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Geosocioeconomics & Childhood Caries at CHCs in Hawai'i: ACA
Implications

by

Sheila Mai Trang Nguyen

THESIS

Submitted in partial satisfaction of the requirements for the degree of

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ABSTRACT

Geosocioeconomics and Childhood Caries at CHCs in Hawai'i: ACA Implications

Nguyen SN, Chung L, Featherstone JDB, Gansky SA (University of California San Francisco, San Francisco, CA)

Purpose: The purpose is to measure childhood caries experience and explore possibly associated geographic, demographic, socioeconomic, and sociocultural factors at community health centers (CHCs) in Hawai'i. **Methods:** The study comprises children ages 0-12 attending a CHC on Hawai'i and O'ahu between August 2007 and August 2012. Data extracted from existing paper charts include demographic, clinical, and utilization variables. **Results:** In 329 patients, 1666 encounters were recorded. Caries was found to be present in 63% of the children. 19.3% of dental appointments were broken, and treatment plans were not completed 35.1% of the time. On Hawai'i and O'ahu, overall visit type was significantly related to broken appointments ($p=0.0002$ and $p=0.0038$ respectively). Children were 3.0 times and 2.5 times more likely to miss their treatment appointments than examination appointments on Hawai'i and O'ahu ($p<0.0001$ and $p=0.0009$ respectively). Residence within the clinic/van ZIP code ($p<0.0001$) was significantly related to broken appointments and treatment plan incompleteness on Hawai'i. Those residing outside the clinic/van ZIP code were 3.1 times more likely to not complete the treatment plan ($p=0.004$). The overall race effect (3 df, $p=0.0369$) was significant for broken appointments on Hawai'i. Pacific Islanders were more likely to break appointments compared to Asians ($p=0.0142$), Hawaiians ($p=0.0385$), and all other races ($p=0.0082$). All races other than Asian, Hawaiian, and Pacific Islander were also 3.2 times more likely to complete treatment plans ($p=0.033$) on Hawai'i. **Discussion:** The study provides an updated

oral health profile of the low-income and minority pediatric population in Hawai'i and can serve as a database for CHCs to re-evaluate how to improve their clinical operations and for policymakers to make decisions on future strategies to effectively and culturally-appropriately promote dental health and enhance health status and access to care in Hawai'i. Despite CHCs accepting Medicaid and having schedule availability, large percentages of broken appointments and untreated caries still remain. This holds great relevance for the Affordable Care Act (ACA) and provides important insights of what to expect. Data from Hawai'i indicate that ACA-mandated enrollment may remain insufficient to meet pediatric dental treatment needs, especially where geographic barriers may reduce access to care.

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INTRODUCTION

Dental caries is a global disease, with children bearing a large burden of disease disadvantage [1]. According to the US Surgeon General's Report, caries is the most common chronic disease in US children – 6 times more common than asthma [2] – and is the most prevalent untreated child healthcare need [3]. Developing caries before 6 years old has high impact and resource consumption. First, children with early childhood caries (ECC) lead a poorer quality of life due to associated pain and infections. These children have trouble eating and sleeping, which affects their growth and development and contributes to other health problems [4-6]. Second, ECC negatively impacts children's school attendance and academic performance [7, 8]. Third, ECC treatment, often requiring general anesthesia, is expensive, exceeding \$1000 per child on average in the US [9] due to difficulty of managing such young patients. The seriousness and societal costs of ECC are enormous.

The first and only US Surgeon General's Report on Oral Health in America in 2000 declared that racial/ethnic minority and low-income children experience poorer oral health and poorer access to dental services than do their majority and higher-income peers [2]. According to the 2002 US Surgeon General's workshop, *Children and Oral Health*, children disadvantaged by poverty and minority status had greater likelihood of having cavities and, when affected, had more cavities than their peers [6]. Milgrom *et al.* report these populations to have the highest ECC rates, with few having adequate access to dental care [10]. Chung *et al.* found a higher burden of dental disease, through ZIP code geocustering, in regions of lower socioeconomic status and high concentrations of Asians among San Francisco kindergarten public school children from 2000-2005 [11].

Hawai'i is the only state of the United States inside the Pacific Rim – in fact in its very center. It is a very diverse state, both geographically and ethnically, with many residents from

Pacific Rim ancestry including 10% Native Hawaiians and Other Pacific Islanders, 39% Asians (Filipino, Japanese, Chinese, Korean, etc.), and 9% Hispanics. Almost 25% of Hawai'i's residents are multiracial [12].

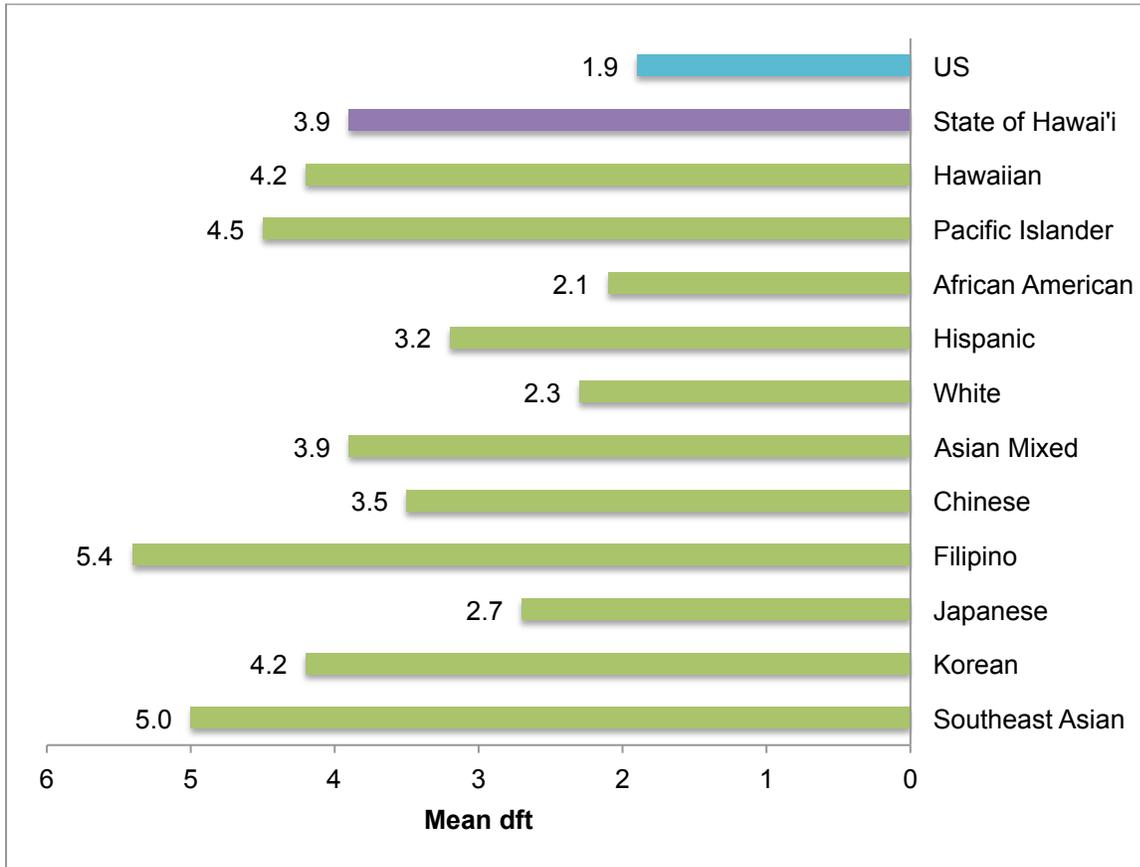
Historically, Hawai'i has experienced many waves of immigration. Between 2000 and 2006, 31% of the 6% overall population increase in Hawai'i (i.e. ~2% of the overall population increase) was attributable to new immigrants [13]. According to a 2012 report by the Immigration Policy Center, nearly 1 in 5 residents of Hawai'i are immigrants (i.e. foreign-born) [14]; 78% of foreign-born Hawaiians were born in Asia, while another 10% were born in Oceania [12]. The majority of immigrants are from the 3 nations known collectively as the Freely Associated States (FAS): the Federated States of Micronesia (FSM), the Republic of the Marshall Islands (RMI), and the Republic of Palau (ROP). Even though the 1996 federal Welfare Reform Act restricted the eligibility of Marshallese migrants for most federal public benefits in the United States, Hawai'i decided to continue entitling FAS migrants health services [15]. Unlike immigrants who are denied access to public programs for 5 years following their receipt of an immigrant visa, migrants from the FAS are eligible to apply for most state-funded public benefits in Hawai'i regardless of date of entry into the US [16]. These FAS migrants are considered one of the most vulnerable populations in Hawai'i. They are located in the lowest socioeconomic brackets in Hawai'i [17]. Less than half have completed high school [15]. The Marshallese in Hawai'i also maintain strong attitudes, with unique cultural concept of time, living in the present moment and not seeking health care until they perceive a health crisis, usually indicated by pain [15]. The immigration of peoples from the Pacific Rim therefore may be a contributor to the high prevalence of pediatric dental caries in the state of Hawai'i. Hawai'i provides a unique opportunity to assess the oral health disparities throughout the Pacific Rim, as well as provide important insights relating to implementing the Affordable Care Act.

Throughout the Pacific Islands, dental disease in childhood is truly endemic. Children from Guam, Palau, and Hawai'i exhibited excessively high caries prevalence, which far exceed those found on the US mainland, with Guam found to have the poorest oral health indicators [18]. A serious decline in oral health was noted between 1963 and 1999 in the population of the Tokelau atolls of the South Pacific [19]. In the Manawatu-Wanganui Area of New Zealand, Maori children were 3 times more likely to have high (5 or more missing or filled teeth) caries experience than non-Maori children [20]. There also is evidence of high childhood caries rates in New Caledonia [21] and Micronesia [22]. Particularly, in the Majuro atoll in the Republic of the Marshall Islands of eastern Micronesia, nearly 50% of children have tooth decay by 36-months-old [10]; 85% of 6-year-old children had at least 1 carious tooth and 65% had 5 or more affected teeth. This caries prevalence rate in Micronesia is close to 3 times the US national mean. Comparably remarkable early childhood dental disease rates were also observed on other populated islands and atolls [23].

Few studies have examined caries specifically in Hawaiian children. Comparing public school children oral screenings in 1989 and 1999, Greer et al. found that children ages 5 through 9 in Hawai'i had twice the average (mean) number of decayed and filled primary teeth (dft) compared to the US mainland in 1999 (Figure 1) [24]. With respect to race/ethnicity, Asian and Pacific Islander children were found to suffer on average from disproportionately higher dental caries severity and were more likely to have unmet treatment needs than Caucasian, African American or Hispanic children. The 1999 data also demonstrated that urban communities can face the same high oral disease challenges as rural communities. O'ahu arguably is the State's most urban island center, and in 1999, the mean dft and the mean number of decayed, missing, and filled permanent teeth (DMFT) varied in comparison to the other islands. The mean dft of 4.2 on O'ahu was not statistically different from those found on Maui, Moloka'i, and Kaua'i and was below the amount found on the Big Island of Hawai'i. The mean DMFT of 0.7 was statistically higher than the other 4 islands. More research is needed to

assess the impact of socioeconomic status on the oral health of young children.

Figure 1. 1999 Mean dft among 5-9 Year Olds in Hawaiian Public Schools (Source: Greer et al 2003)



Dental caries is a multifactorial disease is a preventable, chronic infectious disease with serious health and quality of life consequences with social, cultural, and environmental influences. Hawai'i has the highest rate of dental insurance coverage in the United States [25]. Nonetheless, the high caries rate in childhood still exceeds the national average [18]. In 2010, 2011, and 2012, the Pew Charitable Trusts gave Hawai'i a F grade on how well the state is protecting children from dental decay [26]. Since 2010, at least 7 Pew reports have been released mentioning Hawai'i's failing grade. In 2011, in *The State of Children's Dental Health: Making Coverage Matter*, Pew graded states on an A-through-F scale based on their

performance in meeting eight policy benchmarks for children's dental health [27]:

- 1) Having sealant programs in at least 25% of high-risk schools
- 2) Allowing a hygienist to place sealants in a school sealant program without requiring a dentist's prior exam
- 3) Providing optimally fluoridated water to at least 75% of residents who are served by community water systems
- 4) Meeting or exceeding the 2007 national average (38.1%) of Medicaid-enrolled children ages 1 to 18 receiving dental services
- 5) Paying dentists who serve Medicaid-enrolled children at least the 2008 national average (60.5%) of dentists' median retail fees
- 6) Reimbursing medical care providers through its state Medicaid program for preventive dental health services
- 7) Authorizing a new type of primary-care dental provider
- 8) Submitting basic screening data to the national database that tracks oral health progress

That year, in 2011, Hawai'i met only 1 of the 8 policy benchmarks, having 45.8% of Medicaid-enrolled children receiving dental sealants and exceeding the 2007 national average of 38.1% [28]. In 2012, Pew graded states on their efforts to improve access to sealants for low-income kids based on 4 indicators that should be a key part of any state's prevention strategy [29]:

- 1) Having sealant programs in over 75% high-need schools
- 2) Allowing hygienists to place sealants in school-based programs without requiring a dentist's exam
- 3) Collecting and submitting data to the National Oral Health Surveillance System
- 4) Meeting Healthy People 2010 sealant goal of 50% of children

Based on these indicators, Hawai'i was noted to be lagging far behind in prevention efforts. Hawai'i was nowhere near meeting the Healthy People 2010 goal of sealants being applied to 50% of children [30]. Less than 25% of high-need schools in Hawai'i had a sealant program due to having an outdated "prior exam rule" requiring a dentist to examine a child before he or she can receive sealants [31, 32]. This severe restriction does not permit hygienists to place sealants in school-based programs. Hawai'i also did not submit any data to the National Oral Health Surveillance System database. Among the 50 states and the District of Columbia, Pew ranks Hawai'i to be the worst overall performer in protecting's children's dental health [26]. In addition, Hawai'i has the lowest rate of fluoridation of any state; only residents living on military bases received fluoridated water in 2012 [28].

The purpose of this research project is to shed light on the dental treatment needs and the geographic, demographic, socioeconomic, and sociocultural factors related to accessing and completing dental treatment of the Hawaiian pediatric population at CHCs despite having dental coverage. If ECC is to be controlled in Hawai'i, such understanding is vital. This project will provide an updated oral health profile of Hawai'i's children of lower socioeconomic status visiting two community health centers. The desired long-term effect of this project is to identify pockets of people with the greatest need and identify barriers, which could subsequently be addressed by health centers or community groups to improve dental utilization and access to care in Hawai'i, reduce oral health disparities, and enhance overall health status.

RESEARCH QUESTIONS

What is the extent of childhood caries at community health centers in Hawai'i and how do geosocioeconomic factors relate to it?

What is the percentage of children who fail to attend appointments at community health centers in Hawai'i and how do geosocioeconomic factors relate to attendance?

What is the percentage of children who do not complete their treatment plans at community health centers in Hawai'i and how do geosocioeconomic factors relate to incomplete treatment plans?

HYPOTHESIS

Low socioeconomic status and longer distances to an accessible clinic will be correlated with increased caries severity.

Low socioeconomic status and longer distances to an accessible clinic will be correlated with more frequently broken appointments.

Low socioeconomic status and longer distances to an accessible clinic will be correlated with less frequent treatment plan completion.

SPECIFIC AIMS

1. To measure childhood caries experience at 2 community health centers on 2 separate islands in Hawai'i.
2. To determine the treatment needs and the percentage of children receiving treatment in these settings.
3. To assess the relationships of socioeconomic status, geographical location, and the type of dental visit with caries, broken appointments, and treatment plan completion.

RESEARCH DESIGN AND METHODS

A retrospective longitudinal cohort based on chart reviews from August 1, 2007 to August 1, 2012 was conducted at Bay Clinic on the Big Island of Hawai'i and Wai'anae Coast Community Health Center (WCCHC) on O'ahu. Both sites are community health centers (CHCs) designated as US Medically-Underserved Areas or to have a Medical Professional Shortage in Hawai'i. Both are also affiliated with Lutheran Medical Center and its postdoctoral dental residency training programs.

Sampling Frame

The study sample comprised of American Society of Anesthesiologists (ASA) physical status classification 1 or 2 patients of record, ages 0-12 years old, at the community health centers. Patients with any recorded special health care needs (SHCN) were excluded from the study because they are also characterized to have more untreated caries than those in the general population [33]. The American Academy of Pediatric Dentistry (AAPD) defines SHCN as any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention, and/or use of specialized services or programs [34].

Sample Size Determination

A sample size of 97 patients per clinic was estimated as needed for the study, when comparing hypothetical proportions of untreated caries between any 2 clinics of 0.40 to 0.60 (i.e. a difference of 0.20 between clinics) using a chi-square test with 80% power. Power increases for larger differences, for an overall proportion further away from 0.5, and for continuous measures (such as dmft or DMFT).

Site Selection

At the time of devising the study during Fall 2011, there were 41 CHCs located on the 6 major islands of Hawai'i, with more than 82 service locations. However, only 12 of the CHCs had at least 1 dental clinic associated with them. Five of the service locations were on O'ahu; 3 on the Big Island, 2 were on Maui, and 1 each on Kaua'i and Moloka'i:

O'ahu

1. Kalihi-Palama Health Center
2. Kokua Kalihi Valley Comprehensive Family Services
3. Ko'olauloa Health Center
4. Wai'anae Coast Comprehensive Health Center
5. Waimanalo Health Center

Big Island

6. Bay Clinic
7. West Hawai'i Community Health Center
8. Hamakua Health Center

Maui

9. Hana Community Health Center
10. Malama I Ke Ola Health Center

Kauai

11. Kaua'i Community Health Center

Moloka'i

12. Moloka'i Community Health Center

The principal investigator (PI) had established professional connections in Hawai'i after having practiced as a general dentist at Bay Clinic on the Big Island of Hawai'i from 2010-2011. After some e-mail correspondence, the Hawai'i Primary Care Association provided her in October 2011 with the contact information for dental directors of 5 different CHCs believed to have the most dental data of any of the CHCs: 1 from the Big Island, 1 from Moloka'i, and 3 from O'ahu. The PI e-mailed the 5 dental directors, inviting them to have their CHC be involved in the study. Four replied, interested in participating in the study. One, however, from O'ahu, did not follow through with additional steps. Thus, 3 dental directors, 1 from each island, did.

Bay Clinic is the only CHC on the east side of the Big Island. Big Island is the island with the largest area of the Hawaiian Islands, with a 2010 population of 185,079 over an area of 4,028 square miles [8]. Supplementing their dental clinic operation in Kea'au, Bay Clinic also had a mobile van, that traveled to and was open for a week each month in Hilo, Pahoa, and Na'alehu (ZIP codes 96720, 96721, 96778, and 96772), during the years of the study. Dental services have been offered at Bay Clinic since 2003. Bay Clinic is an accredited American Dental Association (ADA) site for one of the advanced education in general dentistry (AEGD) residency programs at Lutheran Medical Center's Department of Dental Medicine (LMC Dental). The AEGD residency program at Bay Clinic started in July 2005. General dentists treated all patients at Bay Clinic until a pediatric dentist joined the team in Spring 2011 to help see the more challenging pediatric cases every Friday.

WCCHC is the only safety net dental practice on the west side of O'ahu, the island known to be the urban center of Hawai'i. O'ahu has the largest population and population density of the islands with a 2010 population of 953,207 over 597 square miles [8]. Dental services have been offered at WCCHC as early as 1982. WCCHC is an accredited American Dental Association (ADA) site for one of the AEGD and pediatric dentistry programs at LMC Dental. The AEGD residency program at WCCHC started in July 2005. General dentists treated all patients until

the pediatric dentistry residency program began in July 2009, after which pediatric dentists or pediatric dentistry residents saw the majority of children for their dental appointments. On occasion, general dentists, particularly AEGD residents with expressed interest in pursuing pediatric dentistry, would also treat straightforward cases of middle school children and young adolescents at WCCHC.

Moloka'i Community Health Center (MCHC) is the only CHC on the more rural island of Moloka'i, with a 2010 population of 7,345 over an area of 260 square miles [8]. Dental services have been offered at MCHC since 2006. Only one general dentist treats all the patients at MCHC.

IRB Approval & Funding

The dental director at Bay Clinic was the first to provide a letter of support to be submitted to the UCSF institutional review board (IRB), called the Committee on Human Research (CHR), to partake in the study. Upon receipt of Bay Clinic's letter, the UCSF CHR application was submitted May 17, 2012, and the retrospective study period of August 1, 2007 to August 1, 2012 was decided as feasible to provide data to answer the test hypotheses of interest. Arrangements were made to begin 40 hours of data collection August 28–31, 2012, at Bay Clinic. The UCSF CHR application was approved June 11, 2012.

WCCHC has its own IRB and approval process. A Request to Conduct Research Form first needed to be completed for pre-IRB approval; this was submitted on June 14, 2012. On July 11, 2012, the PI received a request for revisions. After all requested revisions were completed and upon pre-IRB approval, the IRB application was submitted and approved September 11, 2012. This IRB approval then was submitted as a modification of the existing approved protocol of UCSF CHR. The CHR modification was approved November 14, 2012 to include WCCHC in the study. Preparations were made to begin data collection at WCCHC December 26–29, 2012,

and the PI submitted her immunization record and completed the remaining HIPAA compliance training required for her to perform research at WCCHC. The WCCHC IRB also required that they co-own the data. On June 19, 2012, a Material Transfer Agreement (MTA) request form, along with the approved CHR application, was submitted to Industry Contracts at the UCSF Office of Innovation, Technology, & Alliances. On June 21, 2012, a UCSF Industry Contracts Officer was assigned to manage the MTA with WCCHC. After the WCCHC IRB approved the study, the assigned UCSF Industry Contracts Officer forwarded a WCCHC Research Data Request Form to the PI to complete to proceed with the MTA; the WCCHC Research Data Request Form was sent back to the UCSF Industry Contracts Officer on October 11, 2012. UCSF Industry Contracts worked with the WCCHC IRB to fully execute a Data Use Agreement for the PI to receive a limited data set from WCCHC. This WCCHC HIPAA Compliance Data Use Agreement was signed by the Wai'ananae District Comprehensive Health and Hospital Board, Incorporated and the Regents of the University of California on behalf of its San Francisco Campus on November 15, 2012.

MCHC took the initial steps to participate in the study, but due to a change in leadership, data transfer from MCHC could not be worked out. During the study period, MCHC used CyDental for their electronic chart system. The PI met in person with the Chief Financial Officer, the Dental Director, and the IT Technician of MCHC on site on September 4, 2012, after her first week of data collection at Bay Clinic. The PI presented her research study, after which MCHC committed to partake in the study under the condition that funds be made available to compensate the IT technician for data extraction. MCHC provided the PI a letter of support on September 11, 2012, to submit to UCSF CHR, and the CHR Modification to include MCHC was approved November 14, 2012.

