The association between Oral Health Care Recommendations and Sugar, Vitamin C, Vitamin D, and Calcium Intakes in U.S. Adults NHANES dataset 2011-2012

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NHANES Research Project

NTR 555 – Nutrition in Epidemiology

Introduction/Rationale

- Oral health is plays a key role in ensuring good nutrition throughout life
- Oral health can cause poor nutritional outcomes but nutrition can also cause poor oral outcomes
- Sugar, Vitamin C, Vitamin D and Calcium intakes have been studied against oral health outcomes
  - Researchers have found associations between high sugar intakes and low calcium and vitamin D levels and the increase in dental caries, decayed or missing teeth, or periodontal disease
- Alcohol, Smoking, and Sugar Sweetened beverages (fruit juices) have also been found to play a role in oral health conditions
- However, research is inconsistent and oral health conditions could potentially be multifactorial

Objectives

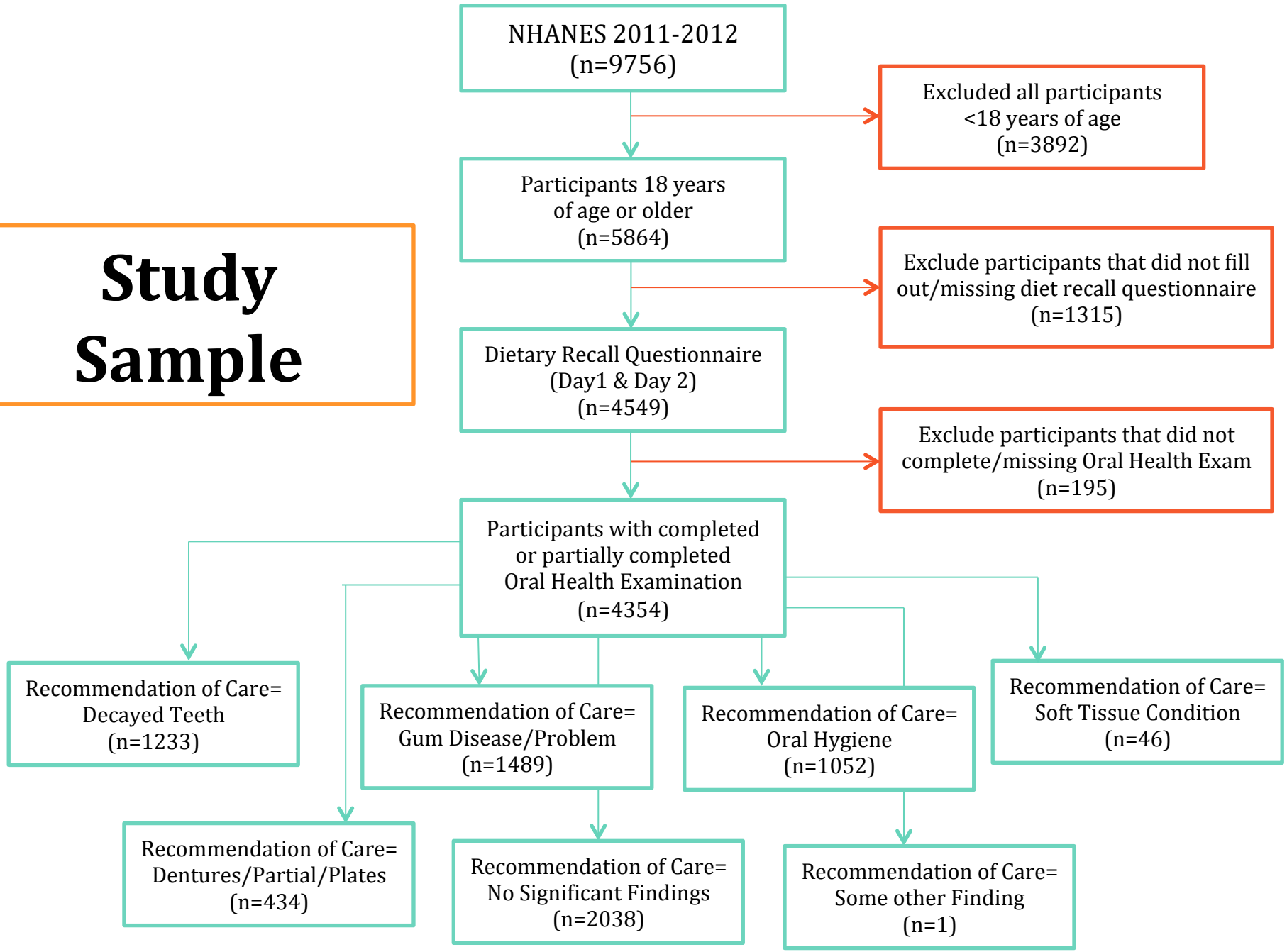
1. **To examine and define the sample of adults with oral health care recommendations and nutrient intake in regards to demographic data in a nationally representative sample of the United States population.**
2. **To determine the association between oral health recommendations of care and sugar, calcium, Vitamin C, Vitamin D, fruit juice, and alcohol intakes among adults in a nationally representative sample of adults (18 years of age and older).**

