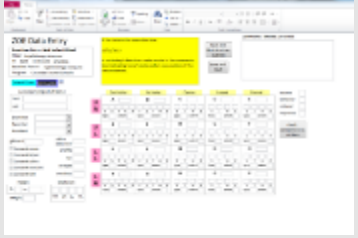
John S. Preisser,[a*†] Kalyan Das,[b] D. Leann Long[c] and Kimon Divaris[d]

The zero-inflated negative binomial regression model (ZINB) is often employed in diverse fields such as dentistry, health care utilization, highway safety, and medicine to examine relationships between exposures of interest and overdispersed count outcomes exhibiting many zeros. The regression coefficients of ZINB have latent class interpretations for a susceptible subpopulation at risk for the disease/condition under study with counts generated from a negative binomial distribution and for a non-susceptible subpopulation that provides only zero counts. The ZINB parameters, however, are not well-suited for estimating overall exposure effects, specifically, in

PMID: 26568034

Preisser JS, Das K, Long DL, Divaris K. Marginalized zero-inflated negative binomial regression with application to dental caries. Stat Med. 2016 May 10;35(10):1722-35.

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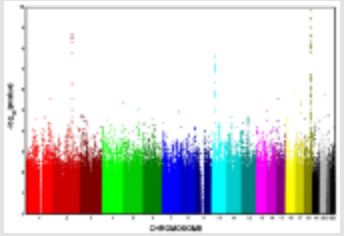
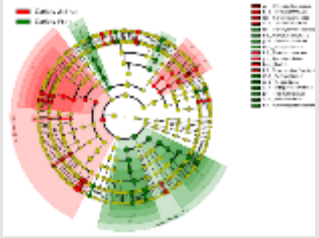
## Metagenomics of Early Childhood Oral Health and Early Childhood Caries

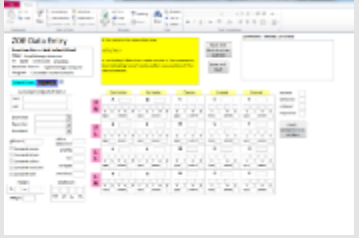
Kimon Divaris, Roach J, Basta PV, Ferreira Zandona AG, Ginnis J, Meyer BD, Hu S, Simancas-Pallares MA, Butz N, Azcarate-Peril MA
*Abstract, AADR meeting, Fr. Lauderdale, March 2018*

118 children, ages 3-5, whole genome sequencing (**WGS**) shotgun of supragingival biofilm

712 million high-quality reads

Comparisons between 3 groups: **health** (caries-free), disease (**unrestored** caries lesions and **restored** caries lesions)

**Lessons and early findings**

1. Logistics
2. Community engagement
3. Examiner calibration
4. Dental caries, obesity, trauma, dental home
5. Water testing – fluoride
6. Genomics
7. Methodological contributions
8. Biofilm insights
9. **Community perspectives**

RESEARCH ARTICLE

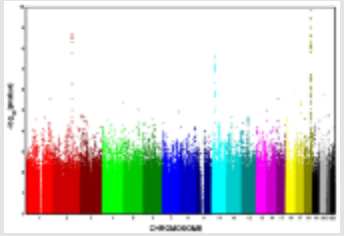
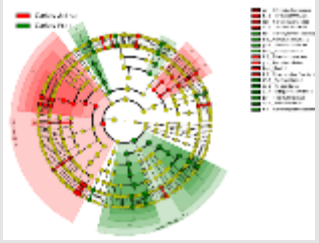
# Framing Young Childrens Oral Health: A Participatory Action Research Project

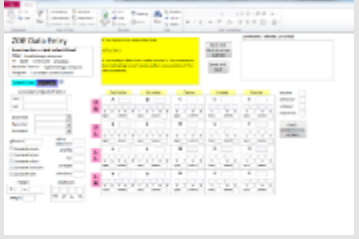
**Chimere C. Collins[1], Laura Villa-Torres[2], Lattice D. Sams[1], Leslie P. Zeldin[3], Kimon Divaris[4,5]***