While the PI had already begun data collection at the other 2 clinics, the PI worked with UCSF Research Management Services and applied to the following funding sources:

- California Society of Pediatric Dentistry Investigator-Initiated Research Grant
- UC Pacific Rim Research Program Advanced Graduate Research Fellowship
- 3M ESPE Preventative Pediatric Dentistry Postdoctoral Research Fellowship
- UCSF Graduate Division Earle C. Anthony Research Travel Award
- HMSA Foundation Grant
- UCSF Graduate Division Graduate Student Research Award
- UCSF Graduate Students' Association Conference Travel Fund Award
- UCSF CTSI Hardship Funding Award
- UCSF CTSI Resident Research Training Program Travel Award

The PI was selected for all 5 of the above UCSF funding awards for which she applied. By Fall 2013, funds were secured to have MCHC take part in the study. However, MCHC underwent a change in Dental and IT Directors in October 2013 with plans to restructure the Dental Department. Unfortunately, as a result, the Dental Director could not accommodate and manage having MCHC partake in the study.

Data Collection

Bay Clinic and WCCHC both used paper chart systems during the study period. All encounters including broken appointments were recorded for each patient. At both clinics, charts were organized alphabetically on the shelves. The sampling process was convenient. All charts had the patient's birthdate on it with the chart identification number. So long as the patient was between the ages of 0-12 years old during the study period, the chart was taken off various shelves throughout the alphabet to be further examined for the study. The shelves at

Bay Clinic had charts of patients whose last visit was within the last 5 years; the shelves at WCCHC had charts of patients whose last visit was within the last 2 years. To account for the inactive patients at WCCHC, a box of purged 2009 charts was also examined for the study.

The dentists and dental staff originally documented all data at the CHCs as part of a standardized practice created for non-research purposes. The limited data set was entered into an Excel spreadsheet using passwords and encryption software (True Crypt), which uses a state of the art encryption algorithm. The Excel spreadsheet was set up with validation rules to improve data quality and reduce data entry errors.

After reviewing a dental chart, the PI affixed a label with the study identification number to the chart to facilitate subsequent systematic resampling of 30 charts from each clinic. After the initial data collection period, 30 charts were systematically sampled from each clinic for re-review to check for reliability of data extraction. Agreement statistics were used to assess reliability.

A total of 4 trips were made to Bay Clinic:

Mon 08/27/2012 7:00am-6:00pm

Tues 08/28/2012 7:00am-6:00pm

Wed 08/29/2012 7:00am-6:00pm

Thurs 08/30/2012 7:00am-6:00pm

Fri 08/31/2012 7:00am-6:00pm

Tues 05/07/2013 7:00am-6:00pm

Wed 05/08/2013 7:00am-6:00pm

Thurs 05/09/2013 7:00am-6:00pm

Fri 05/10/2013 7:00am-6:00pm

Mon 12/31/2012 7:00am-12:00pm

Wed 01/02/2013 7:00am-6:00pm

Thurs 01/03/2013 7:00am-6:00pm

Fri 01/04/2013 7:00am-6:00pm

Mon 01/07/2013 7:00am-5:00pm

Mon 09/30/2013 7:00am-6:00pm

Tues 10/01/2013 7:00am-6:00pm

Wed 10/02/2013 7:00am-6:00pm

Thurs 10/03/2013 7:00am-6:00pm

A total of 2 trips were made to WCCHC:

Wed 12/26/2012 8:00am-4:00pm

Thurs 12/27/2012 8:00am-4:00pm

Fri 12/28/2012 8:00am-4:00pm

Sat 12/29/2012 8:00am-4:00pm

Fri 09/27/2013 8:00am-4:00pm

Sat 09/28/2013 8:00am-4:00pm

Fri 10/04/2013 8:00am-4:00pm

Sat 10/05/2013 8:00am-4:00pm

Variables Assessed

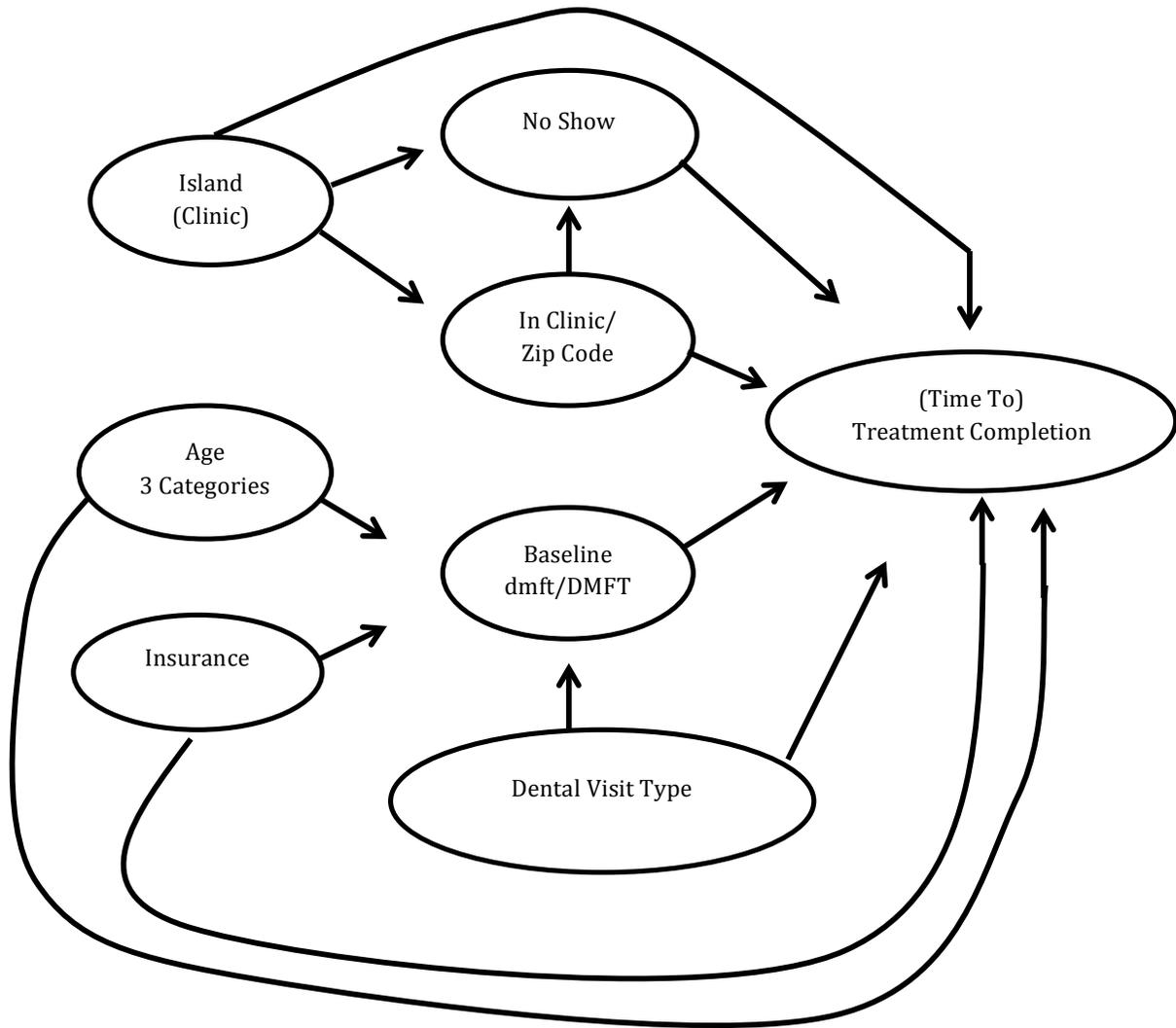
The month and year of every chart entry, including no shows, was recorded; the day was recorded as the 1st day of the month. Documenting only the month and year and not the day prevented any protected health information (PHI) from being in the database, but still allowed calculating time between visits. Demographic data extracted from existing charts included the patient's age (years), gender, race and ethnicity, dental insurance status, and ZIP code. Clinical variables abstracted consisted of the number of decayed, missing (due to caries), and filled primary and permanent teeth (dmft and DMFT); the number of existing and planned stainless steel crowns at the time of treatment planning, most often during an examination visit; the number of existing and planned 3-surface (MOD) restorations on primary teeth; whether extractions due to caries were performed; and whether antibiotics were prescribed due to dental infection. Utilization variables include the type of dental visit (emergency, examination, preventive, and/or treatment); whether or not the appointment was broken; whether the treatment plan was completed; the time to treatment plan completion; and whether the child was referred to a specialist. Furthermore, if the dental visit was a preventive visit, whether fluoride application and/or placement of sealants were indicated was recorded.

Data Analysis

Age, race, ZIP code, and dmft/DMFT were categorized for data analysis. Age was categorized into 3 groups: 1) 0-4 years, 2) 5-9 years, 3) 10-12 years to follow the NHANES 1999-2004 reports' categorization of age. Based on frequencies, race was categorized into 4 categories for analyses: 1) Asian, 2) Hawaiian, 3) Other, and 4) Pacific Islander. The "Other" category consisted of patients reported as African American, Native American, White, and Unknown. The ZIP codes of the dental clinic in Keaau (96749) and the areas to where the dental van traveled in Hilo (96720), Pahoa (96778), and Naalehu (96772) were clustered together to represent closer geographic proximity to dental care in their residency ZIP code; UDS mapper was used to create any geographic maps. The sum of dmft and DMFT were grouped together according to the 4 ranges: 1) 0, 2) 1-4, 3) 5-8, 4) 9-20; each range roughly corresponds to frequency quartiles.

To examine the demographics of all the children, data only from the first recorded visit were analyzed. To calculate dmft and DMFT, only data from the first recorded examination visits were utilized. Of primary interest was how the multiple variables relate to the outcomes of 1) no shows, 2) treatment plan completion, and 3) emergency visits. Figure 2 depicts a directed acyclic graph (DAG) illustrating the hypothesized causal framework among the variables which guided the analysis plan. For no shows and emergency visits, data from all visits were utilized. Only examination visits were used to examine relationships of variables to treatment completion.

Figure 2. Direct Acyclic Graph Depicting the Relationships of Interest



Data analysis included descriptive statistics: (1) percentages, (2) means, and (3) standard deviations. For bivariable and multivariable analyses, categorical variables (e.g. untreated caries, missed appointments, emergency visits, and treatment plan completion) were analyzed with chi-square tests, logistic regression models, and generalized linear mixed effects models (logit link) for multiple visits per patient; continuous variables (e.g. time to treatment plan completion) were analyzed with negative binomial regression for positive count dmft and DMFT,

and linear mixed effects models for the logarithm of time to treatment completion for multiple treatment plans per patient. The threshold of significance was set to be $p \leq 0.05$.

RESULTS

Approximately 2000 charts were reviewed at Bay Clinic and WCCHC; 234 of 800 charts were reviewed at Bay Clinic, and 98 of 400 charts were reviewed at WCCHC to provide data for 329 patients. Three pediatric patients at Bay Clinic were excluded, yielding a total of 329 patients and 1666 encounters for the study (Table 1).

Table 1. Summary of Chart Review Recordings

	Bay Clinic	WCCHC	Total
Patients	231	98	329
Encounters	1126	540	1666

Bay Clinic

At Bay Clinic, 234 of approximately 800 charts were reviewed, and 1126 encounters were recorded. 3 pulled charts were excluded due to patients having SHCN and not meeting the inclusion criteria.

Tables 2. First Recorded Chart Review Visits at Bay Clinic

2a. Demographics

2b. Caries Status

Tables 2a.i. – 2a.vi. display the patient demographics of the 231 charts reviewed at Bay Clinic. There were 123 (53.3%) males and 108 (46.7%) females (Table 2a.i.). Almost half the children (n=46.8%) were in the age range of 5-9 years old at the time of his/her first recorded chart review visit (Table 2a.ii.). The mean age of 231 children was 5.7 years (SD=3, range=1-12). The majority (n=220; 95.2%) were Medicaid patients (Table 2a.iii.).

Table 2a.i. Gender Demographics at First Recorded Bay Clinic Chart Review Visit (n=231)

GENDER	Frequency	Percent
Male	123	53.3
Female	108	46.7

Table 2a.ii. Age Demographics at First Recorded Bay Clinic Chart Review Visit (n=231)

AGE GROUP	Frequency	Percent
0-4 years	80	34.6
5-9 years	108	46.8
10-12 years	43	18.6

Table 2a.iii. Dental Coverage Demographics at First Recorded Bay Clinic Chart Review Visit (n=231)

DENTAL COVERAGE	Frequency	Percent
Cash	5	2.2
Insurance	6	2.6
Medicaid	220	95.2

Figure 3, Table 2a.iv., and Figure 4 display the home ZIP codes of the 231 children whose charts were reviewed at Bay Clinic and how the ZIP codes were clustered according to whether there was an accessible clinic or dental van within the ZIP code. 23.4% (n=54) of patients resided outside the ZIP codes of Bay Clinic's dental clinic and van.

Figure 3. ZIP Code Distributions at First Recorded Bay Clinic Chart Review Visit (n=231)

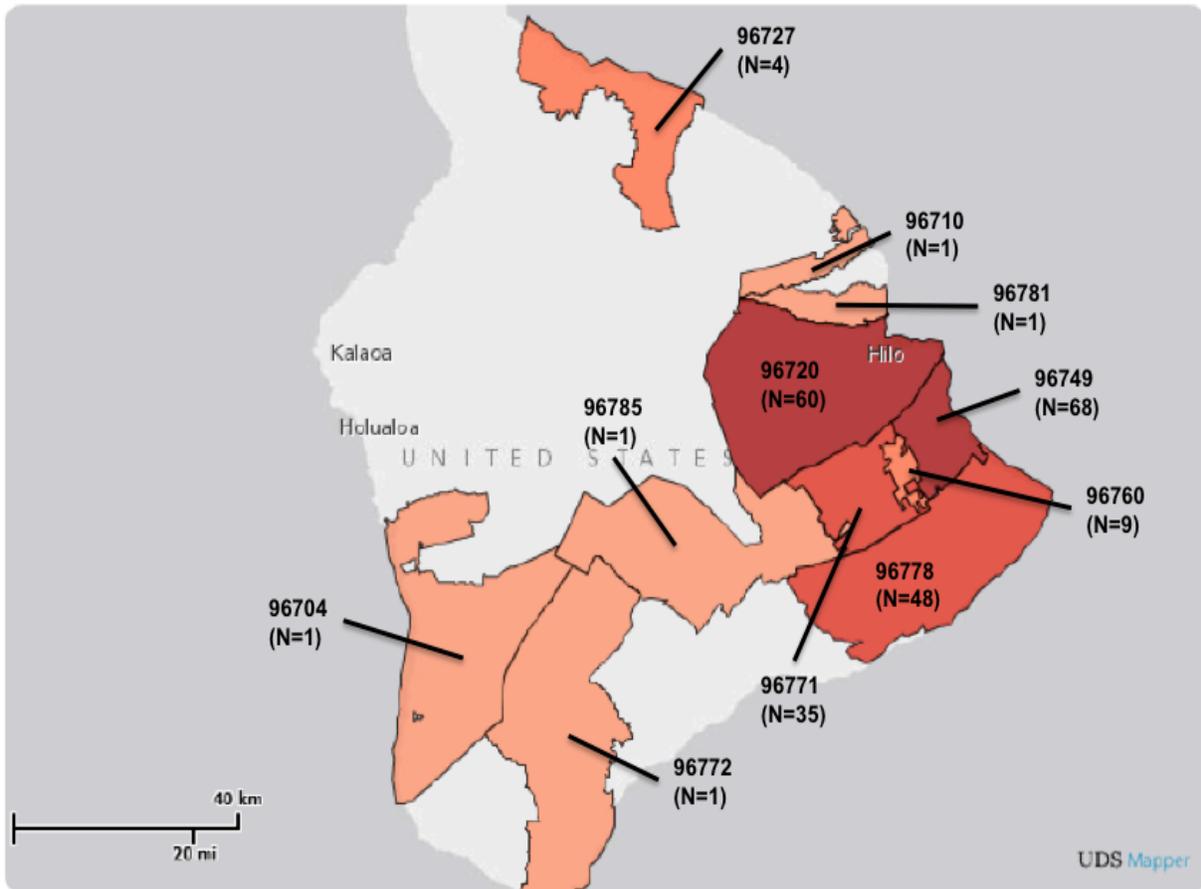
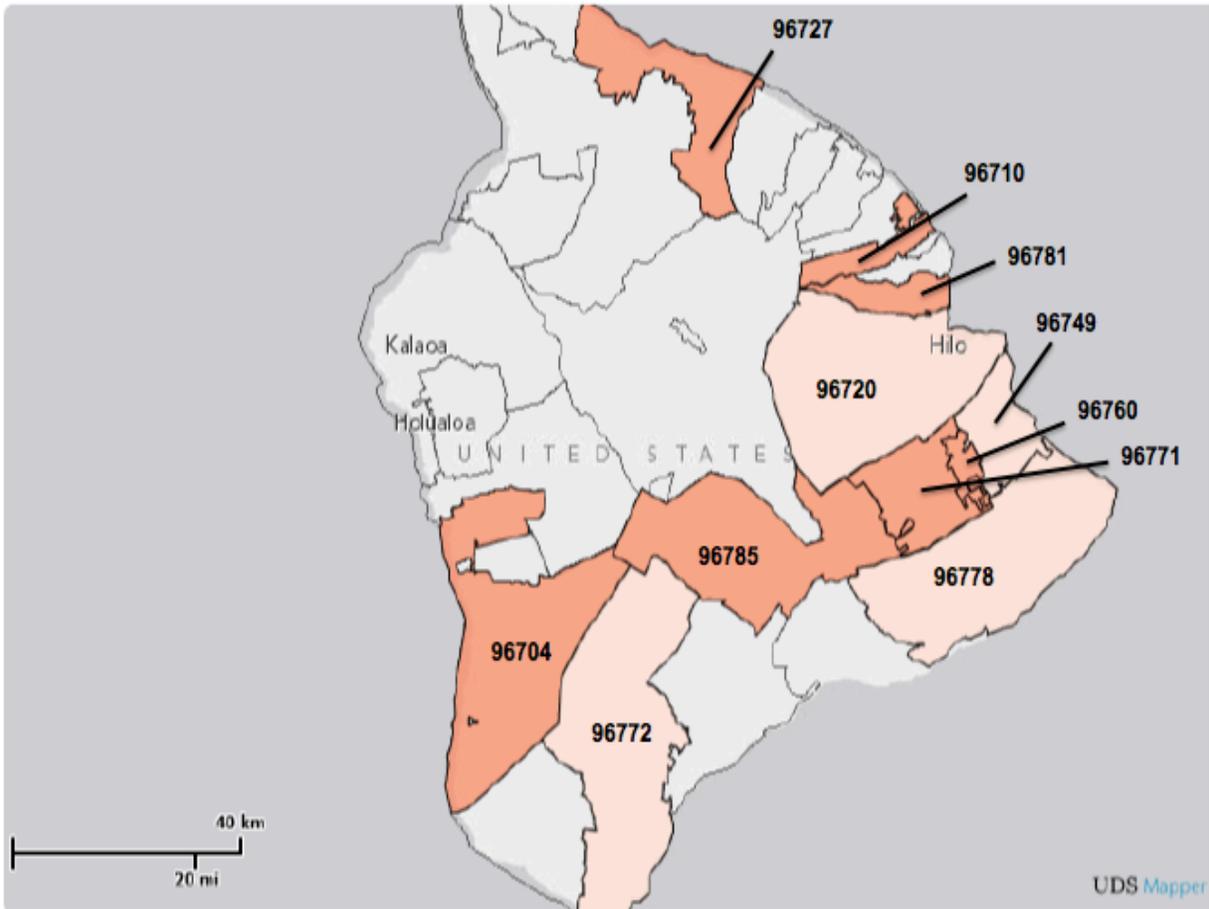


Table 2a.iv. ZIP Code Distributions at First Recorded Bay Clinic Chart Review Visit (n=231)

ZIP CODE (CITY)	Frequency	Percent
96704 (Captain Cook)	1	0.4
96710 (Hakalau)	1	0.4
96720 (Hilo)	61	26.4
96727 (Honokaa)	4	1.7
96749 (Keaau)	68	29.4
96760 (Kurtistown)	9	3.9
96771 (Mountain View)	35	15.2
96772 (Naalehu)	1	0.4
96778 (Pahoa)	48	20.8
96781 (Papaikou)	1	0.4
96785 (Volcano)	1	0.4
96788 (Pukalani)	1	0.4

Figure 4. Dental Clinic/Van Availability within ZIP Codes of Patients at Bay Clinic (n=231)



- Inside clinic
- Outside clinic

At Bay Clinic, 66 (28.6%) of the children were Asian; 57 (24.7%) were Hawaiian (Tables 2a.v.). The second table associated with Tables 2a.v. displays the race groupings used for generalized linear mixed effects models; the remainder of the results will display race according to these groupings. 80.9% (n=187) of patients reported he/she was not Hispanic (Table 2a.vi.)

Tables 2a.v. Race Demographics at First Recorded Bay Clinic Chart Review Visit (n=231)

RACE	Frequency	Percent
Asian	66	28.6
Black	6	2.6
Hawaiian	57	24.7
Native American	11	4.8
Pacific Islander	32	13.8
Unknown	18	7.8
White	41	17.7

RACE	Frequency	Percent
Asian	66	28.6
Hawaiian	57	24.7
Other	76	32.9
Pacific Islander	32	13.8

Table 2a.vi. Ethnicity Demographics at First Recorded Bay Clinic Chart Review Visit (n=231)

ETHNICITY	Frequency	Percent
Hispanic	44	19.1
Non-Hispanic	187	80.9

At the first recorded visit during the chart review time period, 138 (63.6%) of 217 children had existing dental caries. For 14 of the 231 children, whether caries was present or not at the first recorded visit could not be determined from the child's chart (Table 2b.i.).

Table 2b.i. Presence of Untreated Caries at First Recorded Bay Clinic Chart Review Visit (n=217)

UNTREATED CARIES PRESENT?	Frequency	Percent
No	79	36.4
Yes	138	63.6

Frequency Missing = 14

Tables 3. First Examination Visits at Bay Clinic

3a. Demographics

3b. Caries Status

At Bay Clinic, 208 of the 231 subjects had at least one comprehensive oral examination visit. Tables 3a.i. – 3a.vi. display the demographics of the 208 patients at the time of his/her first recorded examination visit at Bay Clinic. Of those having at least one exam visit, 51.9% (n=108) were males and 48.1% (n=100) were females (Table 3a.i.). 44.7% (n=93) of the children were 5-9 years old for his/her recorded first exam visit (Table 3a.ii.). The mean age of 208 children having had at least one exam visit during the years of the study was 6.1 years (SD=3.2, range=1-12). Most children (n=199; 95.7%) had Medicaid dental insurance coverage (Table 3a.iii.). 76.9% (n=160) of patients lived within the ZIP code of the clinic or dental van (Table 3a.iv.). 62 (29.8%) of the children were Asian; 51 (24.5%) were Hawaiian (Table 3a.v.). 80.8% (n=168) reported he/she was not Hispanic (Table 3a.vi.).