    2a. To determine the association of fruit juice drinkers and alcohol drinkers and oral health recommendations of care among races

3. **To determine the association between oral health recommendations of care and sugar, calcium, Vitamin C, Vitamin D, fruit juice, and alcohol intakes among adults in a nationally representative sample of adults (18 years of age and older)**

    3a. To determine the association of fruit juice drinkers and alcohol drinkers and oral health recommendations of care among races

Study Sample



Variables

- **Demographics**
  - Categorical: Race, Gender, Smoking status (yes/no)
  - Continuous: Age, Energy intake, weight, BMI
- **Oral Health Examination – Recommendations of Care**
  - Categorical Variables - 5 options - (yes/no)
  - Decayed teeth, gum disease/problem, oral hygiene, impression of soft tissue condition, dentures/plates, no significant findings
- **Nutrient Intake**
  - Sugar - % of calories from sugar
  - Vitamin C and D and Calcium – per 1000 calories
  - Calculated into quartiles (25^{th}, 50^{th}, 75^{th} percentiles)
- **Lifestyle Choices – gathered from FPED**
  - Fruit juice status, alcohol status - Yes = reported as ≥ 0.01 drinks/day, No = 0
  - Smoking status – Yes = reported as “some days” or “everyday” No = “Never”

Statistical Analysis

OBJECTIVE #1:

- Nominal variables – Frequency distributions (n, %)
  - Gender, race, smoking status, recommendations of care
- Continuous variables – Measures of central tendency (mean ± SD)
  - Age, Weight, BMI, Energy Intake

OBJECTIVE #2:

- Chi-Square Analysis – to find association between each recommendation (yes/no) and each nutrient quartile and fruit juice and alcohol consumption (yes/no)
  - Cramer's V or Phi coefficients for effect size
  - $P < 0.05$ as significant

Objective 2a: Descriptive Statistics for prevalence (n, %) among races

OBJECTIVE #3:

- Chi-Square Analysis – to find the association between smoking status (yes/no) on oral health care recommendations (yes/no)
  - Cramer's V or Phi coefficients for effect size
  - $P < 0.05$ as significant

Objective 3a: Descriptive Statistics for prevalence (n, %) among races

Table 1: Characteristics of Subjects in Oral Health Exam and Dietary Recalls of NHANES 2011-2012 (n=4354)

Variable	Measures
Gender n (%)	
Female	2215 (50.9)
Male	2139 (49.1)
Age (years≥18)	47.3 ± 18.5[1]
Participant Race: n (%)	
Mexican American	422 (9.7)
Other Hispanic	410 (9.4)
Non-Hispanic White	1681 (38.6)
Non-Hispanic Black	1169 (26.8)
Non-Hispanic Asian	535 (12.3)
Other	137 (3.1)
Average Weight (kg)[2]	65.3 ± 29.6[1]
Average BMI (kg/m^2) [2]	25.3 ± 7.7[1]
Average Energy Intake (kcal) [3]	2140.1 ± 999.8[1]
Smoking n (%) [2]	
Smoker	783 (36.9)
Non-smoker	980 (55.6)

Oral Health Exam Recommendations of Care	
Decayed Teeth n (%)	
Yes	1212 (27.8)
No	21 (0.5)
Gum Disease/Problem	
Yes	1477 (33.9)
No	12 (0.3)
Oral Hygiene	
Yes	1047 (24.0)
No	5 (0.1)
Impression of Soft Tissue Condition	26 (0.6)
Yes	20 (0.5)
No	
Dentures/Partial Denture/Plates	432 (9.9)
Yes	2 (0)
No	
No significant findings	
Yes	2016 (46.3)
No	22 (0.5)

[1]Values Represent Mean ± Standard Deviation [2]Not representative of entire sample due to missing data [3]Based on an average of two dietary recalls

Oral Health Care Recommendations and % Calories from Sugar (n=4354)