**1** Department of Dental Ecology, School of Dentistry, University of North Carolina-Chapel Hill, Chapel Hill, NC, United States of America, **2** Department of Health Behavior, UNC Gillings School of Global Public Health, University of North Carolina-Chapel Hill, Chapel Hill, NC, United States of America, **3** Oral and Craniofacial Health Sciences, School of Dentistry, University of North Carolina-Chapel Hill, Chapel Hill, NC, United States of America, **4** Department of Pediatric Dentistry, School of Dentistry, University of North Carolina-Chapel Hill, Chapel Hill, NC, United States of America, **5** Department of Epidemiology, UNC Gillings School of Global Public Health, University of North Carolina-Chapel Hill, Chapel Hill, NC, United States of America

PMID: 27548714

Collins CC, Villa-Torres L, Sams LD, Zeldin LP, Divaris K. Framing Young Children's Oral Health: A Participatory Action Research Project. *PLoS One*. 2016 Aug 22;11(8):e0161728.

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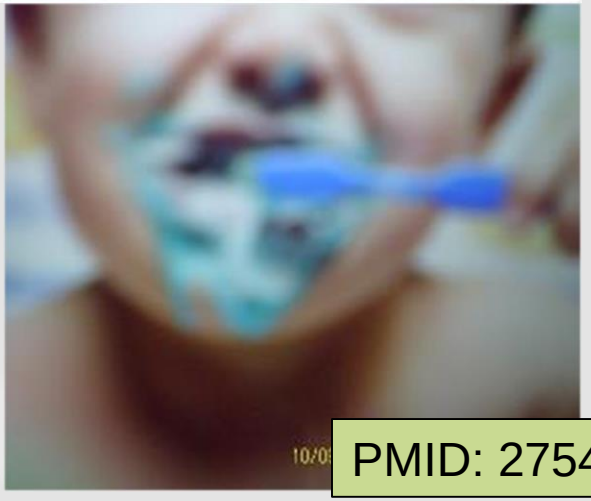

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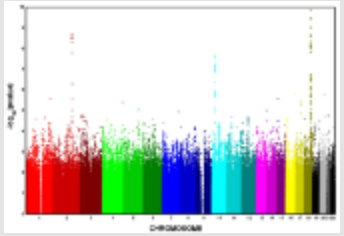
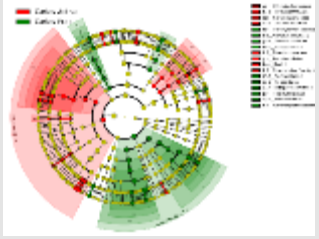


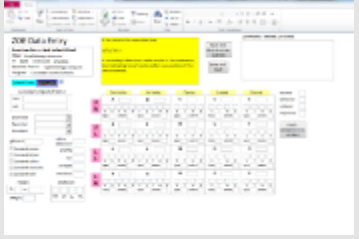

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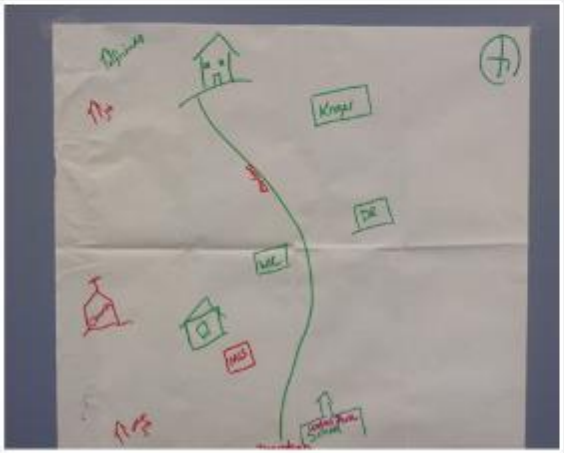
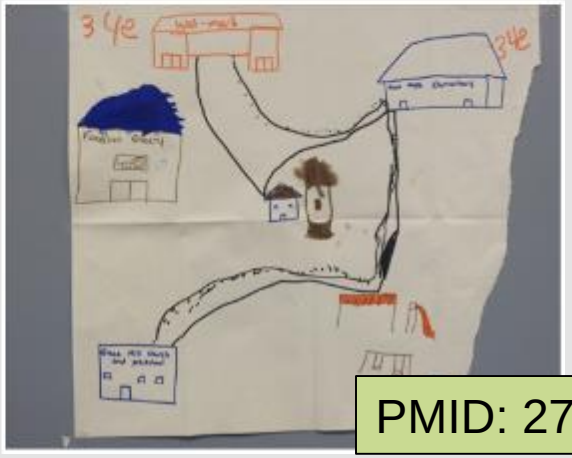