Table 3a.i. Gender Demographics at First Recorded Examination Visit at Bay Clinic (n=208)

GENDER	Frequency	Percent
Male	108	51.9
Female	100	48.1

Table 3a.ii. Age Demographics at First Recorded Examination Visit at Bay Clinic (n=208)

AGE GROUP	Frequency	Percent
0-4 years	76	36.5
5-9 years	93	44.7
10-12 years	39	18.8

Table 3a.iii. Dental Coverage Demographics at First Recorded Examination Visit at Bay Clinic (n=208)

DENTAL COVERAGE	Frequency	Percent
Cash	2	0.9
Insurance	7	3.4
Medicaid	199	95.7

Table 3a.iv. Geographic Demographics at First Recorded Examination Visit at Bay Clinic (n=208)

RESIDENCE IN CLINIC/VAN ZIP CODE?	Frequency	Percent
No	48	23.1
Yes	160	76.9

Table 3a.v. Race Demographics at First Recorded Examination Visit at Bay Clinic (n=208)

RACE	Frequency	Percent
Asian	62	29.8
Hawaiian	51	24.5
Other	66	31.7
Pacific Islander	29	14.0

Table 3a.vi. Ethnicity Demographics at First Recorded Examination Visit at Bay Clinic (n=208)

ETHNICITY	Frequency	Percent
Hispanic	40	19.2
Non-Hispanic	168	80.8

At the first recorded exam visit during the chart review time period, 114 (57.9%) of the 197 exams were noted to have existing dental caries at Bay Clinic. From the chart review, whether caries was present or not could not be determined from 11 of the 208 children recorded to have had at least one exam (Table 3b.i.)

Table 3b.i. Presence of Untreated Caries at First Recorded Bay Clinic Chart Review Visit (n=197)

UNTREATED CARIES PRESENT?	Frequency	Percent
No	83	42.1
Yes	114	57.9

Frequency Missing = 11

At the time of the first exam, the caries experience (sum of dmft and DMFT) was known for 184 out of 208 children. Table 3b.ii. depicts of the number of first recorded chart review exams noted to have the designated caries experience of the primary and permanent dentition. Mean caries experience was 4.5 (median=3.0; SD=4.9, range=0-20).

Table 3b.ii. Caries Experience of Primary and Permanent Dentition at First Recorded Bay Clinic Chart Review Visit (n=184)

dmft + DMFT	Frequency	Percent
0	57	31.0
1	16	8.7
2	12	6.5
3	9	4.9
4	17	9.2
5	8	4.4
6	9	4.9
7	8	4.4
8	13	7.1
9	6	3.3
10	5	2.7
11	6	3.3
12	4	2.2
13	3	1.6
14	2	1.1
15	3	1.6
17	1	0.5
18	2	1.1
19	1	0.5
20	2	1.1

Frequency Missing = 24

At the time of first exam, dmft was known for 185 children. Table 3b.iii. depicts the number of first recorded chart review exams noted to have the designated dmft. Mean dmft was 4.0 (median=2.0; SD=4.7, range=0-20). dmft could not be determined for 23 of the 208 children who had at least one exam during the study period.

Table 3b.iii. Caries Experience of Primary Dentition at First Recorded Bay Clinic Chart Review Visit (n=185)

dmft	Frequency	Percent
0	67	36.2
1	14	7.6
2	14	7.6
3	10	5.4
4	14	7.6
5	11	6.0
6	10	5.4
7	7	3.8
8	11	6.0
9	3	1.6
10	3	1.6
11	4	2.2
12	3	1.6
13	4	2.2
14	2	1.1
15	3	1.6
16	1	0.5
17	1	0.5
18	1	0.5
19	1	0.5
20	1	0.5

Frequency Missing = 23

At the time of first exam, DMFT was known for 184 children at Bay Clinic. Table 3b.iv. depicts the number of first recorded chart review exams noted to have the designated DMFT. Mean DMFT was 0.5 (median=0; SD=1.4, range=0-8). DMFT could not be determined for 24 of the 208 children who had at least one exam during the study period.

Table 3b.iv. Caries Experience of Permanent Teeth at First Recorded Bay Clinic Chart Review Visit (n=184)

DMFT	Frequency	Percent
0	150	81.5
1	9	4.9
2	7	3.8
3	4	2.2
4	12	6.5
8	2	1.1

Frequency Missing = 24

The remainder of the caries experience results for Bay Clinic will display a child's caries experiences as the sum of dmft and DMFT according to the 4 ranges: 0, 1-4, 5-8, and 9-20. Each range roughly corresponds to frequency quartiles and was used for generalized linear mixed effects model analysis.

Tables 4. All Visits at Bay Clinic

4a. Demographics

4b. Caries Status

4c. Utilization

Tables 4a – 4c. describe the breakdown of the 1126 encounters recorded from 231 charts at Bay Clinic. Males made up 57.7% (n=650) of 1126 encounters (Table 4a.i.). 662 of the 1126 encounters at Bay Clinic came from children in the 5-9 years age group (Table 4a.ii.). 97.4% (n=220) of the patients coming in had Medicaid for dental coverage (Table 4a.iii.). 80.3% (n=904) of visits came from patients residing in the clinic/van ZIP code (Table 4a.iv.). 340 (30.2%) of the encounters were from Asian children; 287 (25.5%) were Hawaiian (Table 4a.v.). Most (n=961; 85.3%) were not Hispanic (Table 4a.vi.). For 73.0% (n=804) of the 1102 visits, active caries was noted to be present; whether caries was present or not could not be determined for 24 of the visits (Table 4b.i.).

Table 4a.i. Gender Demographics of All Visits at Bay Clinic (n=1126)

GENDER	Frequency	Percent
Male	650	57.7
Female	476	42.3

Table 4a.ii. Age Demographics of All Visits at Bay Clinic (n=1125)

AGE GROUP	Frequency	Percent
0-4 years	222	19.7
5-9 years	662	58.8
10-12 years	241	21.4

Frequency Missing = 1

Table 4a.iii. Dental Coverage Demographics of All Visits at Bay Clinic (n=1126)

DENTAL COVERAGE	Frequency	Percent
Cash	11	1.0
Insurance	18	1.6
Medicaid	1097	97.4

Table 4a.iv. Geographic Demographics of All Visits at Bay Clinic (n=1126)

RESIDENCE IN CLINIC/VAN ZIP CODE?	Frequency	Percent
No	222	19.7
Yes	904	80.3

Table 4a.v. Race Demographics of All Visits at Bay Clinic (n=1126)

RACE	Frequency	Percent
Asian	340	30.2
Hawaiian	287	25.5
Other	322	28.6
Pacific Islander	177	15.7

Table 4a.vi. Ethnicity Demographics of All Visits at Bay Clinic (n=1126)

ETHNICITY	Frequency	Percent
Hispanic	165	14.7
Non-Hispanic	961	85.3

Table 4b.i. Presence of Untreated Caries at All Visits at Bay Clinic (n=1102)

UNTREATED CARIES PRESENT?	Frequency	Percent
No	298	27.0
Yes	804	73.0

Frequency Missing = 24

At Bay Clinic, 47.4% (n=507) of 1070 known visits were scheduled for exam. 40.2% (n=430) of visits were scheduled for treatment or had treatment completed; this includes treatment for emergency visits and the visit was counted as a treatment visit. 133 emergency visits were consultation and no treatment was provided (Table 4c.i.). 3.3% (n=126) of the 937 scheduled appointments (Exam and Treatment) were broken (Table 4c.ii.). In total, 201 (17.9%) out of 1126 encounters were emergency visits (Table 4c.iii.) regardless of whether treatment was provided or not. In Table 4c.i., 39 (72.2%) of the 56 missing visit type were preventive visits – mostly sealants.

Table 4c.i. Visit Type Frequencies at Bay Clinic (n=1070)

VISIT TYPE	Frequency	Percent
Emergency Consults	133	12.4
Exam	507	47.4
Treatment*	430	40.2

Frequency Missing = 56

* includes treatment completed during emergency visits

Table 4c.ii. Broken Appointment Frequency at Bay Clinic (n=944)

BROKEN APPOINTMENT?	Frequency	Percent
No	818	86.7
Yes	126	13.3

Frequency Missing = 182

Table 4c.iii. Emergency Visit Frequency at Bay Clinic (n=1126)

EMERGENCY VISIT?	Frequency	Percent
No	925	82.1
Yes	201	17.9

Tables 5. Broken Appointments at Bay Clinic based on data collected from all visits

5a. Demographics

5b. Caries Status

5c. Utilization

5d. Correlates

For 944 scheduled visits at Bay Clinic, 13.5% (n=72) of males and 13.2% (n=54) of females broke their appointments (Table 5a.i.). 81 (15.0%) of 539 5-9 year olds missed their scheduled appointments at Bay Clinic (Table 5a.ii.). With regards to dental coverage, the 7 visits of patients paying cash never missed their appointment. In 3 (20%) of the 15 visits of insurance patients, they did not show for their appointment (Table 5a.iii.). 22.1% of scheduled Bay Clinic visits from patients living outside the clinic/van ZIP codes did not show for their appointment compared to a broken appointment rate of 11.3% for those patients living within a clinic/van ZIP code (Table 5a.iv.) Table 5a.v. show Pacific Islanders to be the race with higher frequency (19.4%) for broken appointments at Bay Clinic. At Bay Clinic, Hispanics and Non-Hispanics broke appointments with about equal frequency (15.0% and 13.1%) (Table 5a.vi.).

Table 5a.i. Broken Appointments by Gender at Bay Clinic

BROKEN APPOINTMENT?			
	Frequency (Percentage)		
GENDER	No	Yes	Total
Male	462 (86.5)	72 (13.5)	534
Female	356 (86.8)	54 (13.2)	410
Total	818	126	944
Frequency Missing = 182			

Table 5a.ii. Broken Appointments By Age at Bay Clinic

BROKEN APPOINTMENT?			
	Frequency (Percentage)		
AGE GROUP	No	Yes	Total
0-4 years	172 (91.0)	17 (9.0)	189
5-9 years	458 (85.0)	81 (15.0)	539
10-12 years	187 (87.0)	28 (13.0)	215
Total	817	126	943
Frequency Missing = 183			

Table 5a.iii. Broken Appointments By Dental Coverage at Bay Clinic

BROKEN APPOINTMENT?			
	Frequency (Percentage)		
DENTAL COVERAGE	No	Yes	Total
Cash	7 (100.0)	0(0.0)	7
Insurance	12 (80.0)	3 (20.0)	15
Medicaid	799 (86.7)	123 (13.3)	922
Total	818	126	944
Frequency Missing = 182			

Table 5a.iv. Broken Appointments by Geography at Bay Clinic

BROKEN APPOINTMENT?			
	Frequency (Percentage)		
RESIDENCE IN CLINIC/VAN ZIP CODE?	No	Yes	Total
No	141 (77.9)	40 (22.1)	181
Yes	677 (88.7)	86 (11.3)	763
Total	818	126	944
Frequency Missing = 182			

Table 5a.v. Broken Appointments by Race at Bay Clinic

BROKEN APPOINTMENT?			
	Frequency (Percentage)		
RACE	No	Yes	Total
Asian	259 (88.4)	34 (11.6)	293
Hawaiian	203 (85.3)	35 (14.7)	238
Other	240 (89.2)	29 (10.8)	269
Pacific Islander	116 (80.6)	28 (19.4)	144
Total	818	126	944
Frequency Missing = 182			

Table 5a.vi. Broken Appointments by Ethnicity at Bay Clinic

BROKEN APPOINTMENT?			
	Frequency (Percentage)		
ETHNICITY	No	Yes	Total
Hispanic	113 (85.0)	20 (15.0)	133
Non-Hispanic	705 (86.9)	106 (13.1)	811
Total	818	126	944
Frequency Missing = 182			

The frequency of broken appointments from patients with or without dental decay are similar at 12.7% and 11.1% respectively at Bay Clinic (Table 5b.i.). Children were more likely to miss their treatment appointments (16.2%) than their exam and cleaning appointments (9.5%) (Table 5c.i.).

Table 5b.i. Presence of Untreated Caries at Broken Appointments at Bay Clinic

BROKEN APPOINTMENT?			
Frequency (Percentage)			
UNTREATED CARIES PRESENT?	No	Yes	Total
No	239 (88.9)	30 (11.1)	269
Yes	578 (87.3)	84 (12.7)	662
Total	817	114	931
Frequency Missing = 195			

Table 5c.i. Visit Type Frequencies at Bay Clinic

BROKEN APPOINTMENT?			
Frequency (Percentage)			
VISIT TYPE	No	Yes	Total
Emergency Consults	9 (75.0)	3 (25.0)	12
Exam	459 (90.5)	48 (9.5)	507
Treatment*	311 (83.8)	60 (16.2)	371
Total	779	111	890
Frequency Missing = 236			

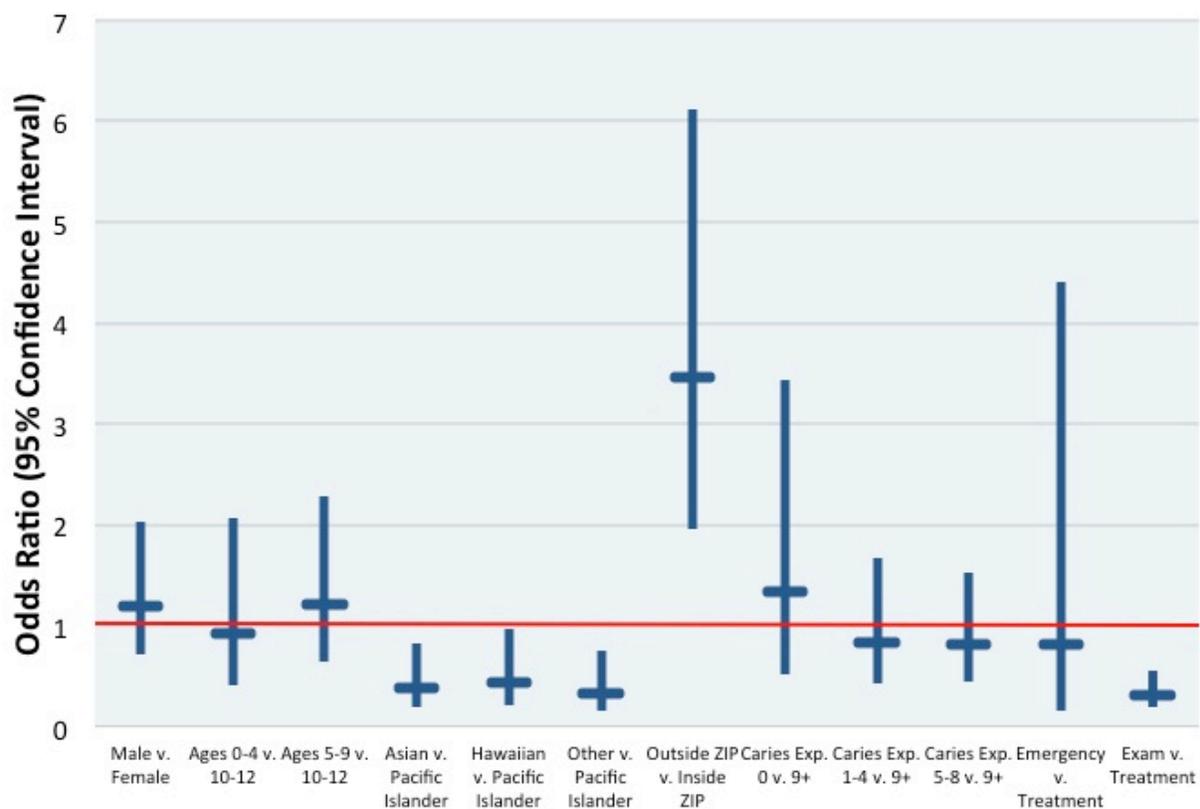
* includes treatment completed during emergency visits

The adjusted odds ratios (aORs), adjusting for all other effects, along with the lower and upper 95% confidence intervals (LCI, UCI), and the p values are displayed in Table 5d.i. for various effects on broken appointments. Pacific Islanders were more likely to break appointments compared to Asians (p=0.0142), Hawaiians (p=0.0385), and all other races (p=0.0082). (Figure 5). Those residing outside the clinic/van ZIP code were 3.5 times more likely to break appointments (p<0.0001) (Figure 5). Treatment appointments were 3 times more likely to be broken than examination appointments (p<0.0001). The overall race effect (3 df, p=0.0369), local residence within the clinic /van ZIP code (p<0.0001), and overall visit type (2 df, p=0.0002) were all significantly related to broken appointments.

Table 5d.i. Adjusted Odds Ratios for Broken Appointments at Bay Clinic

Effect	Explanatory Variable	aOR	LCI	UCI	p value
Gender	Male v. Female	1.208	0.717	2.034	0.4754
Age	0-4 v. 10-12	0.923	0.412	2.067	0.8450
	5-9 v. 10-12	1.215	0.649	2.275	0.5417
Race	Asian v. Pacific Islander	0.394	0.188	0.826	0.0142
	Hawaiian v. Pacific Islander	0.452	0.213	0.958	0.0385
	Other v. Pacific Islander	0.342	0.155	0.754	0.0082
ZIP Code	Outside ZIP v. Inside ZIP	3.465	1.964	6.115	<0.0001
Caries Experience	Caries Exp. 0 v. 9+	1.340	0.522	3.438	0.5425
	Caries Exp. 1-4 v. 9+	0.836	0.420	1.662	0.6073
	Caries Exp. 5-8 v. 9+	0.822	0.441	1.533	0.5361
Visit Type	Emergency v. Treatment	0.817	0.152	4.401	0.8140
	Exam v. Treatment	0.318	0.186	0.544	<0.0001

Figure 5. Correlates for Broken Appointments at Bay Clinic



Tables 6. Broken Examination Appointments at Bay Clinic based on data collected from all examination visits

6a. Demographics

6b. Caries Status

For 507 scheduled exams at Bay Clinic, 9.6% of males and 9.3% of females broke their exam appointment (Table 6a.i.). For 506 scheduled exams, 5-9 year olds made up the age group more likely to miss their exam appointment. Of 272 5-9 year olds who had exam appointments, 33 (12.1%) broke their exam appointment (Table 6a.ii.). With regards to dental coverage, the 5 visits of patients paying cash and the 10 insurance patients never missed their exam appointments. 48 (9.8%) of the 15 492 visits of Medicaid patients did not show for their exam appointment (Table 6a.iii.). Those residing outside the clinic or van ZIP code were almost twice as likely (15.8%) to miss their exam appointments compared to those residing in the clinic or van ZIP code (8.0%) (Table 6a.iv.). Races other than Asian, Hawaiian, and Pacific Islander had a higher frequency (35.4%) of breaking their exam appointments. They represented 10.0% (n=7) of all other races scheduled to have exam appointments (Table 6a.v.). As for ethnicity, 8.1% of Hispanics and 9.8% of Non-Hispanics broke their exam appointments at Bay Clinic (Table 6a.vi.).

Table 6a.i. Broken Examination Appointments by Gender at Bay Clinic

BROKEN EXAM APPOINTMENT?			
	Frequency (Percentage)		
GENDER	No	Yes	Total
Male	264 (90.4)	28 (9.6)	292
Female	195 (90.7)	20 (9.3)	215
Total	459	48	507
Frequency Missing = 8			

Table 6a.ii. Broken Examination Appointments by Age at Bay Clinic

BROKEN EXAM APPOINTMENT?			
	Frequency (Percentage)		
AGE GROUP	No	Yes	Total
0-4 years	127 (96.2)	5 (3.8)	132
5-9 years	239 (87.9)	33 (12.1)	272
10-12 years	92 (90.2)	10 (9.8)	102
Total	458	48	506
Frequency Missing = 9			

Table 6a.iii. Broken Examination Appointments by Dental Coverage at Bay Clinic

BROKEN EXAM APPOINTMENT?			
	Frequency (Percentage)		
DENTAL COVERAGE	No	Yes	Total
Cash	5 (100.0)	0 (0.0)	5
Insurance	10 (100.0)	0 (0.0)	10
Medicaid	444 (90.2)	48 (9.8)	492
Total	459	48	507
Frequency Missing = 8			

Table 6a.iv. Broken Examination Appointments by Geography at Bay Clinic

BROKEN EXAM APPOINTMENT?			
Frequency (Percentage)			
RESIDING IN CLINIC ZIP CODE?	No	Yes	Total
No	80 (84.2)	15 (15.8)	95
Yes	379 (92.0)	33 (8.0)	412
Total	459	48	507
Frequency Missing = 8			

Table 6a.v. Broken Examination Appointments by Race at Bay Clinic

BROKEN EXAM APPOINTMENT?			
Frequency (Percentage)			
RACE	No	Yes	Total
Asian	146 (92.4)	12 (7.6)	158
Hawaiian	101 (89.4)	12 (10.6)	113
Other	149 (89.8)	17 (10.2)	166
Pacific Islander	63 (90.0)	7 (10.0)	70
Total	459	48	507
Frequency Missing = 8			

Table 6a.vi. Broken Examination Appointments by Ethnicity at Bay Clinic

BROKEN EXAM APPOINTMENT?			
Frequency (Percentage)			
ETHNICITY	No	Yes	Total
Hispanic	80 (91.9)	7 (8.1)	87
Non-Hispanic	379 (90.2)	41 (9.8)	420
Total	459	48	507
Frequency Missing = 8			

At Bay Clinic, the frequency of broken exam appointments from patients with or without dental decay were similar at 7.4% and 7.5% respectively (Table 6b.i.). For 482 scheduled exams with known caries experience, no extent of caries experience indicated more likelihood to miss an exam appointment (Table 6b.ii.).

Table 6b.i. Presence of Untreated Caries at Broken Examination Appointments at Bay Clinic

BROKEN EXAM APPOINTMENT?			
Frequency (Percentage)			
UNTREATED CARIES PRESENT?	No	Yes	Total
No	199 (92.6)	16 (7.4)	215
Yes	260 (92.5)	21 (7.5)	281
Total	459	37	496
Frequency Missing = 19			

Table 6b.ii. Caries Experience and Broken Examination Appointments at Bay Clinic

BROKEN EXAM APPOINTMENT?			
Frequency (Percentage)			
dmft + DMFT	No	Yes	Total
0	114 (93.4)	8 (6.6)	122
1-4	110 (92.4)	9 (7.6)	119
5-8	113 (94.2)	7 (5.8)	120
9+	116 (95.9)	5 (4.1)	121
Total	453	29	482
Frequency Missing = 33			

Tables 7. Treatment Completion at Bay Clinic based on data collected from all examination visits

7a. Demographics

7b. Caries Status

7c. Utilization – Not Applicable

7d. Correlates

At Bay Clinic, 66.0% of males and 60.5% of females completed their treatment plans (Table 7a.i.). Table 7a.ii. shows that the older the child, the more likely he/she did not complete his/her treatment plan. At Bay Clinic, 0-4 year olds completed their treatment plan 72.7% of the time, while 10-12 year olds completed their treatment plan 60.6% of the time. With regards to dental coverage, 2 (28.6%) of 7 treatment plans of insurance patients were completed. In contrast 166 (64.8%) of 256 treatment plans of Medicaid patients were completed (Table 7a.iii.). Those residing outside the clinic/van ZIP code did not complete their treatment plans 52.8% of the time compared to 32.4% of those residing in the clinic/van ZIP code (Table 7a.iv.). Table 7a.v. shows that Pacific Islanders had the highest frequency (47.6%) for not completing treatment plans at Bay Clinic. As for ethnicity, Hispanics did not complete their treatment plans 45.0% of the time, while Non- Hispanics did not complete their treatment plans 35.0% of the time (Table 7a.vi.).