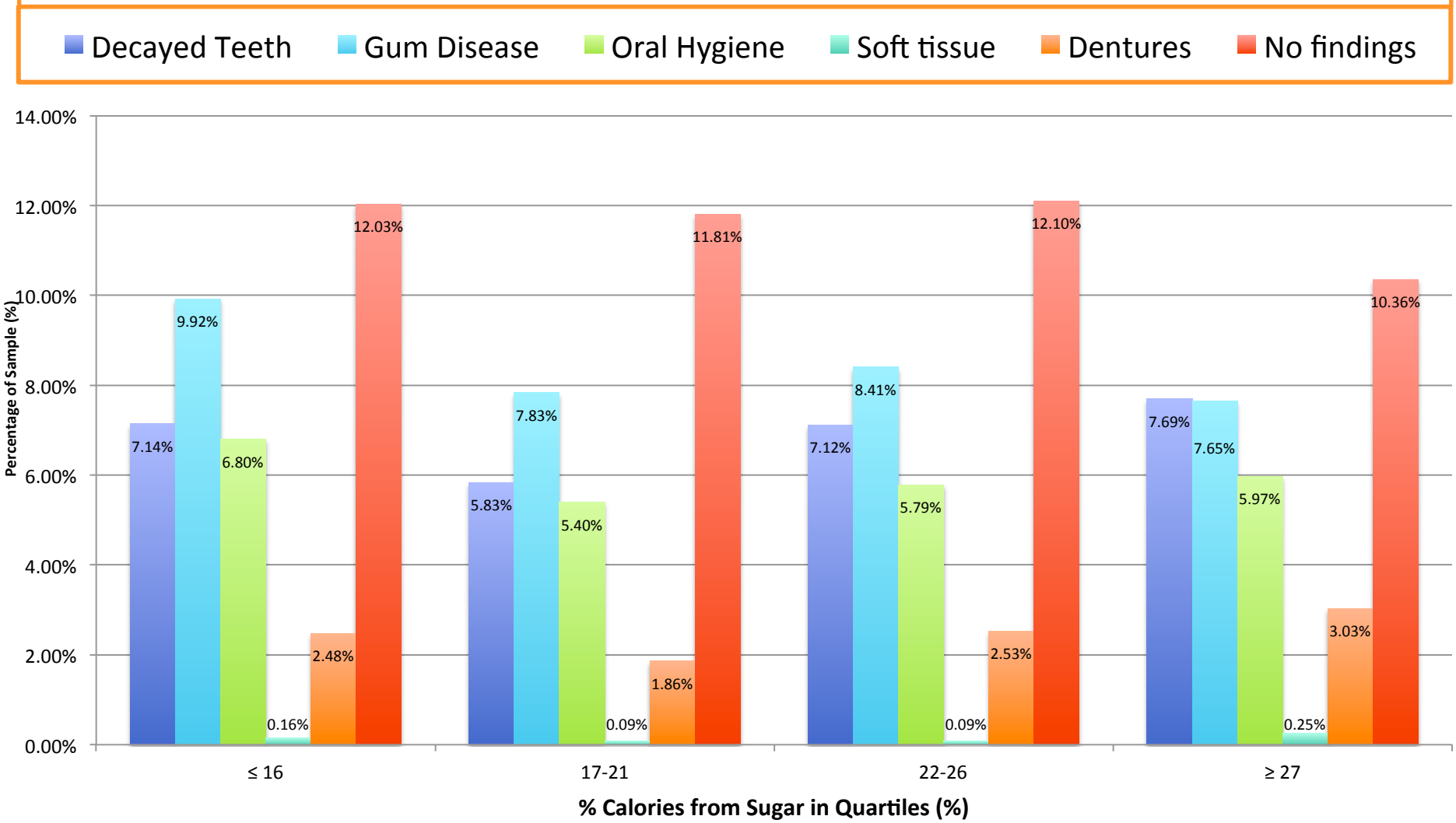


Figure 1: Chi square analysis indicated there was not a significant difference between sugar intake and recommendation of oral health care. Thus, all p-values for each chi-square run for each oral health outcome was >0.05.