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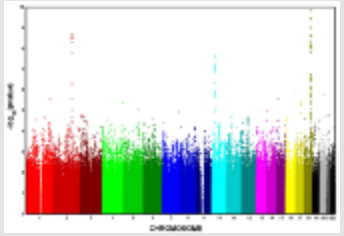
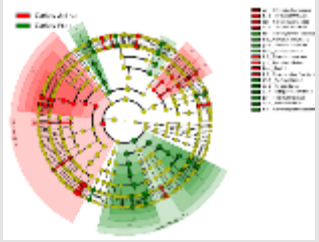


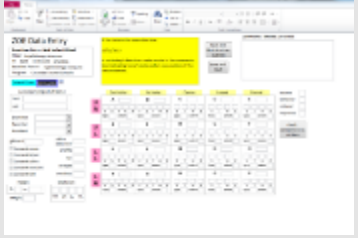

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## Participants' quotes

"It's harder to buy healthier foods, because of the prices".

"We live in a country that subsidizes processed food, and makes the really good stuff expensive".

"So often it's just you get in a rush at bedtime, or ... She's getting to be old enough that I say, "Go brush your teeth", and I'm not always in there too make sure that she's really doing it".

"Accessibility. I'd say that's probably the biggest thing.

"I definitely needed a dentist that's open after 5:00PM…That's the point. To be able to go after school or get the kids to bed and go".

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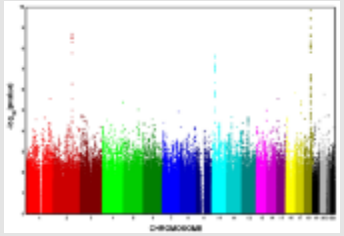
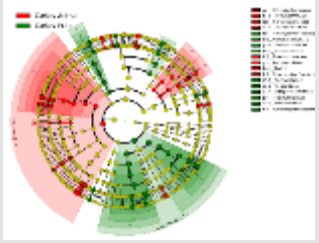


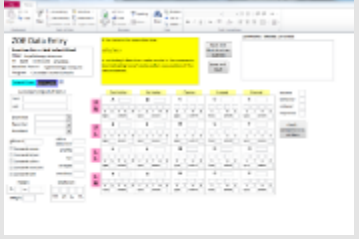

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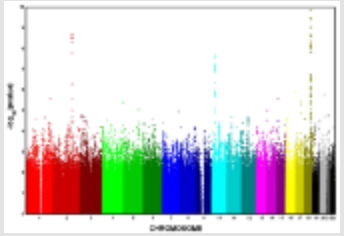
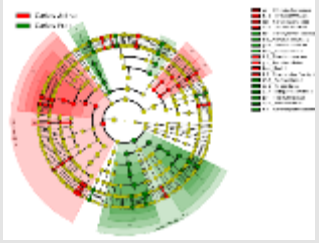
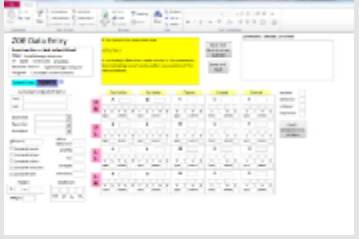
In person interviews with parents of young children

**Investigator**: […] If this is easily available by saliva sample and affordable, would you be interested in having genetic testing to obtain health and disease risk information for your child by a physician?