Table 7a.i. Treatment Completion by Gender at Bay Clinic

TREATMENT COMPLETION			
	Frequency (Percentage)		
GENDER	No	Yes	Total
Male	50 (34.0)	97 (66.0)	147
Female	47 (39.5)	72 (60.5)	119
Total	97	169	266
Frequency Missing = 249			

Table 7a.ii. Treatment Completion by Age at Bay Clinic

TREATMENT COMPLETION			
	Frequency (Percentage)		
AGE GROUP	No	Yes	Total
0-4 years	15 (27.3)	40 (72.7)	55
5-9 years	55 (38.2)	89 (61.8)	144
10-12 years	26 (39.4)	40 (60.6)	66
Total	96	169	265
Frequency Missing = 250			

Table 7a.iii. Treatment Completion by Dental Coverage at Bay Clinic

TREATMENT COMPLETION			
	Frequency (Percentage)		
DENTAL COVERAGE	No	Yes	Total
Cash	2 (66.7)	1 (33.3)	3
Insurance	5 (71.4)	2 (28.6)	7
Medicaid	90 (35.2)	166 (64.8)	256
Total	97	169	266
Frequency Missing = 249			

Table 7a.iv. Treatment Completion by Geography at Bay Clinic

TREATMENT COMPLETION			
	Frequency (Percentage)		
RESIDENCE IN CLINIC/VAN ZIP CODE?	No	Yes	Total
No	28 (52.8)	25 (47.2)	53
Yes	69 (32.4)	144 (67.6)	213
Total	97	169	266
Frequency Missing = 249			

Table 7a.v. Treatment Completion by Race at Bay Clinic

TREATMENT COMPLETION			
	Frequency (Percentage)		
RACE	No	Yes	Total
Asian	33 (36.7)	57 (63.3)	90
Hawaiian	28 (40.6)	41 (59.4)	69
Other	16 (24.2)	49 (75.4)	65
Pacific Islander	20 (47.6)	22 (52.4)	42
Total	97	169	266
Frequency Missing = 249			

Table 7a.vi. Treatment Completion by Ethnicity at Bay Clinic

TREATMENT COMPLETION			
	Frequency (Percentage)		
ETHNICITY	No	Yes	Total
Hispanic	18 (45.0)	22 (55.0)	40
Non-Hispanic	79 (35.0)	147 (65.0)	226
Total	97	169	266
Frequency Missing = 249			

The treatment plan for a child who did not have caries was preventive sealants. Of these 29 caries-free children at Bay Clinic, 24.1% (n=7) did not complete their preventive treatment plans. This 24.1% unfortunately is lower than the 38.0% (n=90) of 237 children who did not follow through on treating the caries found at their examination visit (Table 7b.i.). The highest frequency of children who did not complete their treatment plans were those whose caries experience were in the 5-8 (44.0%) and 9+ (41.5%) groups (Table 7b.ii.)

Table 7b.i. Untreated Caries Presence and Treatment Completion at Bay Clinic

TREATMENT COMPLETION			
Frequency (Percentage)			
UNTREATED CARIES PRESENT?	No	Yes	Total
No	7 (24.1)	22 (75.9)	29
Yes	90 (38.0)	147 (62.0)	237
Total	97	169	266
Frequency Missing = 249			

Table 7b.ii. Caries Experience and Treatment Completion at Bay Clinic

TREATMENT COMPLETION			
Frequency (Percentage)			
dmft + DMFT	No	Yes	Total
0	1 (10.0)	9 (90.0)	10
1-4	21 (25.9)	60 (74.1)	81
5-8	40 (44.0)	51 (56.0)	91
9+	34 (41.5)	48 (58.5)	82
Total	96	168	264
Frequency Missing = 251			

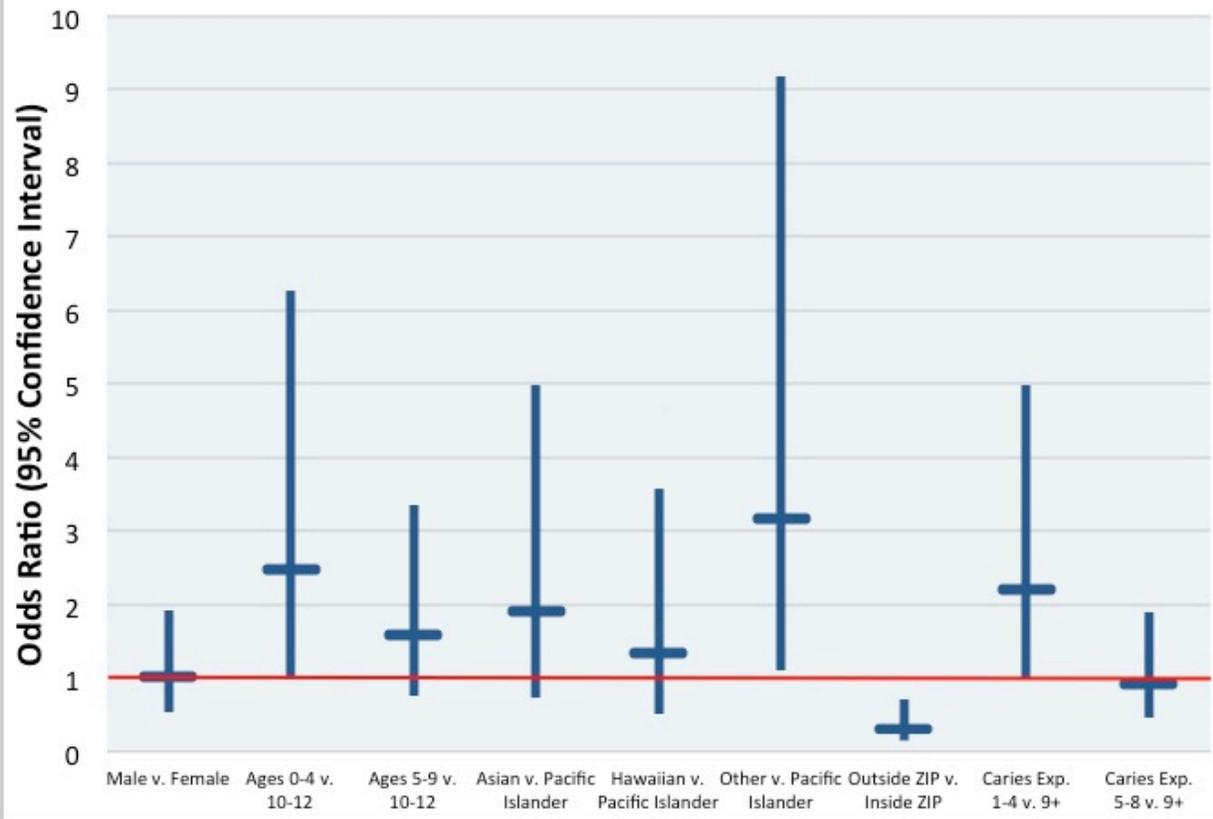
Table 7c. Utilization is not applicable due to a utilization measure already being analyzed at only examination visits.

The adjusted odds ratios (aORs), adjusting for all other effects, along with the lower and upper 95% confidence intervals (LCI, UCI), and the p values are displayed for various effects on treatment plan completion in Table 7d.i. Races other than Asian and Hawaiian were 3.2 times more likely complete treatment plans compared to Pacific Islanders ($p=0.033$) (Figure 6). Those residing outside the clinic/van ZIP code were 3.1 times more likely to not complete the treatment plan ($p=0.004$) (Figure 6). Residence within the clinic/van ZIP code was significantly related to treatment plan completion ($p=0.004$); the overall caries experience effect (2 df, $p=0.066$) was closely related as well.

Table 7d.i. Adjusted Odds Ratios for Treatment Completion at Bay Clinic

Effect	Explanatory Variable	aOR	LCI	UCI	p value
Gender	Male v. Female	1.023	0.541	1.932	0.9440
Age	0-4 v. 10-12	2.476	0.980	6.259	0.3691
	5-9 v. 10-12	1.588	0.752	3.353	0.0552
Race	Asian v. Pacific Islander	1.913	0.734	4.983	0.1815
	Hawaiian v. Pacific Islander	1.347	0.509	3.564	0.5450
	Other v. Pacific Islander	3.179	1.102	9.171	0.0327
ZIP Code	Outside ZIP v Inside ZIP	0.325	0.151	0.699	0.0044
Caries Experience	Caries Exp. 1-4 v. 9+	2.210	0.979	4.990	0.0562
	Caries Exp. 5-8 v. 9+	0.937	0.461	1.907	0.8571

Figure 6. Correlates for Treatment Completion at Bay Clinic



Tables 8. Time to Treatment Completion at Bay Clinic based on data collected from all examination visits

8a. Demographics

8b. Caries Status

If the time to treatment completion is over 6 months, then no 6-month recall examination was completed to establish a new treatment plan. At Bay Clinic, 41.3% (n=38) of males and 42.7% (n=29) of females completed their treatment plans in 1 month (Table 8a.i.). 40.7% (n=13) of 0-4 year olds, 44.3% (n=39) of 5-9 year olds, and 37.5% (n=15) of 10-12 year olds completed their treatment plans in 1 month (Table 8a.ii.). The 1 cash patient completed his/her treatment plan in 2 months at Bay Clinic. The 1 insurance patient completed his/her treatment plan in 1 month. 41.8% (n=6) of Medicaid patients completed their treatment plans in 1 month (Table 8a.iii.). The highest percentage (n=8; 33.3%) of patients residing outside the clinic/van ZIP code completed their treatment plans in 1 month. This is lower than the 43.4% of local patients (n=59) who also completed their treatment plans in 1 month. A higher percentage of patients residing outside the clinic/van ZIP code took over 1 month to complete their treatment plans compared to the local patients (Table 8a.iv.). A higher percentage of Hawaiian and Pacific Islander children required over a month to complete their treatment plans. 57.5% (n=27) of children, who are not Asian, Hawaiian, or Pacific Islander, completed their treatment plans in 1 month (Table 8a.v.). As for ethnicity, 33.3% (n=6) of Hispanics and 43.0% (n=61) of non-Hispanics completed their treatment plans in 1 month. 27.8% (n=5) of Hispanics and 18.3% (n=26) of non-Hispanics completed their treatment plans in 2 months (Table 8a.vi.).

Table 8a.i. Treatment Completion Time by Gender at Bay Clinic

TIME TO TREATMENT COMPLETION									
MONTHS									
GENDER	0	1	2	3	4	5	6	7	Total
Male	14 (15.2)	38 (41.3)	12 (13.1)	15 (16.3)	5 (5.4)	2 (2.2)	5 (5.4)	1 (1.1)	92
Female	6 (8.8)	29 (42.7)	19 (27.9)	6 (8.8)	4 (5.9)	3 (4.4)	1 (1.5)	0 (0.0)	68
Total	20	67	31	21	9	5	6	1	160
Frequency Missing = 355									

Table 8a.ii. Treatment Completion Time by Age at Bay Clinic

TIME TO TREATMENT COMPLETION									
MONTHS									
AGE GROUP	0	1	2	3	4	5	6	7	Total
0-4 years	5 (15.6)	13 (40.7)	7 (21.9)	5 (15.6)	1 (3.1)	0 (0.0)	1 (3.1)	0 (0.0)	32
5-9 years	6 (6.8)	39 (44.3)	20 (22.7)	10 (11.4)	6 (6.8)	4 (4.6)	3 (3.4)	0 (0.0)	88
10-12 years	9 (22.5)	15 (37.5)	4 (10.0)	6 (15.0)	2 (5.0)	1 (2.5)	2 (5.0)	1 (2.5)	40
Total	20	67	31	21	9	5	6	1	160
Frequency Missing = 355									

Table 8a.iii. Treatment Completion Time by Dental Coverage at Bay Clinic

TIME TO TREATMENT COMPLETION										
MONTHS										
DENTAL COVERAGE	0	1	2	3	4	5	6	7	Total	
Cash	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1
Insurance	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1
Medicaid	20 (12.7)	66 (41.8)	30 (18.9)	21 (13.3)	9 (5.7)	5 (3.2)	6 (3.8)	1 (0.6)		158
Total	20	67	31	21	9	5	6	1		160
Frequency Missing = 355										

Table 8a.iv. Treatment Completion Time by Geography at Bay Clinic

TIME TO TREATMENT COMPLETION										
MONTHS										
RESIDING IN CLINIC/VAN ZIP CODE?	0	1	2	3	4	5	6	7	Total	
No	4 (16.7)	8 (33.3)	5 (20.8)	5 (20.8)	2 (8.4)	0 (0.0)	0 (0.0)	0 (0.0)		24
Yes	16 (11.8)	59 (43.4)	26 (19.1)	16 (11.8)	7 (5.2)	5 (3.6)	6 (4.4)	1 (0.7)		136
Total	20	67	31	21	9	5	6	1		160
Frequency Missing = 355										

Table 8a.v. Treatment Completion Time by Race at Bay Clinic

TIME TO TREATMENT COMPLETION									
MONTHS									
RACE	0	1	2	3	4	5	6	7	Total
Asian	5 (8.9)	24 (42.9)	13 (23.2)	8 (14.3)	3 (5.4)	2 (3.6)	1 (1.8)	0 (0.0)	56
Hawaiian	6 (16.6)	12 (33.3)	5 (13.9)	3 (8.3)	5 (13.9)	2 (5.6)	2 (5.6)	1 (2.8)	36
Other	4 (8.5)	27 (57.5)	7 (14.9)	6 (12.8)	1 (2.1)	1 (2.1)	1 (2.1)	0 (0.0)	47
Pacific Islander	5 (23.8)	4 (19.1)	6 (28.6)	4 (19.1)	0 (0.0)	0 (0.0)	2 (9.4)	0 (0.0)	21
Total	20	67	31	21	9	5	6	1	160
Frequency Missing = 355									

Table 8a.vi. Treatment Completion Time by Ethnicity at Bay Clinic

TIME TO TREATMENT COMPLETION									
MONTHS									
ETHNICITY	0	1	2	3	4	5	6	7	Total
Hispanic	3 (16.7)	6 (33.3)	5 (27.8)	3 (16.7)	1 (5.5)	0 (0.0)	0 (0.0)	0 (0.0)	18
Non-Hispanic	17 (12.0)	61 (43.0)	26 (18.3)	18 (12.7)	8 (5.6)	5 (3.5)	6 (4.2)	1 (0.7)	142
Total	20	67	31	21	9	5	6	1	160
Frequency Missing = 355									

At Bay Clinic, completing their treatment plans in 1 month were 40.9% (n=9) of caries-free patients and 42.1% (n=58) of patients with untreated caries (Table 8b.i.). The higher the caries experience, the more likely completing treatment will take longer. For children with caries experience of 9+, 69.7% (n=30) required over a month (\bar{x} =2.6, SD=1.7, range=0-6) to complete their treatment plan compared to 46.9% (n=23) of children with caries experience of 5-8 (\bar{x} =1.8, SD=1.9, range=0-7) and 28.8% (n=17) of children with caries experience of 1-4 (\bar{x} =1.2, SD=1.2, range=0-6). 3 out of 9 caries-free children also spent over a month to complete their likely preventive treatment plans (Table 8b.ii.). The caries experience effect was significantly related to time to treatment completion ($p=0.0003$).

Table 8b.i. Untreated Caries Presence and Treatment Completion Time at Bay Clinic

TIME TO TREATMENT COMPLETION									
MONTHS									
UNTREATED CARIES PRESENT?	0	1	2	3	4	5	6	7	Total
No	7 (31.8)	9 (40.9)	3 (13.6)	1 (4.6)	0 (0.0)	0 (0.0)	2 (9.1)	0 (0.0)	22
Yes	13 (9.4)	58 (42.1)	28 (20.3)	20 (14.5)	9 (6.5)	5 (3.6)	4 (2.9)	1 (0.7)	138
Total	20	67	31	21	9	5	6	1	160
Frequency Missing = 355									

Table 8b.ii. Caries Experience and Treatment Completion Time at Bay Clinic

TIME TO TREATMENT COMPLETION									
MONTHS									
dmft + DMFT	0	1	2	3	4	5	6	7	Total
0	3 (33.3)	3 (33.3)	2 (22.2)	1 (11.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	9
1-4	9 (15.3)	33 (55.9)	9 (15.3)	4 (6.8)	2 (3.3)	1 (1.7)	1 (1.7)	0 (0.0)	59
5-8	5 (10.2)	21 (42.9)	9 (18.4)	9 (18.4)	2 (4.1)	1 (2.0)	1 (2.0)	1 (2.0)	49
9+	3 (7.0)	10 (23.3)	11 (25.5)	7 (16.3)	5 (11.6)	3 (7.0)	4 (9.3)	0 (0.0)	43
Total	20	67	31	21	9	5	6	1	160
Frequency Missing = 355									

Tables 9. Emergency Visits at Bay Clinic based on data collected from all visits

9a. Demographics

9b. Caries Status

9c. Utilization

At Bay Clinic, 126 (62.7%) of 201 emergency visits were from males, making up 19.4% of all 650 male visits (Table 9a.i.). 139 of 201 emergency visits came from patients ages 5-9 years old. They made up 21.0% of all 662 5-9 year olds visits to Bay Clinic (Table 9a.ii.). 193 (96.0%) of 201 emergency visits were patients with Medicaid insurance. This 193 made up 17.6% of the 1097 Medicaid children visiting Bay Clinic (Table 9a.iii.). 155 (77.1%) out of 201 emergency visits were from patients who resided in the ZIP code. They made up 17.2% of the 904 visits from patients residing in the ZIP code (Table 9a.iv.). There was variance amongst the races walking into the clinic for emergency (Table 9a.v.). As for ethnicity, 169 (84.1%) out of 201 emergency visits were Non-Hispanic patients. They made up 17.6% (n=169) of all recorded Non-Hispanic children coming in to Bay Clinic (Table 9a.vi.).

Table 9a.i. Emergency Visits by Gender at Bay Clinic

EMERGENCY VISIT			
Frequency (Percentage)			
GENDER	No	Yes	Total
Male	524 (80.6)	126 (19.4)	650
Female	401 (84.2)	75 (15.8)	476
Total	925	201	1126

Table 9a.ii. Emergency Visits by Age at Bay Clinic

EMERGENCY VISIT			
	Frequency (Percentage)		
AGE GROUP	No	Yes	Total
0-4 years	188 (84.7)	34 (15.3)	222
5-9 years	523 (79.0)	139 (21.0)	662
10-12 years	213 (88.4)	28 (11.6)	241
Total	924	201	1125
Frequency Missing = 1			

Table 9a.iii. Emergency Visits by Dental Coverage at Bay Clinic

EMERGENCY VISIT			
	Frequency (Percentage)		
DENTAL COVERAGE	No	Yes	Total
Cash	6 (54.6)	5 (45.4)	11
Insurance	15 (83.3)	3 (16.7)	18
Medicaid	904 (82.4)	193 (17.6)	1097
Total	925	201	1126

Table 9a.iv. Emergency Visits by Geography at Bay Clinic

EMERGENCY VISIT			
	Frequency (Percentage)		
RESIDENCE IN CLINIC/VAN ZIP CODE?	No	Yes	Total
No	176 (79.3)	46 (20.7)	222
Yes	749 (82.8)	155 (17.2)	904
Total	925	201	1126

Table 9a.v. Emergency Visits by Race at Bay Clinic

EMERGENCY VISIT			
	Frequency (Percentage)		
RACE	No	Yes	Total
Asian	291 (85.6)	49 (14.4)	340
Hawaiian	234 (81.5)	53 (18.5)	287
Other	262 (81.4)	60 (18.6)	322
Pacific Islander	138 (78.0)	39 (22.0)	177
Total	925	201	1126

Table 9a.vi. Emergency Visits by Ethnicity at Bay Clinic

EMERGENCY VISIT			
	Frequency (Percentage)		
ETHNICITY	No	Yes	Total
Hispanic	133 (80.6)	32 (19.4)	165
Non-Hispanic	792 (82.4)	169 (17.6)	961
Total	925	201	1126

At Bay Clinic, dental decay was present for 158 (82.7%) of the 191 emergency visits at Bay Clinic. These visits represent 19.6% of the 804 visits from patients known to have dental decay at Bay Clinic (Table 9b.i.). The higher the caries experience, the higher the likelihood for an emergency visit. 15.8% of patients with caries experience of 9+ came in for emergency compared to 6.4% and 11.0% of patients with caries experience of 0 and 1-4 respectively (Table 9b.ii.). Treatment was completed for 33.8% (n=68) for the 201 emergency visits. Treatment during emergency visits represented 15.8% (n=68) of the 430 treatment visits at Bay Clinic (Table 9c.i.).

Table 9b.i. Untreated Caries Presence and Emergency Visits Time at Bay Clinic

EMERGENCY VISIT			
Frequency (Percentage)			
UNTREATED CARIES PRESENT?	No	Yes	Total
No	265 (88.9)	33 (11.1)	298
Yes	646 (80.4)	158 (19.6)	804
Total	911	191	1102
Frequency Missing = 24			

Table 9b.ii. Caries Experience and Emergency Visits at Bay Clinic

EMERGENCY VISIT			
Frequency (Percentage)			
dmft + DMFT	No	Yes	Total
0	132 (93.6)	9 (6.4)	141
1-4	227 (89.0)	28 (11.0)	255
5-8	273 (87.8)	38 (12.2)	311
9+	262 (84.2)	49 (15.8)	311
Total	894	124	1018
Frequency Missing = 108			

Table 9c.i. Visit Type and Emergency Visits at Bay Clinic

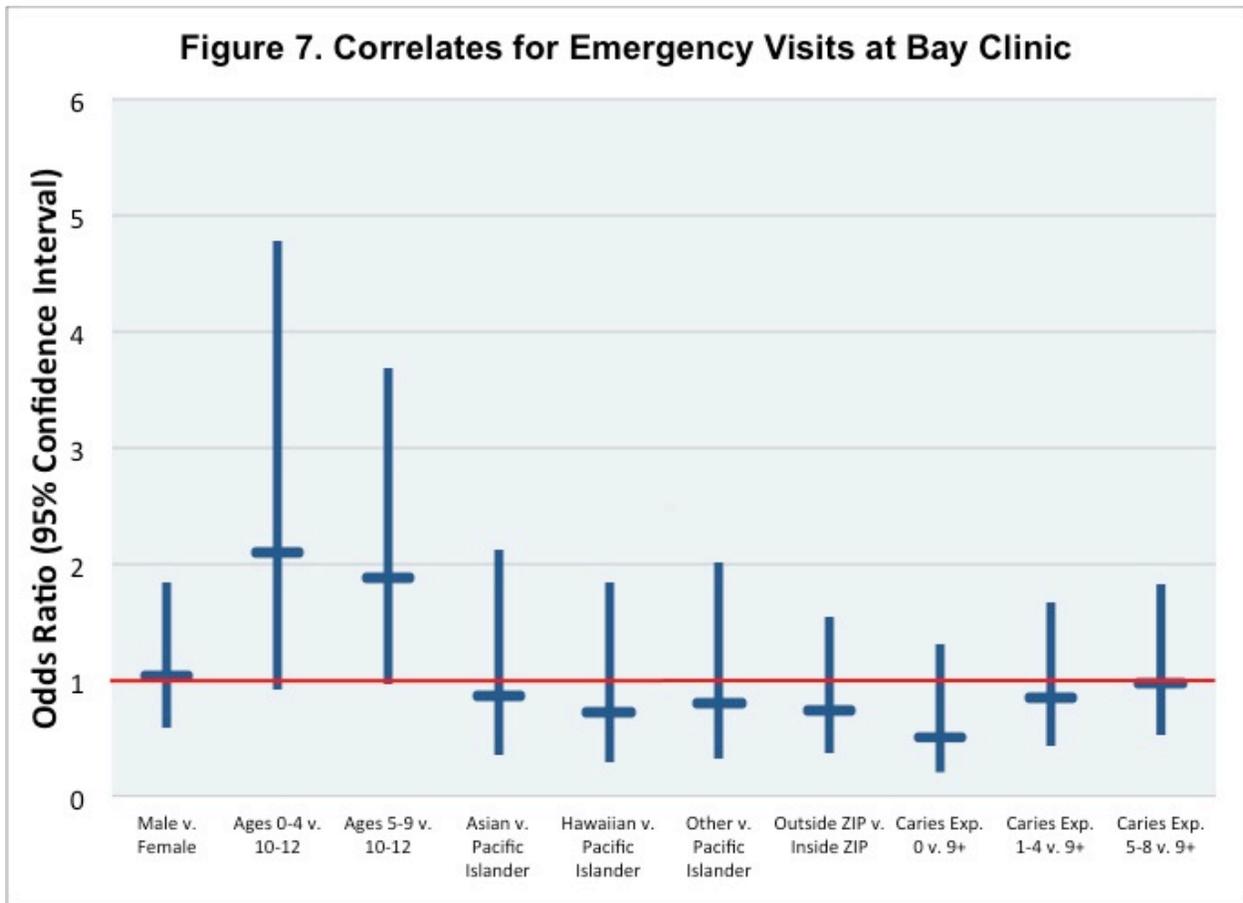
EMERGENCY VISIT			
	Frequency (Percentage)		
VISIT TYPE	No	Yes	Total
Emergency Consults	0 (0.0)	133 (100.0)	133
Exam	507 (100.0)	0 (0.0)	507
Treatment*	362 (84.2)	68 (15.8)	430
Total	869	201	1070
Frequency Missing = 56			

* includes treatment completed during emergency visits

The adjusted odds ratios (aORs), adjusting for all other effects, along with the lower and upper 95% confidence intervals (LCI, UCI), and the p values are displayed for various effects on emergency visits in Table 9d.i. Children ages 0-4 years old were 2.1 times more likely to walk in for an emergency visit than children ages 10-12 years old ($p=0.0778$) (Figure 7); children ages 5-9 years old were 1.9 times more likely ($p=0.0654$). Those residing outside the clinic/van ZIP code were not more likely to not complete the treatment plan ($p=0.4379$) (Figure 7). No overall effect was significantly related to emergency visits.