Oral Health Care Recommendations based on Calcium Intake (n=4354)

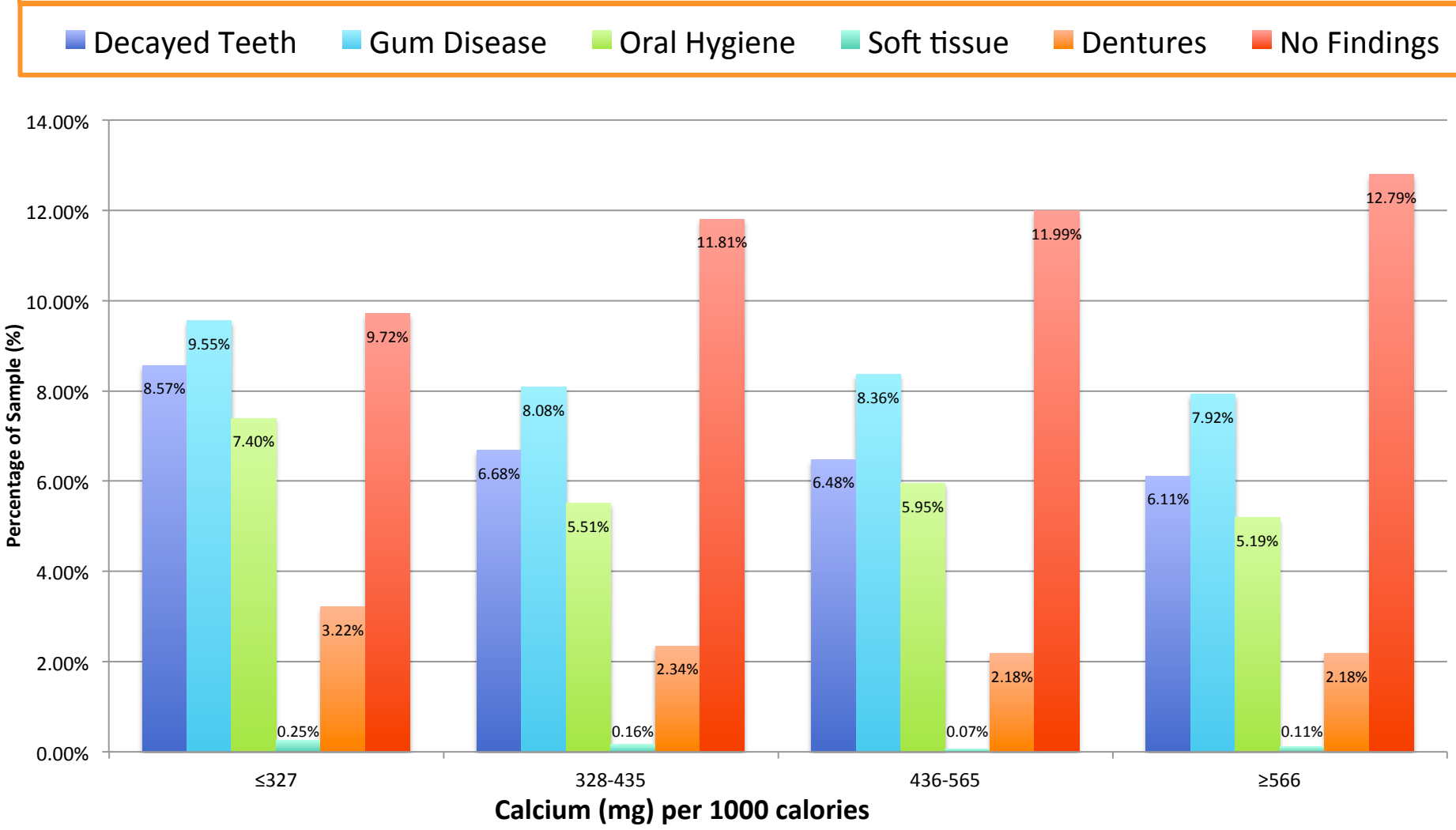


Figure 2: Chi square analysis indicated there was no significant difference between calcium intake and oral health care recommendations. Thus, all p-values for each chi-square run for each oral health outcome was >0.05.

Oral Health Care Recommendations based on Vitamin C Intake (n=4354)