**Parent**: If you had asked me that two years ago, I [would say no] but since I do have a sick kid, I think the answer to that would be yes.

Becherer and Divaris, unpublished

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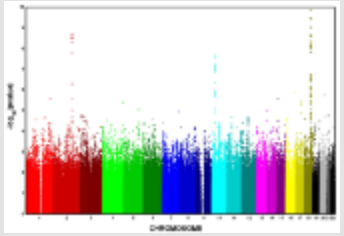
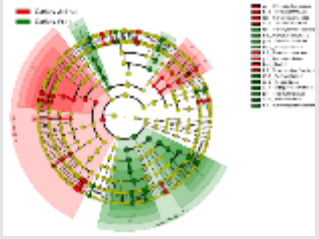
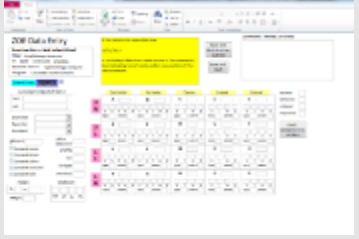
In person interviews with parents of young children

**Investigator**: […] The results are in and she tells you that you are a genetically pre-disposed or high-risk to develop condition that can be prevented with changes in your diet and overall lifestyle […] What would be your reaction?

**Parent**: I would probably do it. Change my lifestyle. I say probably, because those are all hypothetical. I really like chocolates, but I'm not saying I'll be perfect about it but I would give it a shot anyway for sure.

Becherer and Divaris, unpublished

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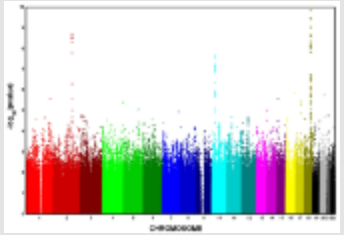
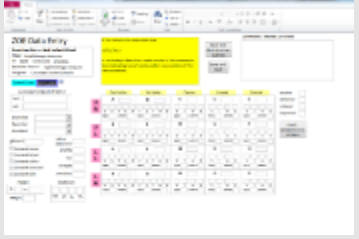
In person interviews with parents of young children

**Investigator:** […] Do you have any ethical or privacy concerns regarding genetic testing for routine health care?

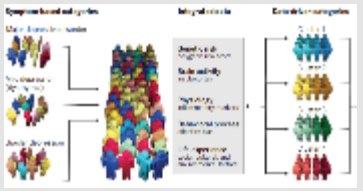
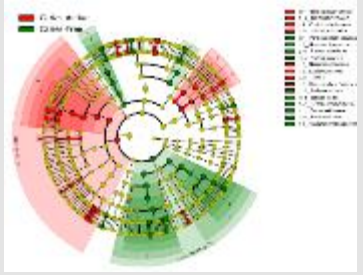
**Parent:** I do, but I'm not as concerned about that as some of the people I know. I'm not a conspiracy theorist, but I do think that the more information that's out there about you, the more likely that information to be acted or used in a way where it wasn't intended for. I think there is cause for concern. How much concern? I have no idea. Who would be using that information and for what? I don't know. Is it going to be ... We end up with a one payer health care system and the government decides who is and who isn't going to get treatments because of the genetic testing, I think it's possible but not probable.