Table 9d.i. Adjusted Odds Ratios for Emergency Visits at Bay Clinic

Effect	Explanatory Variable	aOR	LCI	UCI	p-value
Gender	Male v. Female	1.036	0.584	1.841	0.9022
Age	0-4 v. 10-12	2.099	0.921	4.783	0.0778
	5-9 v. 10-12	1.880	0.961	3.679	0.0654
Race	Asian v. Pacific Islander	0.876	0.362	2.118	0.7675
	Hawaiian v. Pacific Islander	0.734	0.294	1.835	0.5061
	Other v. Pacific Islander	0.814	0.328	2.017	0.6541
ZIP Code	Outside ZIP v. Inside ZIP	0.752	0.366	1.548	0.4379
Caries Experience	Caries Exp. 0 v. 9+	0.517	0.205	1.302	0.1612
	Caries Exp. 1-4 v. 9+	0.850	0.431	1.674	0.6369
	Caries Exp. 5-8 v. 9+	0.982	0.531	1.818	0.9540



WCCHC

At WCCHC, 98 charts were pulled out of 400 charts, and 540 encounters were recorded (Table 1).

Tables 10. First Recorded Chart Review Visits at WCCHC

10a. Demographics

10b. Caries Status

Tables 10a.i. – 10a.iv. display the demographics of the 98 charts reviewed at WCCHC. There were 46 (47.4%) males and 51 (52.6%) females; the gender of one subject was not recorded (Table 10a.i.). Almost half of the subjects (n=48; 49.0%) were 0-4 years old at the time of his/her first recorded chart review visit (Table 10a.ii.). The mean age of 98 children was 5.3 years (SD=3.5, range=0-12). Most subjects (n=85; 86.7%) were Medicaid (Table 10a.iii.). Race and ethnicity were not requested on the patient intake forms at WCCHC and therefore could not be recorded.

Table 10a.i. Gender Demographics at First Recorded WCCHC Chart Review Visit (n=98)

GENDER	Frequency	Percent
Male	46	47.4
Female	51	52.6

Frequency Missing = 1

Table 10a.ii. Age Demographics at First Recorded WCCHC Chart Review Visit (n=98)

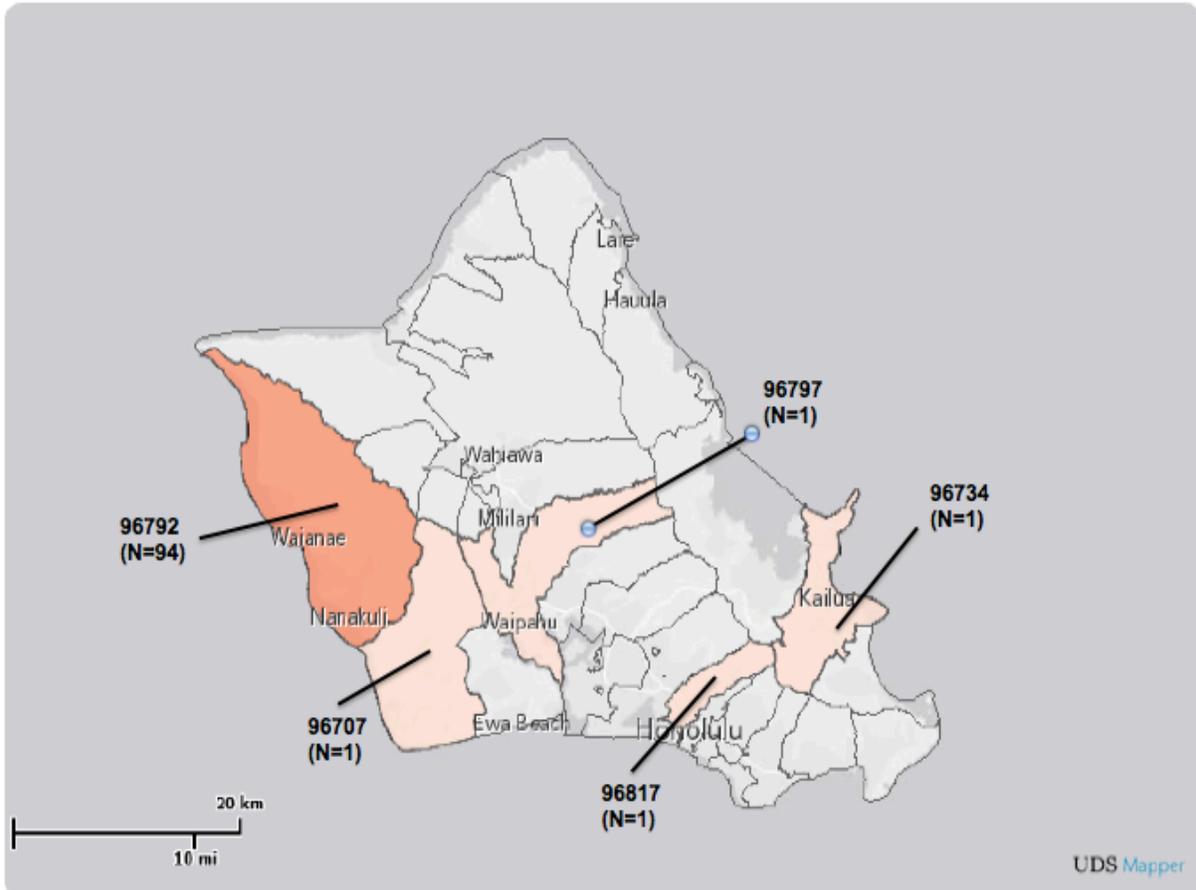
AGE GROUP	Frequency	Percent
0-4 years	48	49.0
5-9 years	34	34.7
10-12 years	16	16.3

Table 10a.iii. Dental Coverage Demographics at First Recorded WCCHC Chart Review Visit (n=98)

DENTAL COVERAGE	Frequency	Percent
Cash	2	2.1
Insurance	11	11.2
Medicaid	85	86.7

Figure 8 and Table 10a.iv. display the home ZIP codes of the 98 children whose charts were reviewed at WCCHC. ZIP codes at WCCHC were not analyzed further because 96.0% of the patients resided in Wai'anae (ZIP code 96792).

Figure 8. ZIP Code Distributions at First Recorded WCCHC Chart Review Visit (n=98)



Percent of Patients



Table 10a.iv. ZIP Code Demographics at First Recorded WCCHC Chart Review Visit (n=98)

CITY (ZIP CODE)	Frequency	Percent
96707 (Kapolei)	1	1.0
96734 (Kailua)	1	1.0
96792 (Wai'anae)	94	96.0
96797 (Waipahu)	1	1.0
96817 (Honolulu)	1	1.0

At the first recorded visit during the chart review time period, 58 (63.0%) of 92 children had existing dental caries at WCCHC. For 6 of the 98 children, whether caries was present or not at the first recorded visit could not be determined from the child's chart (Table 10b.i.).

Table 10b.i. Presence of Untreated Caries at First Recorded WCCHC Chart Review Visit (n=92)

UNTREATED CARIES PRESENT?	Frequency	Percent
No	34	37.0
Yes	58	63.0

Frequency Missing = 6

Tables 11. First Examination Visits at WCCHC

11a. Demographics

11b. Caries Status

At WCCHC, 94 of the 98 subjects had at least one comprehensive oral examination visit. Tables 11a.i. – 11a.iii. display the demographics of the 94 patients at the time of his/her first recorded examination visit at WCCHC. Of those having at least one exam visit, 48.4% (n=45) were males and 51.6% (n=48) were females (Table 11a.i.). Half of the children (n=47) were 0-4 years old for his/her recorded first exam visit (Table 11a.ii.). The mean age of 94 children having had at least one exam visit during the years of the study was 5.2 years (SD=3.5, range=0-12). Most children (n=82; 87.2%) had Medicaid dental insurance coverage (Table 11a.iii.).

Table 11a.i. Gender Demographics at First Recorded Examination Visit at WCCHC (n=93)

GENDER	Frequency	Percent
Male	45	48.4
Female	48	51.6

Frequency Missing = 1

Table 11a.ii. Age Demographics at First Recorded Examination Visit at WCCHC (n=94)

AGE GROUP	Frequency	Percent
0-4 years	47	50.0
5-9 years	31	33.0
10-12 years	16	17.0

Table 11a.iii. Dental Coverage Demographics at First Recorded Examination Visit at WCCHC (n=94)

DENTAL COVERAGE	Frequency	Percent
Cash	1	1.1
Insurance	11	11.7
Medicaid	82	87.2

At the first recorded exam visit during the chart review time period, 53 (60.9%) of the 87 exams were noted to have existing dental caries at WCCHC. From the chart review, whether caries was present or not could not be determined from 7 of the 94 children recorded to have had at least one exam (Table 11b.i.). The caries experience (sum of dmft and DMFT) was known for 85 out of 94 children. Table 11b.ii. depicts the number of first recorded chart review exams noted to have the designated caries experience. Mean caries experience was 3.7 (median=2.0; SD=3.9, range=0-14). dmft was known for 85 children. Table 11b.iii. depicts the number of first recorded chart review exams noted to have the designated dmft. Mean dmft was 3.1 (median=2.0; SD=3.7, range=0-14). dmft could not be determined for 9 of the 94 children who had at least one exam during the study period. DMFT was known for 85 children at WCCHC. Table 11b.iv. depicts the number of first recorded chart review exams noted to have the designated DMFT. Mean DMFT was 0.6 (median=0; SD=1.5, range=0-7). DMFT could not be determined for 9 of the 94 children who had at least one exam during the study period.

Table 11b.i. Presence of Untreated Caries at First Recorded WCCHC Chart Review Visit (n=87)

UNTREATED CARIES PRESENT?	Frequency	Percent
No	34	39.1
Yes	53	60.9

Frequency Missing = 7

Table 11b.ii. Caries Experience of Primary and Permanent Dentition at First Recorded WCCHC Chart Review Visit (n=85)

dmft + DMFT	Frequency	Percent
0	28	32.9
1	6	7.1
2	6	7.1
3	6	7.1
4	12	14.1
5	3	3.5
6	5	5.9
7	5	5.9
8	3	3.5
9	1	1.2
10	5	5.9
11	1	1.2
13	1	1.2
14	3	3.5

Frequency Missing = 9

Table 11b.iii. Caries Experience of Primary Dentition at First Recorded WCCHC Chart Review Visit (n=85)

dmft	Frequency	Percent
0	32	37.7
1	6	7.1
2	11	12.9
3	6	7.1
4	8	9.4
5	2	2.4
6	6	7.1
7	3	3.5
8	1	1.2
9	3	3.5
10	3	3.5
12	1	1.2
13	1	1.2
14	2	2.4

Frequency Missing = 9

Table 11b.iv. Caries Experience of Permanent Teeth at First Recorded WCCHC Chart Review Visit (n=85)

DMFT	Frequency	Percent
0	68	80.0
1	6	7.1
2	3	3.5
3	2	2.4
4	1	1.2
5	3	3.5
6	1	1.2
7	1	1.2

Frequency Missing = 9

The remainder of the caries experience results for WCCHC will display a child's caries experiences as the sum of dmft and DMFT according to the 4 ranges: 0, 1-4, 5-8, and 9-20. Each range roughly corresponds to frequency quartiles and was used for generalized linear mixed effects model analysis.

Tables 12. All Visits at WCCHC

12a. Demographics

12b. Caries Status

12c. Utilization

Tables 12a – 12c describe the breakdown of the 540 encounters recorded from 98 charts at WCCHC. Males made up 55.1% (n=297) of 540 encounters (Table 12a.i.). 228 of the 540 encounters at WCCHC came from children 0-4 years old (Table 12a.ii.). 90.0% (n=486) of the visits came from patients who had Medicaid for dental coverage (Table 12a.iii.). For 75.9% (n=366) of the 504 visits, active caries was noted to be present; whether caries was present or not could not be determined for 58 of the visits (Table 12b.i.).

Table 12a.i. Gender Demographics of All Visits at WCCHC (n=539)

GENDER	Frequency	Percent
Male	297	55.1
Female	242	44.9

Frequency Missing = 1

Table 12a.ii. Age Demographics of All Visits at WCCHC (n=540)

AGE GROUP	Frequency	Percent
0-4 years	228	42.2
5-9 years	218	40.4
10-12 years	94	17.4

Table 12a.iii. Dental Coverage Demographics of All Visits at WCCHC (n=540)

INSURANCE	Frequency	Percent
Cash	2	0.4
Insurance	52	9.6
Medicaid	486	90.0

Table 12b.i. Presence of Untreated Caries at All Visits at WCCHC (n=482)

UNTREATED CARIES PRESENT?	Frequency	Percent
No	116	24.1
Yes	366	75.9

Frequency Missing = 58

At WCCHC, 53.4% (n=279) of 522 known visits were scheduled for exam. 43.7% (n=228) of visits were scheduled for treatment or had treatment completed; this includes treatment for emergency visits and the visit was counted as a treatment visit. 15 emergency visits were consultation and no treatment was provided (Table 12c.i.). 30.2% (n=157) of the 520 scheduled appointments (Exam and Treatment) were broken (Table 12c.ii.). In total, 31 (5.7%) of 540 encounters were emergency visits (Table 12c.iii.) regardless of whether treatment was provided or not. In Table 12c.i., 100% of the 18 missing visit types were preventive sealant visits.

Table 12c.i. Visit Type Frequencies at WCCHC (n=522)

VISIT TYPE	Frequency	Percent
Emergency Consults	15	2.9
Exam	279	53.4
Treatment*	228	43.7

Frequency Missing = 18

* includes treatment completed during emergency visits

Table 12c.ii. Broken Appointment Frequency at WCCHC (n=520)

BROKEN APPOINTMENT?	Frequency	Percent
No	363	69.8
Yes	157	30.2

Frequency Missing = 20

Table 12c.iii. Emergency Visit Frequency at WCCHC (n=540)

EMERGENCY VISIT?	Frequency	Percent
No	509	94.3
Yes	31	5.7

Tables 13. Broken Appointments at WCCHC based on data collected from all visits

13a. Demographics

13b. Caries Status

13c. Utilization

13d. Correlates

At WCCHC, 28.7% of males and 31.7% of females missed their scheduled appointments (Table 13a.i.). 72 (15.0%) of 221 0-4 year olds, 64 (30.9%) of 207 5-9 year olds, and 21 (22.8%) of 92 10-12 year olds missed their scheduled appointments (Table 13a.ii.). With regards to dental coverage, 11 (21.6%) of 51 visits of insurance patients missed their appointment. In 146 (31.2%) of the 468 visits of Medicaid patients, they did not show for their appointment (Table 13a.iii.).

Table 13a.i. Broken Appointments by Gender at WCCHC

BROKEN APPOINTMENT?			
	Frequency (Percentage)		
GENDER	No	Yes	Total
Male	206 (71.3)	83 (28.7)	289
Female	157 (68.3)	73 (31.7)	230
Total	363	156	519
Frequency Missing = 21			

Table 13a.ii. Broken Appointments by Age at WCCHC

BROKEN APPOINTMENT?			
	Frequency (Percentage)		
AGE GROUP	No	Yes	Total
0-4 years	149 (67.4)	72 (32.6)	221
5-9 years	143 (69.1)	64 (30.9)	207
10-12 years	71 (77.2)	21 (22.8)	92
Total	363	157	520
Frequency Missing = 20			

Table 13a.iii. Broken Appointments by Dental Coverage at WCCHC

BROKEN APPOINTMENT?			
	Frequency (Percentage)		
DENTAL COVERAGE	No	Yes	Total
Cash	1 (100.0)	0 (0.0)	1
Insurance	40 (78.4)	11 (21.6)	51
Medicaid	322 (68.8)	146 (31.2)	468
Total	363	157	520
Frequency Missing = 20			

At WCCHC, the frequency of broken appointments from patients with or without dental decay were 23.5% and 16.8% respectively (Table 13b.i.). 3 (42.9%) of 7 scheduled emergency visits were broken. 31.9% (n=89) of exam visits and 29.2% (n=63) of treatment visits were broken (Table 13c.i.).

Table 13b.i. Presence of Untreated Caries at Broken Appointments at WCCHC

BROKEN APPOINTMENT?			
Frequency (Percentage)			
UNTREATED CARIES PRESENT?	No	Yes	Total
No	94 (83.2)	19 (16.8)	113
Yes	267 (76.5)	82 (23.5)	349
Total	361	101	462
Frequency Missing = 78			

Table 13c.i. Visit Type Frequencies at WCCHC

BROKEN APPOINTMENT?			
Frequency (Percentage)			
VISIT TYPE	No	Yes	Total
Emergency Consults	4 (57.1)	3 (42.9)	7
Exam	190 (68.1)	89 (31.9)	279
Treatment*	153 (70.8)	63 (29.2)	216
Total	347	155	502
Frequency Missing = 38			

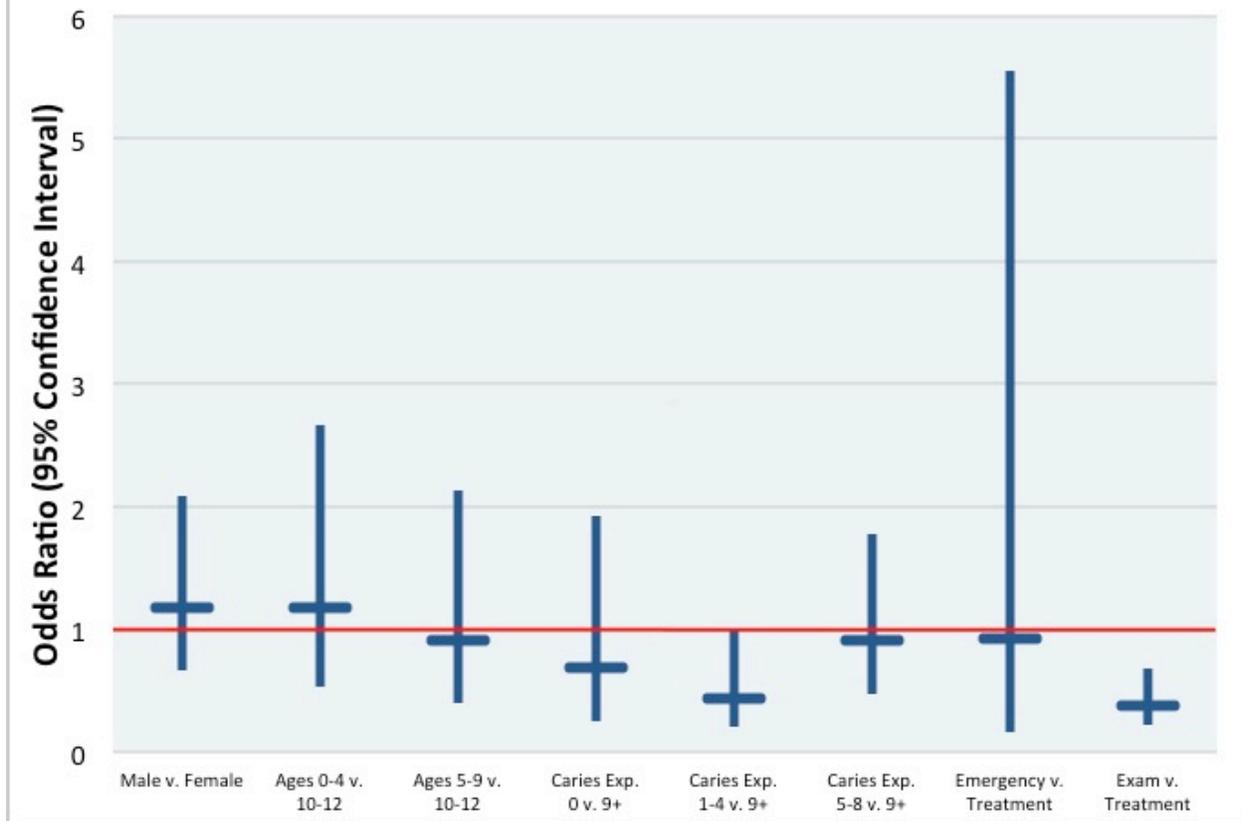
* includes treatment completed during emergency visits

The adjusted odds ratios (aORs), adjusting for all other effects, along with the lower and upper 95% confidence intervals (LCI, UCI), and the p values are displayed for various effects on broken appointments at WCCHC in Table 13d.i. Children ages 0-4 years were 1.2 times more likely ($p=0.0937$) to break appointments compared to children ages 10-12 years old (Figure 9). Children with a high caries experience score over 9 were over 2.2 times more likely ($p=0.0498$) to break appointments than those with a caries index of 1-4 (Figure 9). Treatment appointments were over 2.5 times more likely to be broken than examination appointments ($p<0.0009$). The overall visit type effect (2 df, $p=0.0038$) was significantly related to broken appointments.