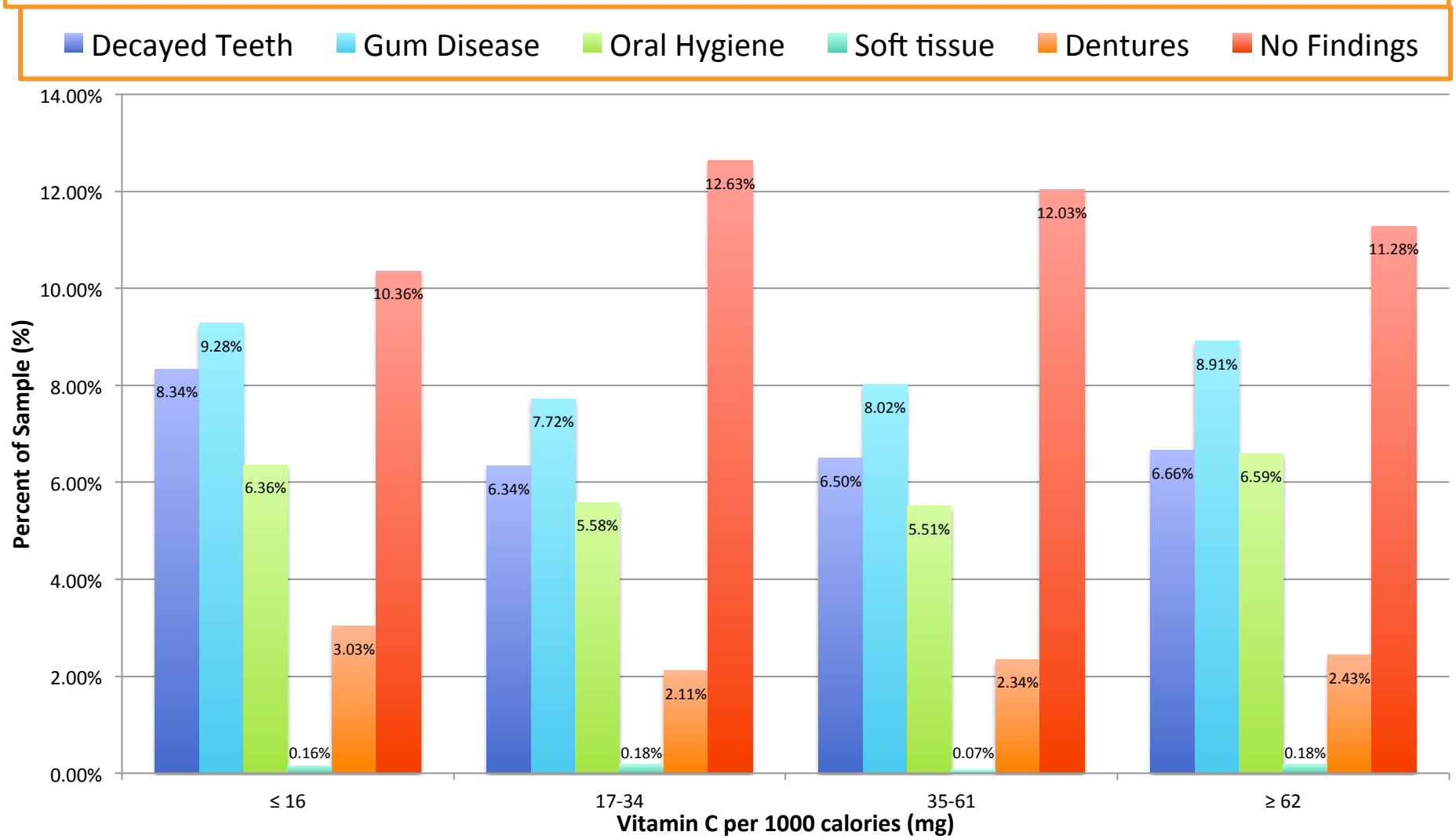


Figure 3: Chi square analysis indicated no significant difference between vitamin C intake and oral health care recommendations. Thus, all p-values for each chi-square run for each oral health outcome was >0.05.

Oral Health Care Recommendations based on Vitamin D Intake (n=4354)