Becherer and Divaris, *unpublished*

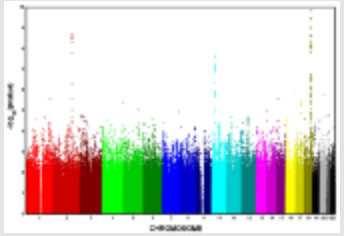
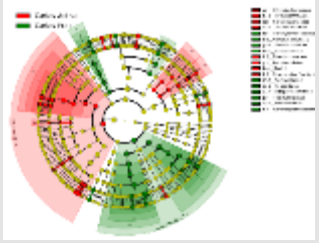



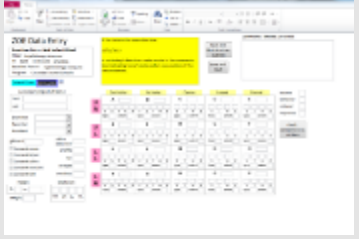


1. Early childhood oral health
2. The ZOE 2.0 study
3. Lessons and early findings
4. **What next**



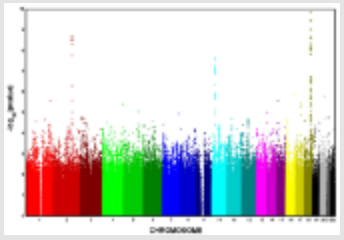
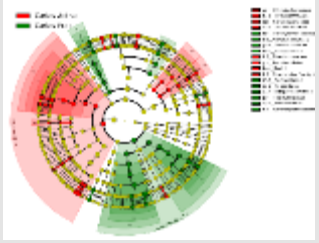



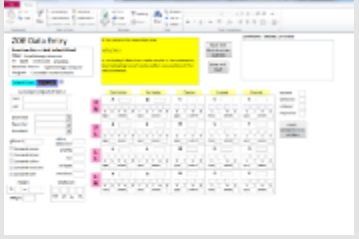



**What next**

1. **Added measures to the current cohort**
2. Further characterize disease subtypes
3. Further understand communities
4. Follow-up

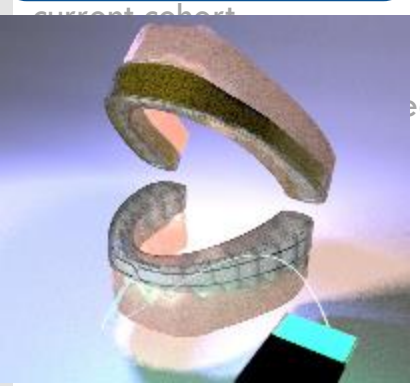
1. **Medicaid claims data**
2. **Qualitative studies among the positive outliers**
3. **Understand HS program/centers influence**
4. **Super-impose contextual factors**
5. **Obtain intra-oral photos**
6. **Conceptualize ways to monitor oral health**

Tooth surface status monitoring

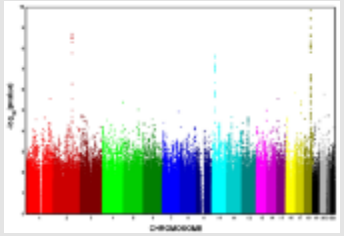
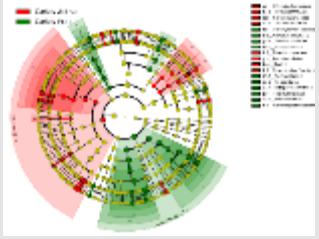
## Conceptualize ways to monitor oral health

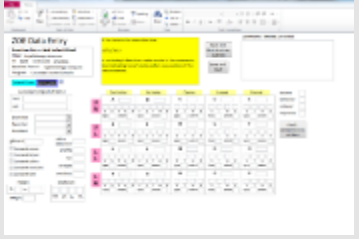


Genomics

-  -

Metagenomics
(meta-)
Transcriptomics
Metabolomics

**What next**

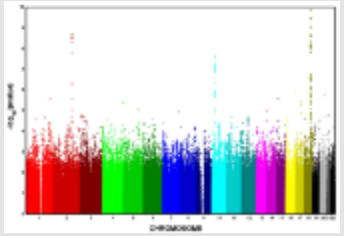
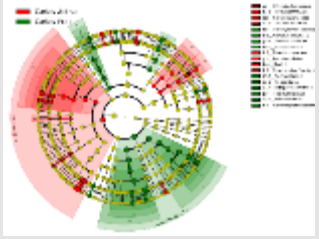
1. Added measures to the current cohort
2. **Further characterize disease subtypes**
3. **Further understand communities**
4. Follow-up