Table 13d.i. Adjusted Odds Ratios for Broken Appointments at WCCHC

Effect	Explanatory Variable	aOR	LCI	UCI	p value
Gender	Male v. Female	1.179	0.667	2.085	0.5643
Age	0-4 v. 10-12	1.192	0.534	2.662	0.0937
	5-9 v. 10-12	0.923	0.398	2.140	0.6657
Caries Experience	Caries Exp. 0 v. 9+	0.698	0.253	1.923	0.4859
	Caries Exp. 1-4 v. 9+	0.452	0.205	0.999	0.0498
	Caries Exp. 5-8 v. 9+	0.923	0.479	1.778	0.8085
Visit Type	Emergency v. Treatment	0.937	0.158	5.555	0.9423
	Exam v. Treatment	0.387	0.221	0.676	0.0009

Figure 9. Correlates for Broken Appointments at WCCHC



Tables 14. Broken Examination Appointments at Bay Clinic based on data collected from all examination visits

14a. Demographics

14b. Caries Status

At WCCHC, for 279 scheduled exams at WCCHC, 27.5% of males and 36.2% of females broke their exam appointment (Table 14a.i.). For 280 scheduled exams at WCCHC, 0-4 year olds and 5-9 year olds made up the age groups more likely to miss their exam appointments. 35.6% of 0-4 years olds and 32.0% of 5-9 year olds broke their scheduled exam appointments, while 20.8% of 10-12 year olds broke theirs (Table 14a.ii.). With regards to dental coverage, the 1 cash patient never missed his/her exam appointment at WCCHC. 3 (11.5%) of 26 examination visits from insurance patients were missed. 33.9% (n=86) of Medicaid exam visits were broken (Table 14a.iii.).

Table 14a.i. Broken Examination Appointments by Gender at WCCHC

BROKEN EXAM APPOINTMENT?			
Frequency (Percentage)			
GENDER	No	Yes	Total
Male	108 (72.5)	41 (27.5)	149
Female	83 (63.9)	47 (36.1)	130
Total	191	88	279
Frequency Missing = 3			

Table 14a.ii. Broken Examination Appointments by Age at WCCHC

BROKEN EXAM APPOINTMENT?			
	Frequency (Percentage)		
AGE GROUP	No	Yes	Total
0-4 years	87 (64.4)	48 (35.6)	135
5-9 years	66 (68.0)	31 (32.0)	97
10-12 years	38 (79.3)	10 (20.8)	48
Total	191	89	280
Frequency Missing = 2			

Table 14a.iii. Broken Examination Appointments by Dental Coverage at WCCHC

BROKEN EXAM APPOINTMENT?			
	Frequency (Percentage)		
DENTAL COVERAGE	No	Yes	Total
Cash	1 (100.0)	0 (0.0)	1
Insurance	23 (88.5)	3 (11.5)	26
Medicaid	167 (66.0)	86 (33.9)	253
Total	191	89	280
Frequency Missing = 2			

At WCCHC, the frequency of broken exam appointments from patients with or without dental decay were 14.8% and 17.6% respectively (Table 14b.i.). For 217 scheduled exams with known caries experience, 21.7% of patients with caries experience of 5-8 and 19.5% of patients with caries experience of 9 or more broke their exam appointments, compared to 9.1% for caries free and 6.6% for caries experience of 1-4 (Table 14b.ii.).

Table 14b.i. Presence of Untreated Caries at Broken Examination Appointments at WCCHC

BROKEN EXAM APPOINTMENT?			
Frequency (Percentage)			
UNTREATED CARIES PRESENT?	No	Yes	Total
No	75 (82.4)	16 (17.6)	91
Yes	115 (85.2)	20 (14.8)	135
Total	190	36	226
Frequency Missing = 56			

Table 14b.ii. Caries Experience and Broken Examination Appointments at WCCHC

BROKEN EXAM APPOINTMENT?			
Frequency (Percentage)			
dmft + DMFT	No	Yes	Total
0	50 (90.9)	5 (9.1)	55
1-4	57 (93.4)	4 (6.6)	61
5-8	47 (78.3)	13 (21.7)	60
9+	33 (80.5)	8 (19.5)	41
Total	187	30	217
Frequency Missing = 65			

Tables 15. Treatment Completion at WCCHC based on data collected from all examination visits

15a. Demographics

15b. Caries Status

15c. Utilization – Not Applicable

15d. Correlates

At WCCHC, 67.5% of males and 67.2% of females completed their treatment plan (Table 15a.i.). 72.7% of 0-4 year olds and 72.4% of 10-12 year olds completed their treatment plans. In contrast, 59.7% of 5-9 year olds completed their treatment plans (Table 15a.ii.). With regards to dental coverage, 9 (60.0%) of 15 WCCHC treatment plans of insurance patients were completed. Similarly, 86 (68.3%) of 126 treatment plans of Medicaid patients were completed (Table 15a.iii.).

Table 15a.i. Treatment Completion by Gender at WCCHC

TREATMENT COMPLETION			
Frequency (Percentage)			
GENDER	No	Yes	Total
Male	27 (32.5)	56 (67.5)	83
Female	19 (32.8)	39 (67.2)	58
Total	46	95	141
Frequency Missing = 141			

Table 15a.ii. Treatment Completion by Age at WCCHC

TREATMENT COMPLETION			
	Frequency (Percentage)		
AGE GROUP	No	Yes	Total
0-4 years	15 (27.3)	40 (72.7)	55
5-9 years	23 (40.3)	34 (59.7)	57
10-12 years	8 (27.6)	21 (72.4)	29
Total	46	95	141
Frequency Missing = 141			

Table 15a.iii. Treatment Completion by Dental Coverage at WCCHC

TREATMENT COMPLETION			
	Frequency (Percentage)		
DENTAL COVERAGE	No	Yes	Total
Cash	0	0	0
Insurance	6 (40.0)	9 (60.0)	15
Medicaid	40 (31.7)	86 (68.3)	126
Total	46	95	141
Frequency Missing = 141			

The treatment plan for a child who did not have caries was preventive sealants. At WCCHC, of the 19 caries-free children, 89.5% (n=17) did not follow through with their preventive treatment plans. 64.2% (n=77) of 120 children with caries did not complete their treatment plans (Table 15b.i.). 3 (37.5%) of 8 children with no caries experience did not complete their preventive treatment plans. 34.8% and 34.4% of children with a caries experience of 5-8 and 9+ respectively did not complete their treatment plans (Table 15b.ii.).

Table 15b.i. Untreated Caries Presence and Treatment Completion at WCCHC

TREATMENT COMPLETION			
	Frequency (Percentage)		
UNTREATED CARIES PRESENT?	No	Yes	Total
No	2 (10.5)	17 (89.5)	19
Yes	43 (35.8)	77 (64.2)	120
Total	45	94	139
Frequency Missing = 143			

Table 15b.ii. Caries Experience and Treatment Completion at WCCHC

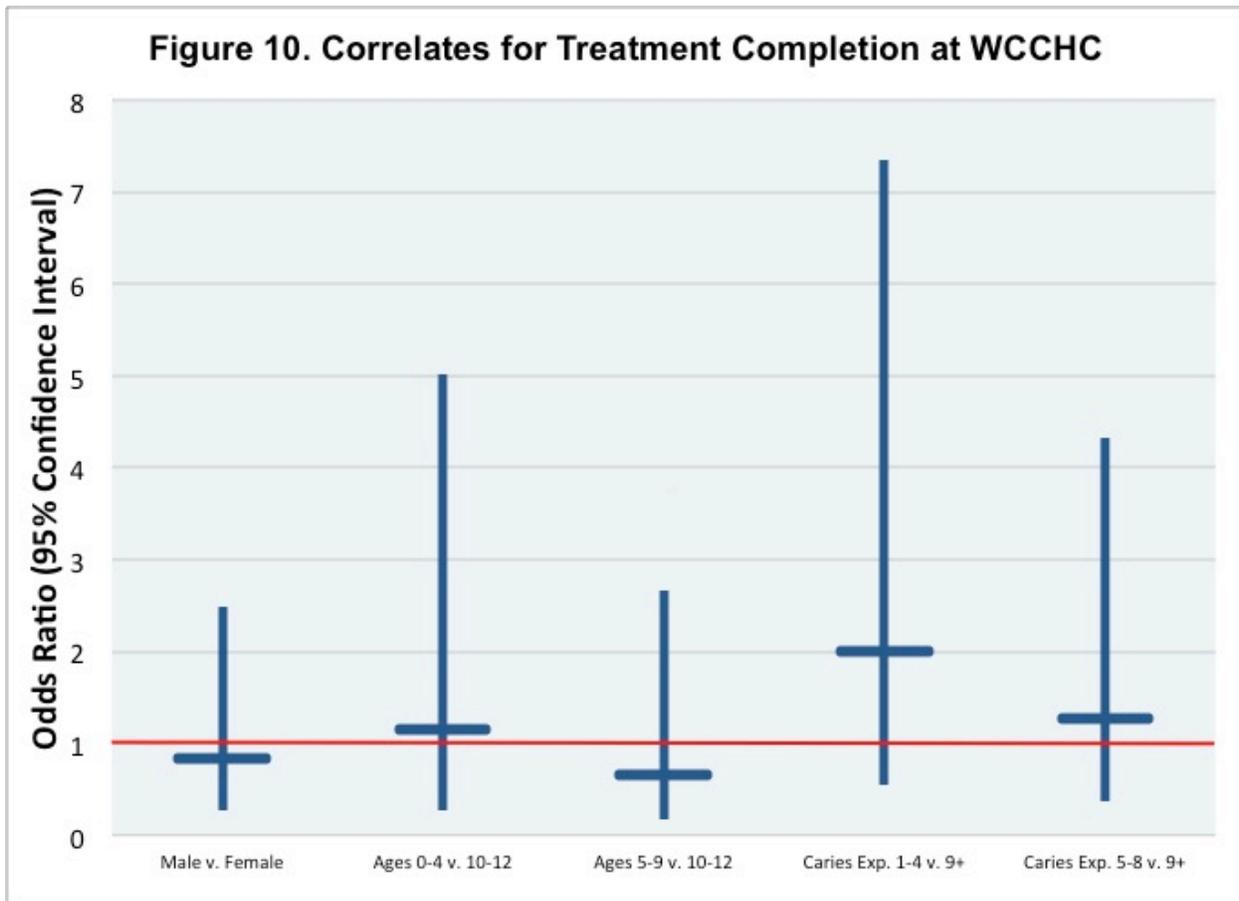
TREATMENT COMPLETION			
	Frequency (Percentage)		
dmft + DMFT	No	Yes	Total
0	3 (37.5)	5 (62.5)	8
1-4	12 (24.0)	38 (76.0)	50
5-8	16 (34.8)	30 (65.2)	46
9+	11 (34.4)	21 (65.6)	32
Total	42	94	136
Frequency Missing = 146			

Table 15c. Utilization is not applicable due to a utilization measure already being analyzed at only examination visits.

The adjusted odds ratios (aORs), adjusting for all other effects, along with the lower and upper 95% confidence intervals (LCI, UCI), and the p values are displayed in Table 15d.i. for various effects on treatment plan completion at WCCHC. No significant relationship was found for overall gender, age, or caries experience effect with treatment plan completion (Figure 10).

Table 15d.i. Adjusted Odds Ratios for Treatment Completion at WCCHC

Effect	Explanatory Variable	aOR	LCI	UCI	p value
Gender	Male v. Female	0.835	0.281	2.478	0.7412
Age	0-4 v. 10-12	1.154	0.265	5.023	0.8470
	5-9 v. 10-12	0.662	0.165	2.654	0.5578
Caries Experience	Caries Exp. 1-4 v. 9+	2.017	0.553	7.352	0.2849
	Caries Exp. 5-8 v. 9+	1.276	0.376	4.330	0.6940



Tables 16. Time to Treatment Completion at WCCHC based on data collected from all examination visits

16a. Demographics

16b. Caries Status

If the time to treatment completion is over 6 months, then no 6-month recall examination was completed to establish a new treatment plan. At WCCHC, 33.9% (n=19) of males and 26.3% (n=10) of female completed their treatment plans within 15 days (Table 16a.i.). Completing their treatment plans within 15 days were 15.4% (n=6) of 0-4 year olds, 47.1% (n=16) of 5-9 year olds, and 33.3% (n=7) for 10-12 year olds. One month was required for the highest percentage of 0-4 year olds (n=13; 33.3%) and 10-12 year olds (n=8; 38.1%) to complete treatment (Table 16a.ii.). Four (44.5%) of the 9 private insurance patients completed their treatment plans in 2 months at WCCHC. 31.8% (n=27) and 30.6% (n=26) of Medicaid patients completed their treatment within 15 days and 1 month respectively (Table 16a.iii.).

Table 16a.i. Treatment Completion Time by Gender at WCCHC

TIME TO TREATMENT COMPLETION									
MONTHS									
GENDER	0	1	2	3	4	5	6	10	Total
Male	19 (33.9)	17 (30.3)	9 (16.1)	5 (8.9)	3 (5.4)	1 (1.8)	1 (1.8)	1 (1.8)	56
Female	10 (26.3)	11 (29.0)	9 (23.7)	4 (10.5)	2 (5.3)	1 (2.6)	1 (2.6)	0 (0.0)	38
Total	29	28	18	9	5	2	2	1	94
Frequency Missing = 188									

Table 16a.ii. Treatment Completion Time by Age at WCCHC

TIME TO TREATMENT COMPLETION									
MONTHS									
AGE GROUP	0	1	2	3	4	5	6	10	Total
0-4 years	6 (15.4)	13 (33.3)	10 (25.6)	4 (10.3)	5 (12.8)	0 (0.0)	0 (0.0)	1 (2.6)	39
5-9 years	16 (47.1)	7 (20.6)	4 (11.8)	4 (11.8)	0 (0.0)	2 (5.8)	1 (2.9)	0 (0.0)	34
10-12 years	7 (33.3)	8 (38.1)	4 (19.0)	1 (4.8)	0 (0.0)	0 (0.0)	1 (4.8)	0 (0.0)	21
Total	29	28	18	9	5	2	2	1	94
Frequency Missing = 188									

Table 16a.iii. Treatment Completion Time by Dental Coverage at WCCHC

TIME TO TREATMENT COMPLETION									
MONTHS									
DENTAL COVERAGE	0	1	2	3	4	5	6	10	Total
Cash	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0
Insurance	2 (22.2)	2 (22.2)	4 (44.5)	1 (11.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	9
Medicaid	27 (31.8)	26 (30.6)	14 (16.5)	8 (9.4)	5 (5.9)	2 (2.3)	2 (2.3)	1 (1.2)	85
Total	29	28	18	9	5	2	2	1	94
Frequency Missing = 188									

At WCCHC, 70.6% (n=12) of caries-free patients completed their preventive treatment plans within 15 days. 22.4% (n=17) and 32.9% (n=25) of patients with children completed their treatment plans within 15 days and in 1 month respectively (Table 16b.i.). The higher the caries experience, the more likely completing treatment will take longer. For children with caries experience of 9+, 52.4% (n=11) required over a month (\bar{x} =2.2, SD=1.8, range=0-6) to complete their treatment plan compared to 34.5% (n=10) of children with caries experience of 5-8 (\bar{x} =1.4, SD=1.5, range=0-6) and 39.5% (n=15) of children with caries experience of 1-4 (\bar{x} =1.3, SD=1.8, range=0-10). 3 out of 5 caries-free children completed their preventive treatment plans within 15 days (Table 16b.ii.).

Table 16b.i. Untreated Caries Presence and Treatment Completion Time at WCCHC

TIME TO TREATMENT COMPLETION									
MONTHS									
UNTREATED CARIES PRESENT?	0	1	2	3	4	5	6	10	Total
No	12 (70.6)	2 (11.7)	3 (17.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	17
Yes	17 (22.4)	25 (32.9)	15 (19.8)	9 (11.8)	5 (6.6)	2 (2.6)	2 (2.6)	1 (1.3)	76
Total	29	27	18	9	5	2	2	1	93
Frequency Missing = 189									

Table 16b.ii. Caries Experience and Treatment Completion Time at WCCHC

TIME TO TREATMENT COMPLETION									
MONTHS									
dmft + DMFT	0	1	2	3	4	5	6	10	Total
0	3 (60.0)	1 (20.0)	1 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5
1-4	14 (36.8)	9 (23.7)	10 (26.3)	4 (10.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.7)	38
5-8	9 (31.0)	10 (34.5)	3 (10.3)	4 (13.8)	2 (6.9)	0 (0.0)	1 (3.5)	0 (0.0)	29
9+	3 (14.3)	7 (33.3)	4 (19.0)	1 (4.8)	3 (14.3)	2 (9.5)	1 (4.8)	0 (0.0)	21
Total	29	27	18	9	5	2	2	1	93
Frequency Missing = 189									

Tables 17. Emergency Visits at WCCHC based on data collected from all visits

17a. Demographics

17b. Caries Status

17c. Utilization

At WCCHC, 18 (58.1%) of 31 emergency visits came from females. They made up 7.4% of all 242 females visiting WCCHC (Table 17a.i.). 19 (61.3%) of 31 emergency visits came from children ages 5-9 years. They made up 8.7% of all 218 5-9 year olds visiting WCCHC (Table 17a.ii.). Of the 2 cash visits, 1 came in for emergency at WCCHC. 3 (5.8%) of 52 insurance visits and 27 (5.6%) of 385 Medicaid visits were emergency visits (Table 17a.iii.).

Table 17a.i. Emergency Visits by Gender at WCCHC

EMERGENCY VISIT			
	Frequency (Percentage)		
GENDER	No	Yes	Total
Male	284 (95.6)	13 (4.4)	297
Female	224 (92.6)	18 (7.4)	242
Total	508	31	539
Frequency Missing = 1			

Table 17a.ii. Emergency Visits by Age at WCCHC

EMERGENCY VISIT			
	Frequency (Percentage)		
AGE GROUP	No	Yes	Total
0-4 years	219 (96.1)	9 (3.9)	228
5-9 years	199 (91.3)	19 (8.7)	218
10-12 years	91 (96.8)	3 (3.2)	94
Total	509	31	540

Table 17a.iii. Emergency Visits by Dental Coverage at WCCHC

EMERGENCY VISIT			
	Frequency (Percentage)		
DENTAL COVERAGE	No	Yes	Total
Cash	1 (50.0)	1 (50.0)	2
Insurance	49 (94.2)	3 (5.8)	52
Medicaid	459 (94.4)	27 (5.6)	486
Total	509	31	540

At WCCHC, dental decay was present for 25 (86.2%) of the 29 emergency visits (Table 17b.i.). These visits represent 6.8% of the 366 visits from patients known to have dental decay at WCCHC. The higher the caries experience, the higher the likelihood for an emergency visit at WCCHC. None of the patients walking in for emergency had a dmft less than 5. 9 (52.9%) of the 17 emergency visits had a caries experience of 5-8 representing 5.9% of 152 visits known to have that caries experience. 47.1% of emergency visits were from patients who had caries experience of 9+; this represents 7.1% of all WCCHC visits (Table 17b.ii.).

Table 17b.i. Untreated Caries Presence and Emergency Visits Time at WCCHC

EMERGENCY VISIT			
Frequency (Percentage)			
UNTREATED CARIES PRESENT?	No	Yes	Total
No	112 (96.5)	4 (3.5)	116
Yes	341 (93.2)	25 (6.8)	366
Total	453	29	482
Frequency Missing = 58			

Table 17b.ii. Caries Experience and Emergency Visits at WCCHC

EMERGENCY VISIT			
Frequency (Percentage)			
dmft + DMFT	No	Yes	Total
0	63 (100.0)	0 (0.0)	63
1-4	126 (100.0)	0 (0.0)	126
5-8	143 (94.1)	9 (5.9)	152
9+	104 (92.9)	8 (7.1)	112
Total	436	17	453
Frequency Missing = 87			

At WCCHC, Treatment was completed for 51.6% (n=16) of the 31 emergency visits. Treatment during emergency visits represented 7.0% (n=16) of the 228 treatment visits at WCCHC (Table 17c.i.).

Table 17c.i. Visit Type and Emergency Visits at WCCHC

EMERGENCY VISIT			
	Frequency (Percentage)		
VISIT TYPE	No	Yes	Total
Emergency Consults	0 (0.0)	15 (100.0)	15
Exam	279 (100.0)	0 (0.0)	279
Treatment*	212 (93.0)	16 (7.0)	228
Total	491	31	522
Frequency Missing = 18			

* includes treatment completed during emergency visits

Table 17d.i. Adjusted Odds Ratios for Emergency Visits at WCCHC

Statistical models did not converge because there were few emergency visits and the distribution of the explanatory variables were too skewed and dominated by one category, except for gender.

Bay Clinic & WCCHC Combined

Tables 18. Broken Appointments at Both Clinics based on data collected from all visits

18a. Demographics – Not Available

18b. Caries Status – Not Available

18c. Utilization – Not Applicable

18d. Correlates

Data from all visits at both Bay Clinic and WCCHC was combined to analyze the overall relationship of gender, age, caries experience, and visit type on broken appointments. Table 18d.i. displays the adjusted odds ratios (aORs), lower and upper 95% confidence intervals (LCI, UCI), , and the p values for various effects on broken appointments. Children with caries experience over 9 were 1.65 times more likely to break an appointment compared to children with caries experience of 1-4 ($p=0.0518$) (Figure 12). Treatment visits overall were broken 2.86 more times than examination visits ($p<0.0001$) (Figure 13). Broken appointments occurred twice as much at WCCHC than at Bay Clinic ($p=0.0004$) (Figure 13). The overall visit type effect (2 df, $p<0.0001$) and clinic effect ($p=0.0004$) were found to be significantly related to broken appointments.