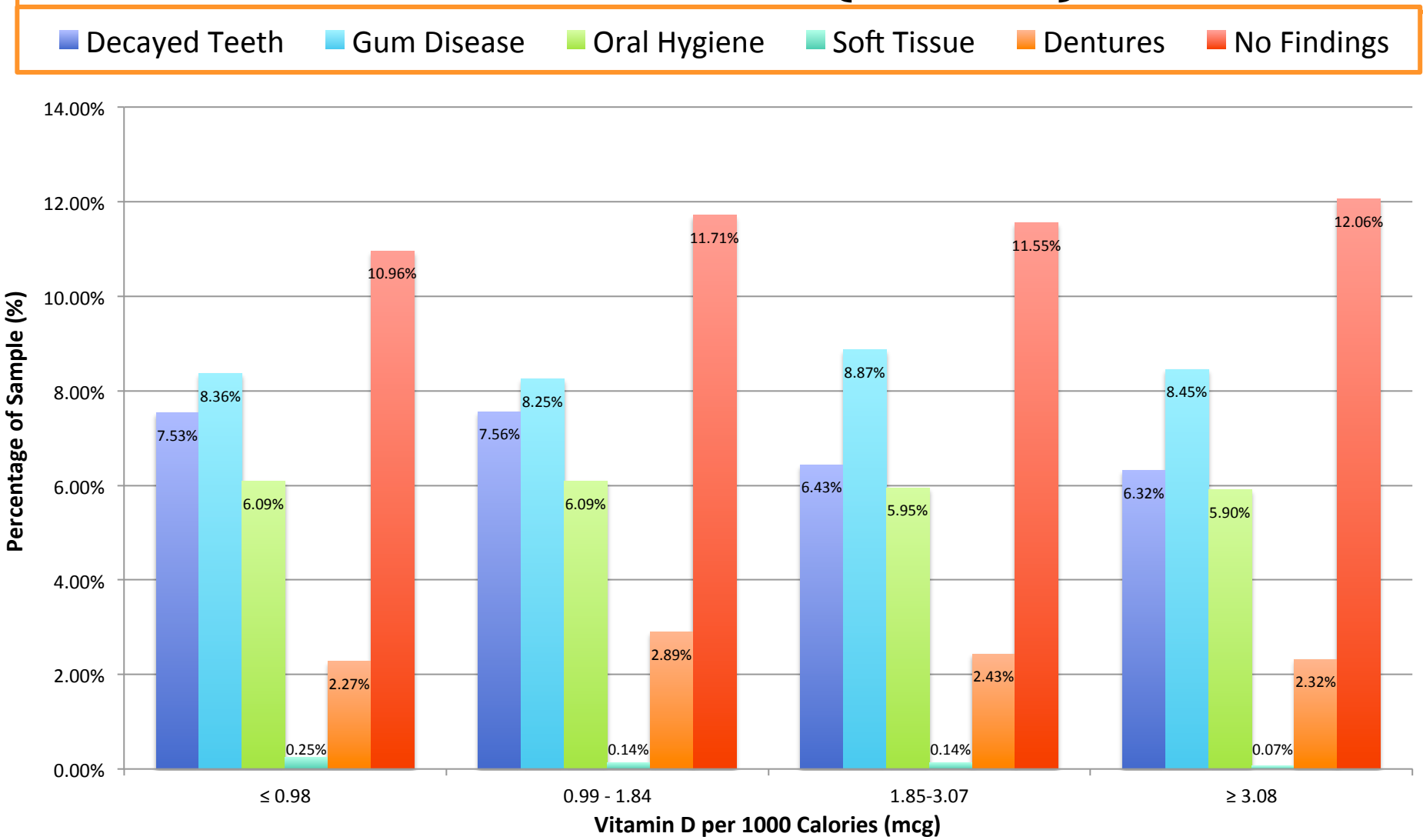


Figure 4: Chi square analysis indicated no significant difference between vitamin D intake and oral health care recommendations. Thus, all p-values for each chi-square run for each oral health outcome was >0.05.

Table 2: Chi-Square Analyses for Nutrient Intakes against Recommendations of OHC

% Calories from Sugar						
Chi Square Statistics	**Decayed teeth**	**Gum Disease/Problem**	**Oral Hygiene**	**Soft Tissue Condition**	**Dentures/Plates**	**No Findings**
df, n	3, 1233	3, 1489	3, 1052	3, 46	3, 434	3, 2038
X^2	4.23	3.49	0.625	2.85	1.95	3.68
p-value	0.237	0.322	0.891	0.416	0.584	0.299
Cramer's V	0.059	0.049	0.024	0.249	0.067	0.042
Calcium per 1000 Calories (mg)						
Chi Square Statistics	**Decayed teeth**	**Gum Disease/Problem**	**Oral Hygiene**	**Soft Tissue Condition**	**Dentures/Plates**	**No Findings**
df, n	3, 1233	3, 1489	3, 1052	3, 46	3, 434	3, 2038
X^2	2.81	2.54	2.37	1.46	6.98	0.507
p-value	0.422	0.467	0.500	0.692	0.073	0.917
Cramer's V	0.048	0.041	0.047	0.178	0.127	0.016
Vitamin C per 1000 Calories (mg)						
Chi Square Statistics	**Decayed teeth**	**Gum Disease/Problem**	**Oral Hygiene**	**Soft Tissue Condition**	**Dentures/Plates**	**No Findings**
df, n	3, 1233	3, 1489	3, 1052	3, 46	3, 434	3, 2038
X^2	1.19	2.55	0.831	1.46	2.37	1.69
p-value	0.755	0.467	0.842	0.691	0.499	0.639
Cramer's V	0.031	0.041	0.028	0.178	0.074	0.029
Vitamin D per 1000 Calories (mcg)						
Chi Square Statistics	**Decayed teeth**	**Gum Disease/Problem**	**Oral Hygiene**	**Soft Tissue Condition**	**Dentures/Plates**	**No Findings**
df, n	3, 1233	3, 1489	3, 1052	3, 46	3, 434	3, 2038
X^2	5.19	3.61	5.31	1.73	6.06	0.756
p-value	0.158	0.307	0.151	0.630	0.108	0.860
Cramer's V	0.065	0.049	0.071	0.194	0.118	0.019

df: degree of freedom, p-value set at <0.05 for significance.