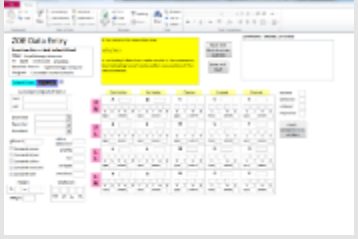
## 1.Further characterize disease subtypes

a) Patterns of dental caries lesion development in the primary dentition
b) Microbial/biochemical signatures

## 2.Further understand communities

a) What works, what doesn't
b) Impact and development of oral health champions
c) School-based programs
d) How does precision dental public health look like?

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**Primary dentition**

Human genome

Supragingival biofilm: metagenomics transcriptomics metabolomics

Behaviors: OH, diet, dental attendance, etc.

Environment: fluoride, contextual (geocoding)

Others

**Mixed dentition**

**Incident or progressive outcomes**

**1st permanent molars**

Supragingival biofilm, behaviors, environment, expenditures, comorbidities, others

**Permanent dentition**

**Incident or progressive outcomes**

**2nd permanent molars**

**Periodontal assessment**

Supragingival, subgingival biofilm, behaviors, environment, comorbidities, OHRQoL, expenditures, others

**3-4 y.o** — **2017-18**

**8-9 y.o** — **2022-23**

**13-14 y.o** — **2027-28**

# The team

Supported by NIH/NIDCR U01-DE025046



**Investigators**

**Kari North**, Department of Epidemiology, School of Public Health
**Andrea Zandona**, Department of Operative Dentistry, School of Dentistry
**Gary Slade**, Department of Dental Ecology, School of Dentistry
**Jeannie Ginnis**, Department of Pediatric Dentistry
**John Preisser**, Department of Biostatistics, School of Public Health
**Danyu Lin**, Department of Biostatistics, School of Public Health
**Beau Meyer**, Department of Pediatric Dentistry, School of Dentistry

**Core UNC team**

**Diane Baker**, Department of Oral and Craniofacial Health Sciences
**Mika Antonio-Obese**, Department of Oral and Craniofacial Health Sciences
**Tom Pahel**, Department of Oral and Craniofacial Health Sciences
**John Cantrell**, Department of Oral and Craniofacial Health Sciences & Injury Prevention Research Center

**Collaborators**

**Patricia Basta**, Biospecimen Processing Core facility, Gillings SPH
**Andrea Azcarate-Peril**, Microbiome core, UNC SOM
**Cindy Price**, State Laboratory of Public Health, NC DPH

**Clinical examiners**

**Jeannie Ginnis**, Department of Oral and Craniofacial Health Sciences
**Bhavna Pahel**, Department of Pediatric Dentistry
**Johanna Irving**, Department of Pediatric Dentistry
**Katie Blaylock**, Department of Oral and Craniofacial Health Sciences
**Shannon Thomason**, Oral and Craniofacial Health Sciences
**Jackie Burgette**, Department of Pediatric Dentistry*

**Post-doc, Graduate students and RAs**

**Cary Agler,** Oral and Craniofacial Health Sciences
**Eun Young Oh**, Department of Health Policy & Management
**Katie Doswell Born**, Department of Orthodontics
**Jami Ballantine**, Department of Pediatric Dentistry
**Yuri Oh**, Department of Dental Ecology
**Abby Becherer**, UNC School of Dentistry
**Talia Johnson,** UNC School of Dentistry
**De'Ja Alexander**, UNC School of Dentistry
**Walid Al-Soneidar**, Department of Epidemiology
**Laura Villa-Torres**, Department of Social Medicine

**Regional coordinators, field staff, volunteers**

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