Table 18d.i. Adjusted Odds Ratios for Broken Appointments at Both Clinics

Effect	Explanatory Variable	aOR	LCI	UCI	p value
Gender	Male v. Female	1.069	0.733	1.560	0.7257
Age	0-4 v. 10-12	1.137	0.659	1.962	0.6425
	5-9 v. 10-12	1.055	0.645	1.727	0.8297
Caries Experience	Caries Exp. 0 v. 9+	0.841	0.429	1.649	0.6142
	Caries Exp. 1-4 v. 9+	0.606	0.366	1.004	0.0518
	Caries Exp. 5-8 v. 9+	0.853	0.548	1.328	0.4813
Visit Type	Emergency v. Treatment	0.968	0.287	3.261	0.9581
	Exam v. Treatment	0.350	0.239	0.513	<0.0001
Clinic	Bay Clinic v. WCCHC	0.495	0.336	0.730	0.0004

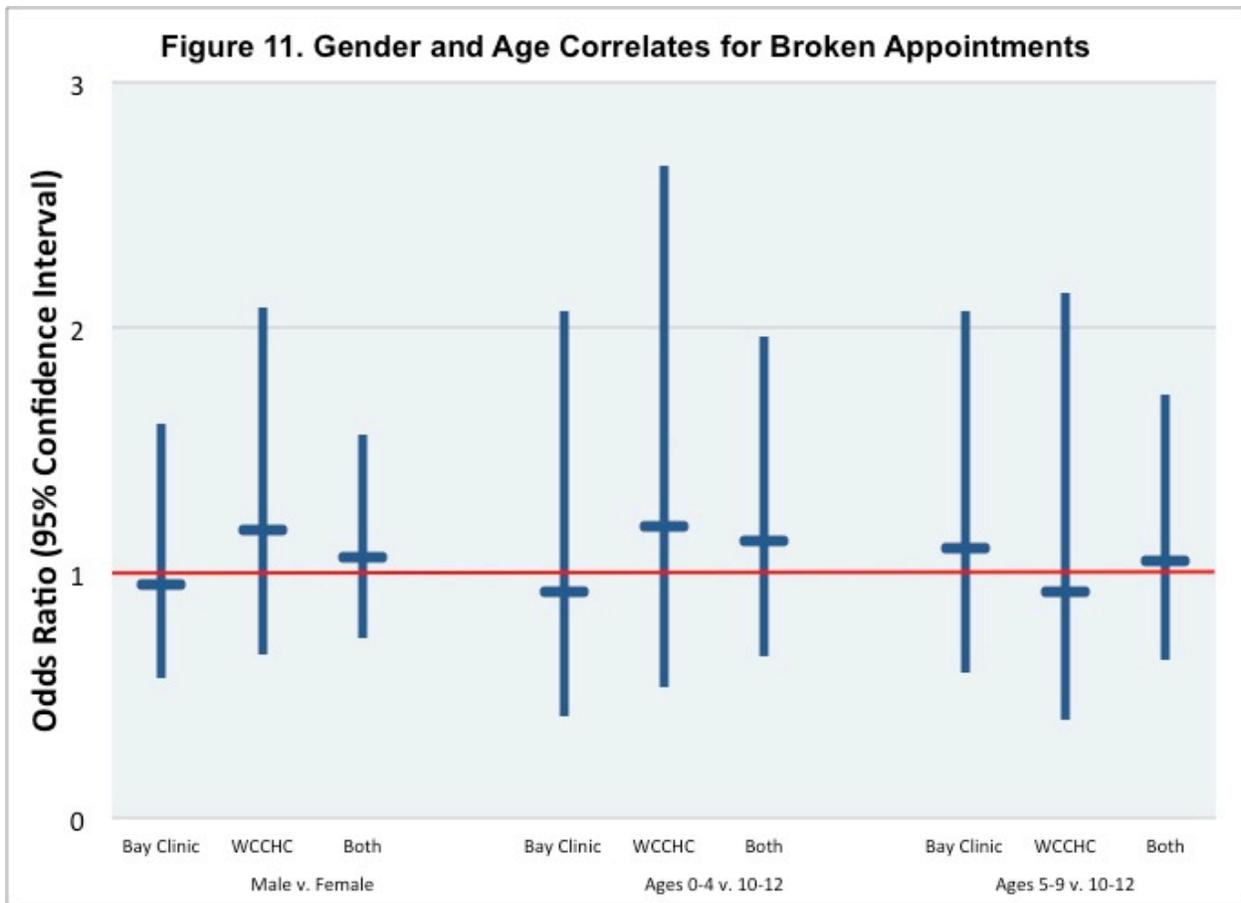


Figure 12. Caries Experience Correlates for Broken Appointments

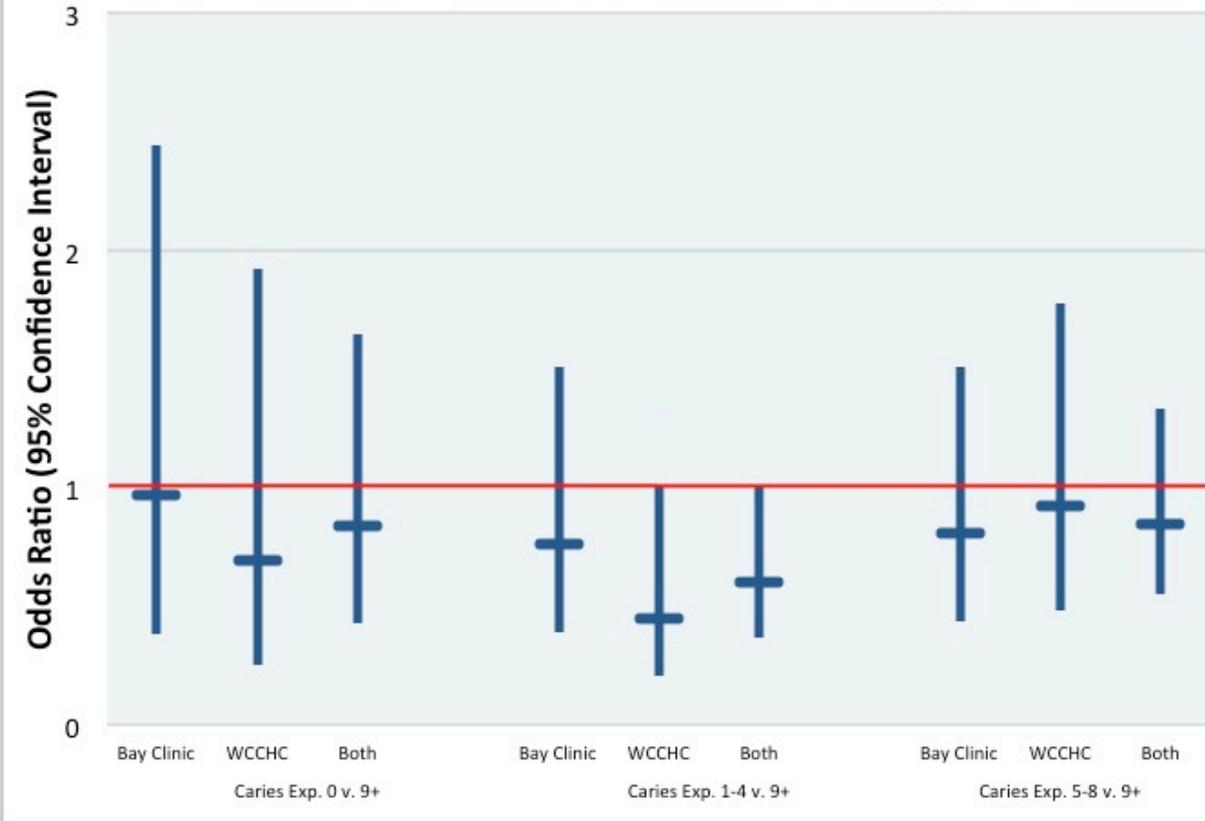
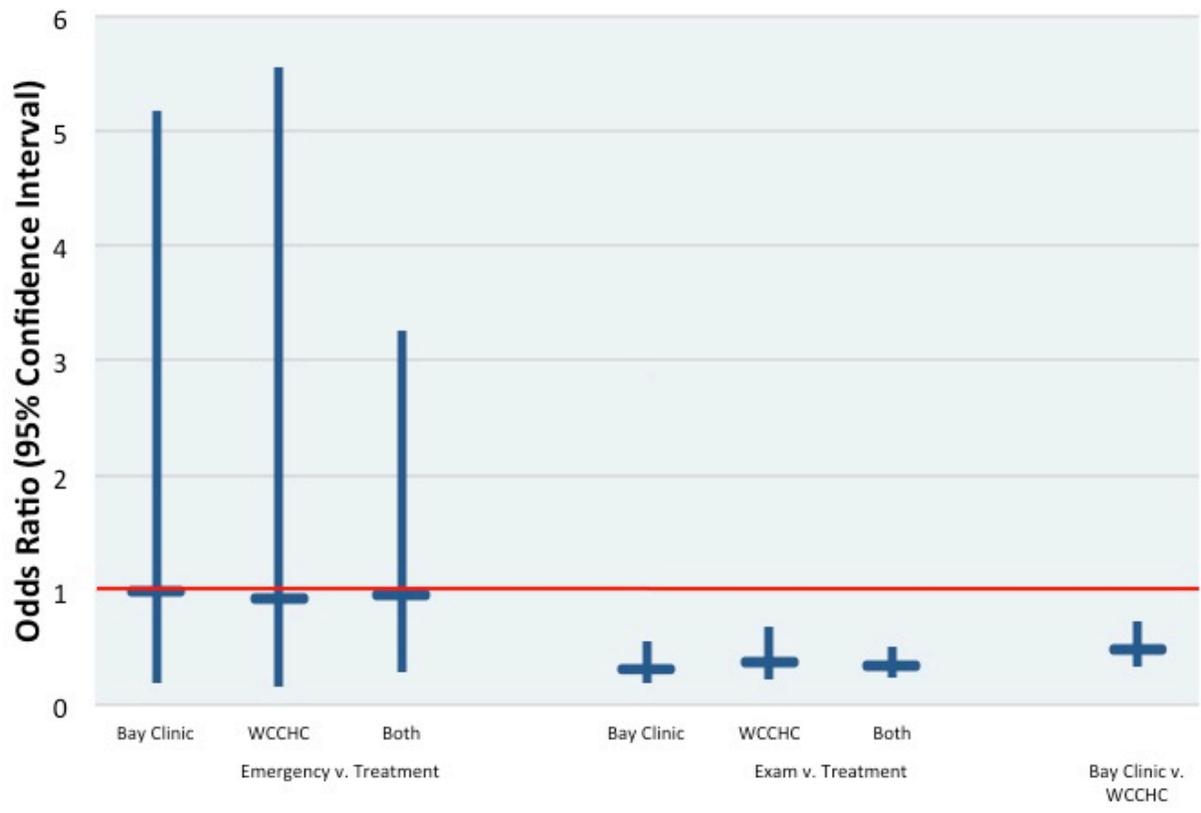


Figure 13. Visit Type & Clinic Correlates for Broken Appointments



Tables 19. Treatment Completion at Both Clinics based on data collected from all examination visits

19a. Demographics – Not Available

19b. Caries Status – Not Available

19c. Utilization – Not Applicable

19d. Correlates

Data from all examination visits at both Bay Clinic and WCCHC were combined to analyze the overall relationship of gender, age, caries experience, and broken appointments on treatment plan completion. Table 19d.i. displays the adjusted odds ratios (aORs), lower and upper 95% confidence intervals (LCI, UCI), , and the p values for various effects on treatment plan completion. Children ages 0-4 years old were twice as likely to complete their treatment plans compared to children ages 10-12 years old (p=0.0670) (Figure 14). Children with caries experience of 1-4 were 2.3 times more likely to complete their treatment plans compared to children with caries experience over 9 (p=0.0155) (Figure 15). No significant relationship was found between broken appointments and clinic with regards to treatment plan completion (Figure 15). The overall caries experience effect was found to be significantly related (2 df, p=0.0255) to treatment plan completion.

Table 19d.i. Adjusted Odds Ratios for Treatment Completion at Both Clinics

Effect	Explanatory Variable	aOR	LCI	UCI	p value
Gender	Male v. Female	1.103	0.654	1.860	0.7113
Age	0-4 v. 10-12	2.010	0.952	4.244	0.0670
	5-9 v. 10-12	1.255	0.668	2.360	0.4791
Caries Experience	Caries Exp. 1-4 v. 9+	2.252	1.168	4.340	0.0155
	Caries Exp. 5-8 v. 9+	1.095	0.605	1.982	0.7630
Utilization Clinic	Show v. Broken Appt	1.876	0.611	5.765	0.2711
	Bay Clinic v. WCCHC	0.791	0.446	1.404	0.4220

Figure 14. Gender and Age Correlates for Treatment Completion

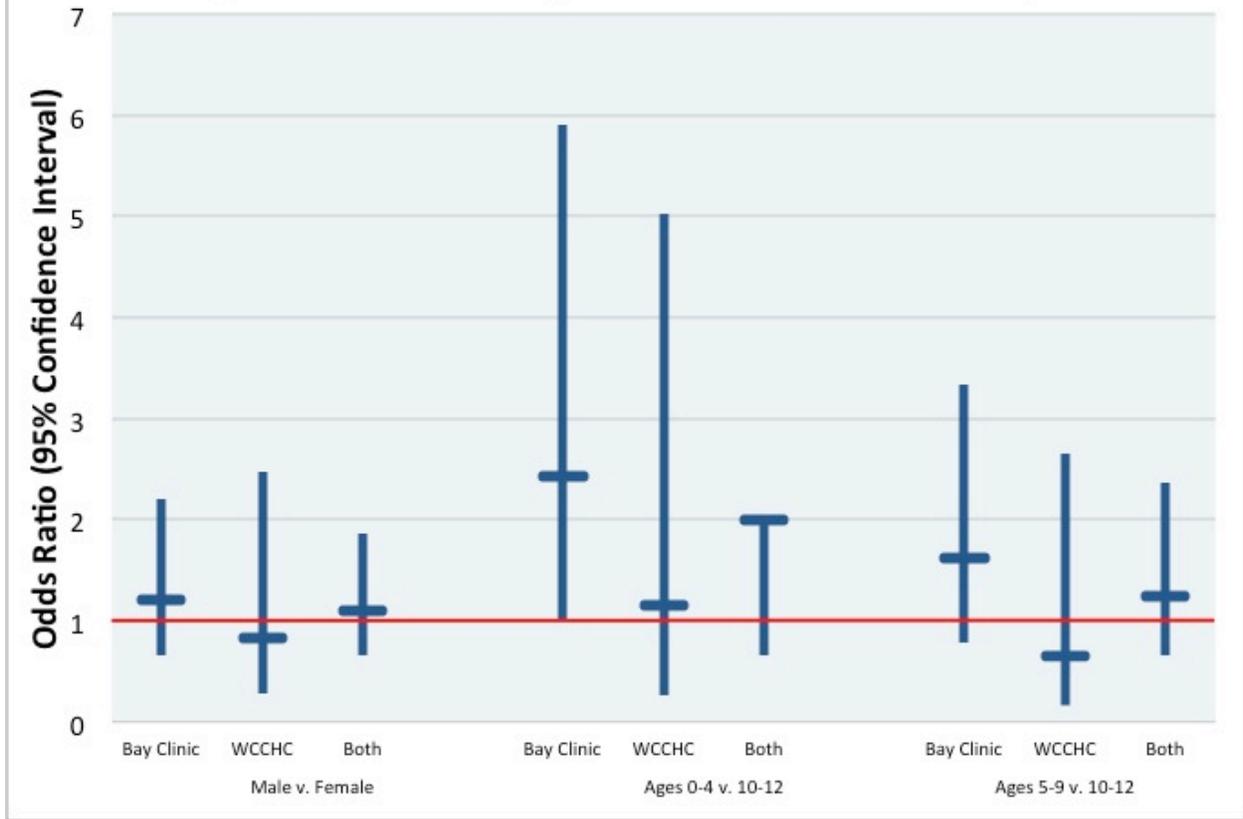
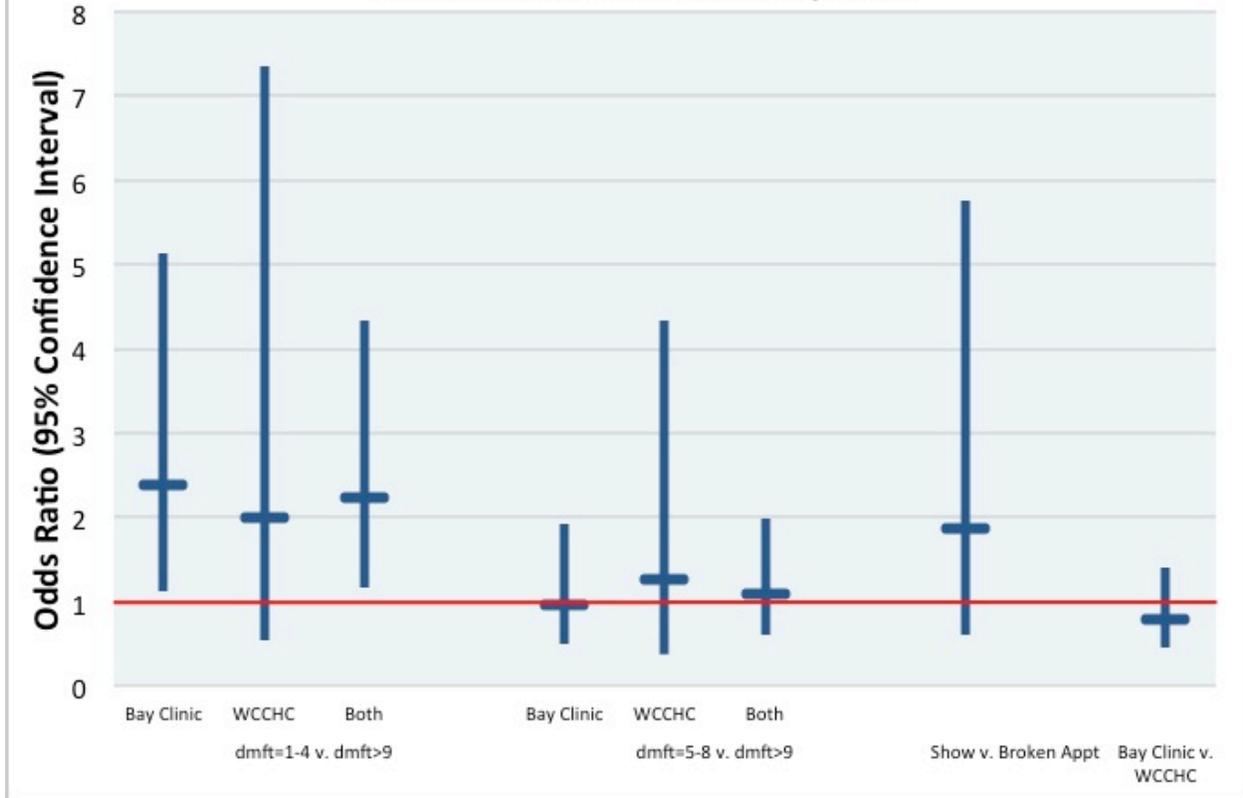


Figure 15. Caries Experience, Broken Appointment, and Clinic Correlates for Treatment Completion



Tables 20. Emergency Visits at Both Clinics based on data collected from all visits

20a. Demographics – Not Available

20b. Caries Status – Not Available

20c. Utilization – Not Applicable

20d. Correlates

Data from all examination visits at both Bay Clinic and WCCHC were combined to analyze the overall relationship of gender, age, caries experience, and clinic on emergency visits. Table 20d.i. displays the adjusted odds ratios (aORs), lower and upper 95% confidence intervals (LCI, UCI), and the p values for various effects on treatment plan completion. Children ages 5-9 years old were twice as likely to come in for emergency visits compared to children ages 10-12 years old ($p=0.0335$) (Figure 16). Children with caries experience of 9+ were 2.4 times more likely to come in for emergency visits compared to children with no caries experience ($p=0.0415$) (Figure 17). Emergency visits occurred 4.3 times as much at Bay Clinic than at WCCHC ($p<0.0001$) (Figure 17). The overall clinic effect was found to be significantly related ($p<0.0001$) to emergency visits.

Table 20d.i. Adjusted Odds Ratios for Emergency Visits at Both Clinics

Effect	Explanatory Variable	aOR	LCI	UCI	p value
Gender	Male v. Female	0.961	0.582	1.586	0.8760
Age	0-4 v. 10-12	2.011	0.940	4.301	0.0716
	5-9 v. 10-12	2.020	1.056	3.862	0.0335
Caries Experience	Caries Exp. 0 v. 9+	0.410	0.174	0.966	0.0415
	Caries Exp. 1-4 v. 9+	0.674	0.365	1.243	0.2057
	Caries Exp. 5-8 v. 9+	0.993	0.580	1.698	0.9781
Clinic	Bay Clinic v. WCCHC	4.250	2.153	8.390	<0.0001

Figure 16. Gender and Age Correlates for Emergency Visits

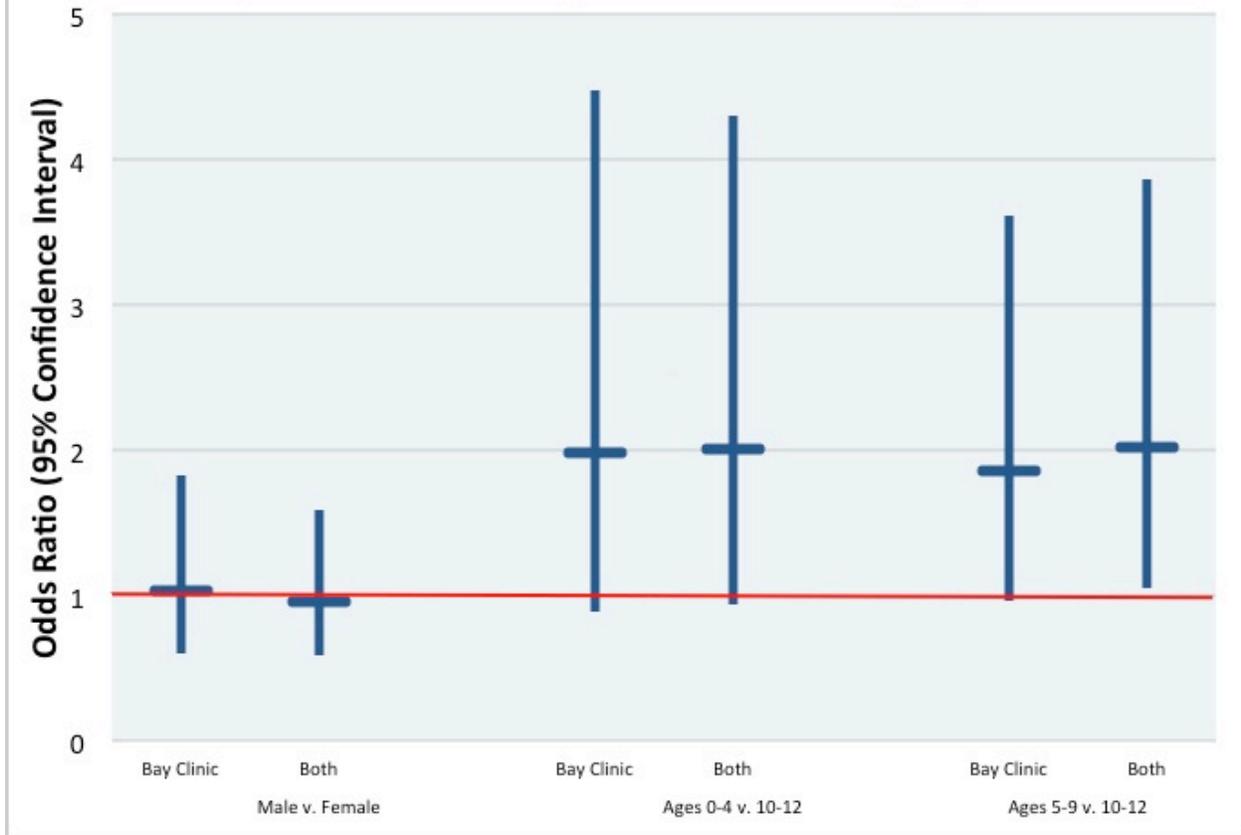
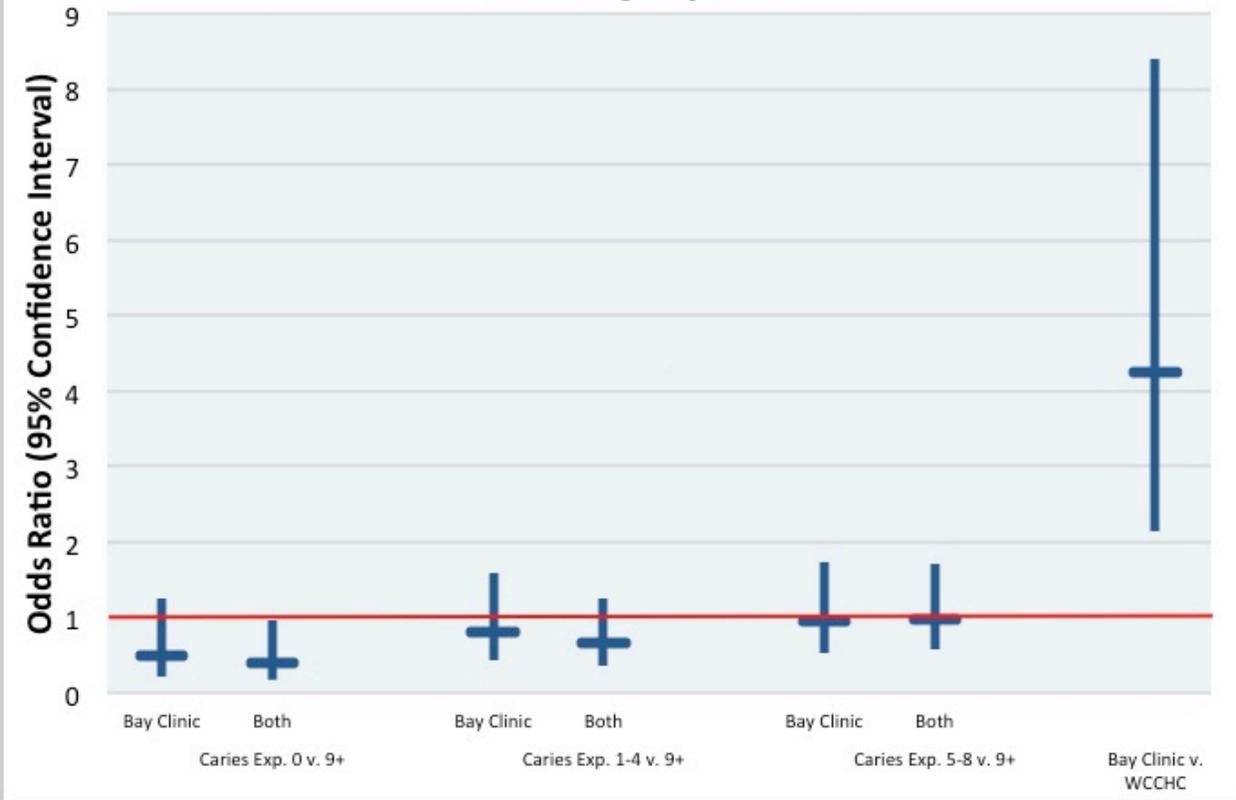


Figure 17. Caries Experience and Clinic Correlates for Emergency Visits



DISCUSSION

This CHC-based study is not representative of the general pediatric population, but representative of the lower-income and minority Hawaiian pediatric population. With respect to gender and age, tables 21a.i. and 21a.ii show that gender and age demographics recorded at the first chart review visit are similar to the 2010 US Census on the State of Hawai'i; only for children ages 10-12 years old attending the two clinics in this study was there a lower percentage than the US Census. This study data, however, can reflect any time point between August 2007 and August 2012, while the US Census is reflective of the data collected on the population once every 10 years and projected each year.