Oral Health Care Recommendations based on Fruit Juice Status (n=4354)

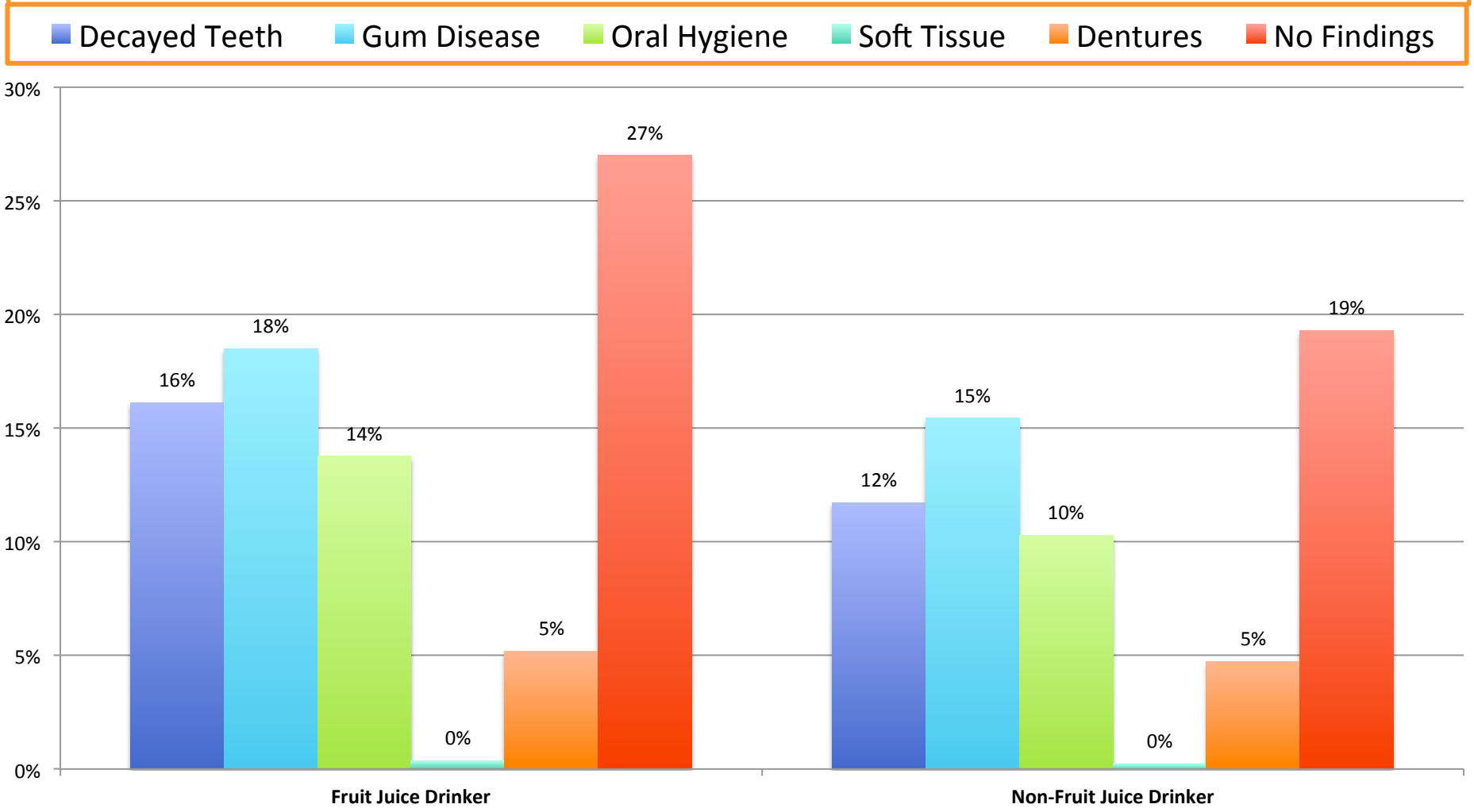


Figure 5: Chi square analysis indicated there was not a significant difference between fruit juice intake and recommendation of oral health care. Thus, all p-values for each chi-square run for each oral health outcome was >0.05. Refer to **Table 3** for details.