Table 21a.i. Gender Demographic Percentages at Clinics Compared to 2010 Hawai'i Census Data

Gender	Bay Clinic	WCCHC	Both	Census
Male	53.3	47.4	51.5	51.4
Female	46.7	52.6	48.5	48.6

Table 21a.ii. Age Demographic Percentages at Clinics Compared to 2010 Hawai'i Census Data

Age (Years)	Bay Clinic	WCCHC	Both	Census
0-4	34.6	49.0	38.9	39.8
5-9	46.8	34.7	43.2	37.9
10-12	18.6	16.3	17.9	22.3

Due to financial need, a large percentage of Hawai'i's population qualifies for Medicaid for dental coverage. Unfortunately, not all areas have a Medicaid accepting dentist, so access and clinic convenience can be a barrier to care. By looking at Hawaiian CHCs, this study is representative of the lower-income population with 92.7% of patients under 13 years old having Medicaid for dental insurance coverage (Table 21a.iii.).

Table 21a.iii. Overall Dental Coverage Percentages at Clinics

Dental Coverage	Bay Clinic	WCCHC	Both
Cash	2.2	2.1	2.1
Insurance	2.6	11.2	5.2
Medicaid	95.2	86.7	92.7

From a geographic standpoint, in addition to being located on different islands, both Bay Clinic and WCCHC have very different patient bases. In this study, patients at Bay Clinic came from 13 different ZIP codes, while patients at WCCHC came from 5 different ZIP codes. The Bay Clinic dental van traveled to 3 of the 13 ZIP codes to help patients from these ZIP codes receive dental care. The 3 ZIP codes notably had higher percentages of children who attended appointments. The main dental clinic is in Keaau; thus, it makes sense that Keaau was the ZIP code with highest percentage of children being seen (29.4%). The next nearest sizable cities to where the dental van traveled were Hilo and Pahoa; they were the cities with the next largest percentages of children attending the clinic or dental van at 26.4% and 20.8% respectively. On the other hand, WCCHC did not have a van, and 96.0% of the WCCHC patients were residents of the local ZIP code. Adjusting for all other effects, residence outside the clinic/van ZIP code was related to broken appointments ($p < 0.0001$) and treatment incompleteness ($p = 0.004$) at Bay Clinic.

Racially, the study provides information on the minority groups of Hawaiians and Pacific Islanders. Table 21a.v. shows a higher percentage of Hawaiian and Pacific Islander children coming to Bay Clinic and a lower percentage of Asian children compared to 2010 Hawai'i Census data. There also was a higher percentage of Hispanic children coming to Bay Clinic compared to the 2010 Census data in Hawai'i (Table 21a.vi.).

Table 21a.v. Race Demographic Percentages Compared to 2010 Hawai'i Census Data

Race	Bay Clinic	Census
Asian	28.6	51.3
Hawaiian	24.7	7.9
Other	32.9	35.4
Pacific Islander	13.8	5.4

Table 21a.vi. Ethnicity Demographic Percentages Compared to 2010 Hawai'i Census Data

Ethnicity	Bay Clinic	Census
Hispanic	19.1	8.9
Non Hispanic	80.9	91.1

Caries was found to be present in 63% of the children in both clinics combined. The caries experience values of the children at Hawaiian CHCs are likely underestimated in this study. In comparison to the National Health and Nutrition Examination Survey (NHANES) 1999-2004 results, all caries experience values at the first examination visit at Bay Clinic and WCCHC were lower (Table 21b.ii.), except for dmft at Bay Clinic. The study results represent children ages 0-12 years. NHANES dmft, however, is representative of children ages 2-8 years old and therefore is expected to be higher than the study results. Vice versa, the NHANES DMFT is representative of children ages 5-11 years and thus is expected to be lower than the study results. Accurately calculating the dmft and DMFT retrospectively from charts was difficult with opportunity for error. Decay was recorded based on treatment plans in the chart. Providers and/or the parents could elect to monitor decay instead of treat it, which decreased the caries experience score in the study. The decay values also do not account for any incipient decay. In addition, because Bay Clinic did not have a pediatric dentist once a week until spring 2011, a thorough comprehensive oral exam frequently could not always be completed on children ages 0-4 years old due to age-appropriate lack of cooperation or anxiety. These children often were

referred, especially during emergency visits, and from personal experience, they unquestionably had rampant decay with a diagnosis of severe early childhood caries, which the PI could not record and calculate towards the caries experience score. Only occasionally could the PI record the rampant caries if the treating specialist upon referral sends a treatment report back to Bay Clinic. Furthermore, the caries experience score in this study does not take into account the child's ever-changing dentition. As a child grows up with gradual exfoliation of his/her primary teeth, the dmft score decreases in this study if a previously decayed or restored tooth had exfoliated. If there were a larger sample size, the caries experience scores for the various age groups could be calculated and help resolve this discrepancy. In the charts, following the end date of the retrospective study, the PI also noticed the presence of more caries in later examination visits, especially in children ages 0-4 years with caries experience scores of 1-4. Once a child is determined to be high caries risk, carious lesions are expected to be found at future examination visits due to the unlikelihood of improved oral home care.

Table 21b.ii. Caries Experience Data Compared to US NHANES 1999-2004

	Bay Clinic (N=211)	WCCHC (N=98)	NHANES 1999-2004*
dmft	4.0	3.1	3.7
DMFT	0.5	0.6	0.7

* dmft ages 2-8yo, DMFT ages 6-11yo

From the utilization results, parents appeared to find greater value in examination visits than treatment visits. Between both clinics, dental appointments were broken 19.3% of the time (Table 21c.). At Bay Clinic and WCCHC, visit type was significantly related to broken appointments ($p=0.0002$ and $p=0.0038$ respectively). Children were 3.0 times and 2.5 times more likely to miss their treatment appointments than examination appointments at Bay Clinic

and WCCHC ($p < 0.0001$ and $p = 0.0009$ respectively). At every examination visit, dental prophylaxis was completed. Parents likely desired the dental cleaning done at examination visits more than the restoration of decayed teeth at treatment visits. At Bay Clinic, no child left with a 6 month recall appointment due to the schedule not being open that far in advance. At WCCHC, every child left with his/her next examination visit scheduled in 6 months. Therefore, Bay Clinic parents likely were more motivated than WCCHC parents, for they had to be proactive to schedule all examination visits in due time. Parental motivation may explain why fewer examination visits (9.5%) (Table 5c.i.) were missed at Bay Clinic compared to WCCHC (31.9%) (Table 13c.i.). Nonetheless, treatment appointments were significantly broken more than examination appointments, suggesting parents' indifference toward treating dental decay as opposed to receiving a dental cleaning.

Relating to treatment appointments being significantly broken more than examination appointments, pediatric patients did not complete their treatment plans 35.1% of the time, with the Big Island having a higher percentage (36.5%) of incomplete treatment plans (Table 21c.). One reason for the higher percentage at Bay Clinic may be due to more appointments being required to complete a treatment plan. Instead of quadrant dentistry being practiced, one tooth often was treated per appointment at Bay Clinic due to the very busy clinic schedule. Especially when there were multiple emergency patients waiting, dentists also frequently performed the quickest procedure on the treatment plan (e.g. sealants) instead of prioritizing and treating the tooth with the largest cavitation first. These all may be contributors towards Bay Clinic having a higher percentage of incomplete treatment plans. In contrast, at WCCHC, pediatric dentists or pediatric dentistry residents practiced quadrant dentistry, and if the patient needed any treatment, immediate availability as soon as the next day appeared to be feasible.

Disparities in oral health are evident for the Native Hawaiian and Pacific Islander pediatric population. Even though 96.0% of the WCCHC patients resided locally in the same

ZIP code, broken appointments at WCCHC ironically occurred 16.9% more frequently than at Bay Clinic. The broken appointment percentage (30.2%) at WCCHC was more than double that of Bay Clinic's (13.3%), and only 11.3% of the Bay Clinic patients who resided in the clinic/van ZIP code broke their appointments. Adjusting for all other effects, race (3 df, $p=0.0369$) and residence outside the clinic/van ZIP code ($p<0.0001$) were related to broken appointments at Bay Clinic. At Bay Clinic, of all the races to break appointments, Native Hawaiians were the most frequent (Table 5a.v.). Native Hawaiians and Pacific Islanders were also the most frequent to not complete treatment plans (Table 7a.v.), where all races other than Asian, Hawaiian, and Pacific Islander were 3.2 times more likely to complete treatment plans ($p=0.033$) (Figure 7). In general, a higher percentage (30.6%) of Native Hawaiians and other Pacific Islanders live in Wai'anae compared to Hawai'i's average (10.0%) and the national average (0.2%) [12]. Furthermore, at WCCHC, children with a high caries experience score over 9 were over 2.2 times more likely ($p=0.0498$) to break appointments than those with a caries experience score of 1-4 (Figure 10).

The frequency of broken appointments is likely to be underestimated at WCCHC. The WCCHC charts indicated an extensive amount of appointments being rescheduled and canceled, both of which were not entered as part of the data collection. At WCCHC, rescheduled appointments and cancelations can occur on the same day. When an appointment was rescheduled or canceled, the chart did not specify whether or not it took place on the same day as an appointment. Therefore, for data collection at WCCHC, only broken appointments were recorded when indicated. In contrast, at Bay Clinic, if an appointment was canceled or rescheduled on the same day, the appointment was recorded as a broken appointment in the chart and for the data collection. The broken appointment rate at Bay Clinic is more accurate.

The percentage of emergency visits at WCCHC is also likely underestimated. At WCCHC, a visit was recorded as an emergency visit based on indication of there being a limited oral exam in the chart note. Charting at WCCHC was not well calibrated, and limited oral exam was not always written in the chart, particularly when a walk-in already had a pending treatment plan. According to a provider at WCCHC, typically 10-15 pediatric patients were seen per day with 1-2 of them being emergency patients. If the emergency patient already had pending treatment, in addition to tending to the chief concern, the provider often also practiced quadrant dentistry treating other carious lesions in the area. For future studies, when analyzing utilization, billing records should be scrutinized as opposed to chart notes. The 5.7% rate of emergency visits at WCCHC is likely closer to Bay Clinic's rate of 17.9%.

Table 21c. Utilization Percentages Summary

	Bay Clinic	WCCHC	Both
Broken Appointments	13.3	30.2	19.3
Treatment Incompletion	36.5	32.6	35.1
Emergency Visits	17.9	5.7	13.9

With this study, there is some bias with the community health centers that became involved. Performing a research project in Hawai'i is difficult if one does not already have connections. Unless those in charge know you, they likely will be unwilling to help. Bay Clinic was responsive and the easiest to recruit because the PI previously worked as a general dentistry resident at Bay Clinic from 2010-2011. For WCCHC, the PI had shadowed at the site and interviewed in October 2010 there for the Lutheran Medical Center pediatric dentistry residency program in Hawai'i. As for MCHC, the first clinic director with whom the PI originally communicated was a

previous Lutheran Medical Center general dentistry resident and therefore knew the PI prior as well.

Acquiring WCCHC IRB approval was a long 6 month process. A requirement of all pediatric dentistry residency programs is a research project. Unfortunately, due to the lengthy IRB approval process, residents at WCCHC have trouble setting up, conducting, and completing any patient-related studies at their own clinic site during their 2-year residency program. The PI fortunately was in a 3-year residency program and had bountiful resources at UCSF to aid her acquire IRB approval at WCCHC.

A limitation of the study was that data could only be obtained from paper charts. Without clinical examination, calculation of dmft and DMFT was underestimated. Analog radiographs and odontograms if available were used to record the missing and filled component for calculating dmft and DMFT. Bay Clinic only had analog radiographs. WCCHC had analog radiographs until digital radiography was implemented in 2010. The PI did not have time to look at any digital radiographs, but the PI did feel that the documentation of existing conditions at WCCHC was reliable. Reviewing paper charts requires much more time than if an information technology (IT) technician could extract data from electronic records.

More time was also required in the early research trips to discern how to extract data from the charts. Initial data collected was more granular. The PI recorded more detail – e.g. whether antibiotics were prescribed, whether extractions were performed, etc. Over time, the PI learned not to overanalyze and to look at the big picture. Fewer data entry errors were likely made with future research trips. Time to review the charts was limited. The PI was only excused one week per quarter for research and therefore was highly motivated to collect as much data as possible during her research trips.

To maintain focus and collect data from paper charts for 8-10 hours a day for a few days straight was also challenging. At Bay Clinic, the PI always performed data collection in the dentists' office with no wireless internet connection and with clinic operations taking place and dentists coming in and out of the office. The background activity kept the PI awake for 10 hours of chart reviews. In contrast, during the PI's first research trip to WCCHC, the PI collected data in a quiet empty room that WCCHC had reserved away from the clinic. The PI had trouble focusing in the isolated room for 8 hours of chart reviews at WCCHC. Having learned from her experience at Bay Clinic, the PI requested to collect data in the clinic at WCCHC for future research trips. To accommodate the request, due to there being limited workspace in the clinic, the PI could only undergo data collection in the clinic on days there were less providers scheduled.

Only the PI collected data. Assistance from others calibrated to collect data would have been greatly appreciated. The PI asked both dental directors at Bay Clinic and WCCHC if they knew anyone who would be willing and/or interested to help perform chart reviews. Both dental directors could not think of anyone. For WCCHC, any volunteer would also have to be approved through the lengthy WCCHC IRB process. From California, no volunteer could afford to fly over to Hawai'i to collect data. Having only one person collect data, however, does help eliminate possible differences in interpreting charts and reduce errors.

Charting was also not well calibrated at both clinics. There was large variability from dental assistant to dental assistant and from provider to provider who wrote in the charts. Every year, different providers were at both CHCs due to their affiliation with Lutheran Medical Center dental residency programs. At Bay Clinic, there were at least 2 new providers each year; at WCCHC, there were at least 6. Each provider has different treatment philosophies. Each provider has a different temperament that may or may not motivate patients to return for treatment or recall. The amount of information a provider writes in his/her chart notes varies as well.

Charts could not easily be re-reviewed at any time. Despite the PI's communication of her need to re-review labeled charts in the future, not all charts could be gathered again to review and test for reliability. At Bay Clinic, some chart folders labeled with a study ID were purged, and the chart folder itself was re-used for a new patient because the original patient had not returned to the clinic for a couple of years. Fortunately the head dental assistant saved and was able to retrieve some of the chart paperwork of those purged. At WCCHC, if the last visit of a child in the study was in 2009, his/her chart could not be retrieved because they were moved to a storage unit offsite. Thus, reliability testing at Bay Clinic and WCCHC did not account for all those purged.

Nonetheless, the study is the first to look at ZIP code clustering in Hawai'i. This study has identified a strong significant association between outside the clinic/van ZIP codes with broken appointments ($p < 0.0001$) and incomplete treatment plans ($p = 0.004$). This suggests distance to be a barrier to care. More children would visit the clinic or dental van and complete treatment if care were more accessible. The Affordable Care Act (ACA) may expand access to Medicaid coverage, but not necessarily receipt of dental care.

ECC is a serious concern in low-income and minority populations in the US, and unfortunately, research on its epidemiology and determinants has been limited to cross-sectional or small clinical studies. More studies are needed to determine associations between ECC prevalence and predisposing factors among ethnic groups for more effective preventive regimens to be developed and implemented [35, 36]. Some significant correlations with ECC include child's age [37-40], child's gender [39], caregiver's age [39], caregiver's education [40, 41], caregiver's fatalistic oral health beliefs [38, 39], lack of dental insurance [40], dental visit history [35, 37], oral hygiene practices, and the consumption of sugary snacks and beverages [38]. Numerous studies also explore the significant association between ECC and salivary levels of mutans streptococci (MS) and lactobacilli (LB) in minority populations [42].

Racial- and income-based disparities in both oral health and dental care continue into adolescence and young adulthood [41] with harmful consequences. Consequences of ECC include increased risks for caries in primary and permanent dentitions [43, 44], hospitalizations and emergency room visits [45, 46], higher treatment costs [47], delayed physical growth and development [48, 49], loss of school days and gain of days with restricted activity [50, 51], diminished ability to learn [52], and diminished oral health-related quality of life [2].

In all, ECC is a devastating disease that can be prevented. With the population of children who are both minority and low-income growing, preventive practices will be key. Multimodality and interdisciplinary approaches to caries prevention in children are being aggressively sought. Such interventions to reduce oral health disparities include administration of xylitol, use of dental sealant agents and topical fluorides, improvement of oral health education, and regular caries risk assessment. In this study, oral health education appeared to be emphasized more at WCCHC than Bay Clinic like due to the presence of pediatric dentists and a pediatric dentistry residency program. All patients received fluoride treatment during their examination appointments at WCCHC and if they cooperated at Bay Clinic. Dental sealants were always treatment planned when indicated. At WCCHC, a Caries Management by Risk Assessment (CAMBRA) Form was completed for all new patients and for all high caries risk patients on 3 month recall. When a child was deemed to be high caries risk, the child was placed on preventive 3 month recalls, at which time the child would receive another fluoride application. At WCCHC, most providers also prescribed fluoride due to no fluoride in drinking water; this was not consistently done at Bay Clinic.

Setting up water fluoridation in Hawai'i would be a large effective preventive undertaking. According to the Division of Oral Health, Centers for Disease Control and Prevention, as of December 31, 2012, 10.8% of people in Hawai'i were receiving fluoridated water compared to

63.7% of people in California. Hawai'i is ranked 50th out of 50 states with the lowest percentage of the state population receiving fluoridated water. California is ranked 34th out of 50 states [53].

Further studies of the cultural and behavioral patterns, as well as traditional risk factors, specific to ethnic subgroups, also are essential [36, 39, 54] in order to develop effective prevention strategies and set priorities for any minority population. Every ethnic group is unique with its own cultural beliefs, traditions, and behavioral patterns. Ethnic minorities and low-income children make up a greater percentage of the dental caries experience, which overall has impacted 40% of all children ages 2-11 years [41]. Minority groups like the Native Hawaiians and Pacific Islanders often are not as well educated and do not realize the importance of oral health, especially of the primary dentition. The highest education level of mothers in most of the chart reviews at Bay Clinic was some grade in high school. To aid with oral health education, when children come in for their vaccinations, pediatricians can play a critical role in ensuring that all children be seen by a dentist by the age of 1 year. Other healthcare professionals, such as nurses, pharmacists, and physician assistants, can be trained to train to screen for oral diseases and deliver preventive dental care services [55]. Head Start programs also need to be stricter on their requirements. The PI learned that on Big Island, Head Start programs frequently extended deadlines for children's required medical and dental examinations.

The study most significantly supports all possibilities for overcoming the distance barrier for children to receive the dental care they need. In this study, wherever the Bay Clinic dental van traveled, more children were treated. Having more dental vans travel to cover all the ZIP codes or providing transportation via buses will improve access to care. Habits are hard to break, and parents are unlikely to change and find a way for their children to regularly see a dentist until they are in dental pain. If the parents do not bring the children to the dental clinic, then policymakers instead can make sure the dental clinic comes to them, by having dental

vans travel to their ZIP codes or better yet to their schools. At schools, all paperwork including consent for dental treatment can be sent home, filled out, and returned back. Parents this way do not also have to take time out of their workday to bring their children to the dentist.

In all, this study provides an updated oral health profile of the low-income and minority pediatric population in Hawai'i. The hope is that that the research results will serve as a database for CHCs to re-evaluate how to improve their clinical operations and for policymakers to make decisions on future strategies to effectively and culturally-appropriately promote dental health and enhance health status and access to care in Hawai'i. Despite CHCs accepting Medicaid and having schedule availability, large percentages of untreated caries and broken appointments still remain. This holds great relevance for the ACA and provides important insights of what to expect. In conclusion, insurance coverage alone is not sufficient to meet treatment needs. Dental clinics accepting Medicaid need to be more accessible. Overcoming the distance barrier by having more dental vans or providing transportation may be a big help. There also needs to be a greater emphasis on the importance of oral health within the communities, especially among the lower socioeconomic and minority class of patients. Only with more preventive interventions directed at low-income ethnic populations will the prevalence of ECC be reduced and the overall oral health state in Hawai'i be improved.

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