Oral Health Care Recommendations based on Alcohol Status(n=4354)

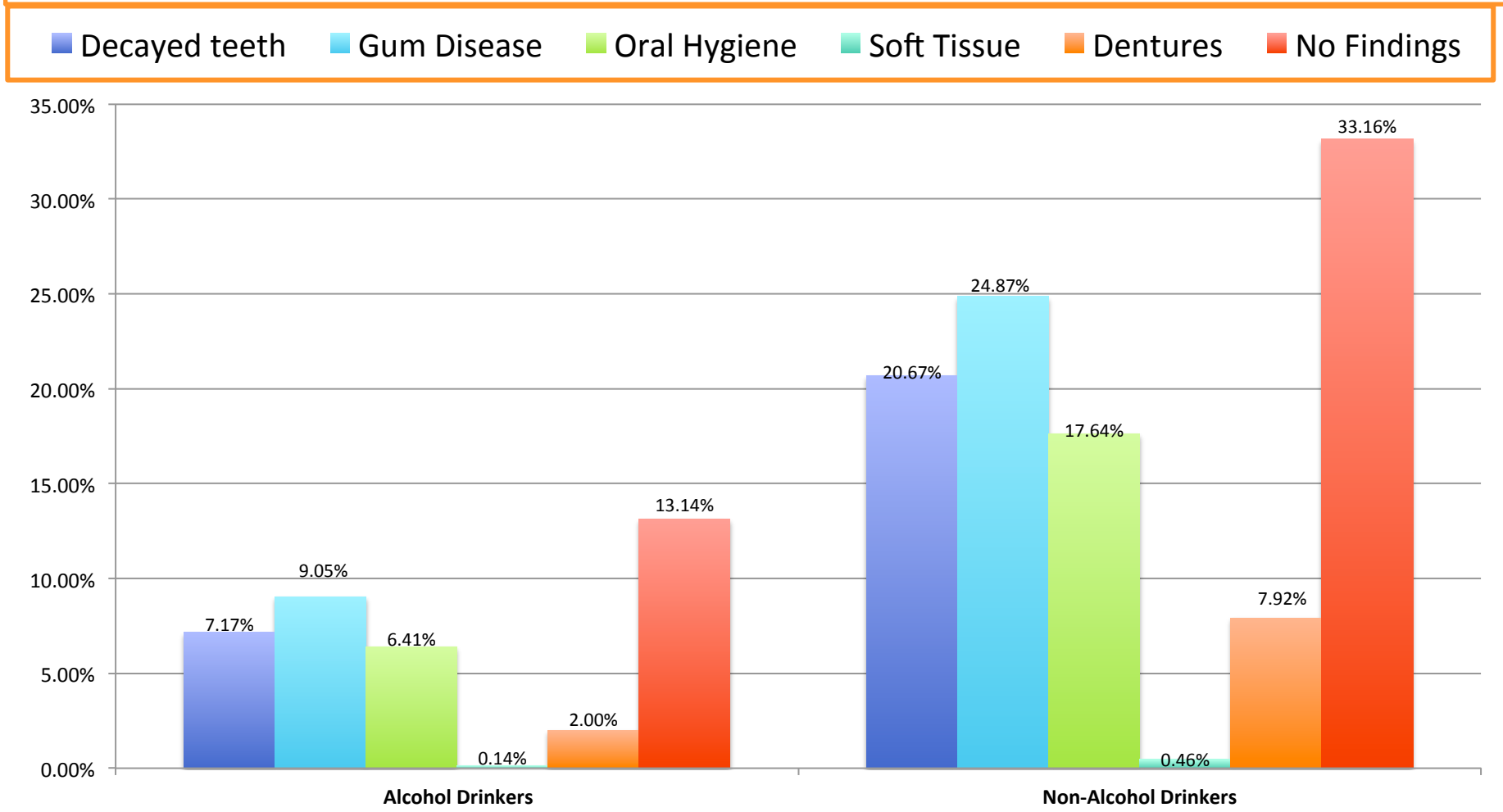


Figure 7: Chi square analysis indicated there was not a significant difference between alcohol intake and recommendation of oral health care. Thus, all p-values for each chi-square run for each oral health outcome was >0.05. Refer to **Table 3** for details.

Oral Health Care Recommendations based on Smoking Status (n=1763)

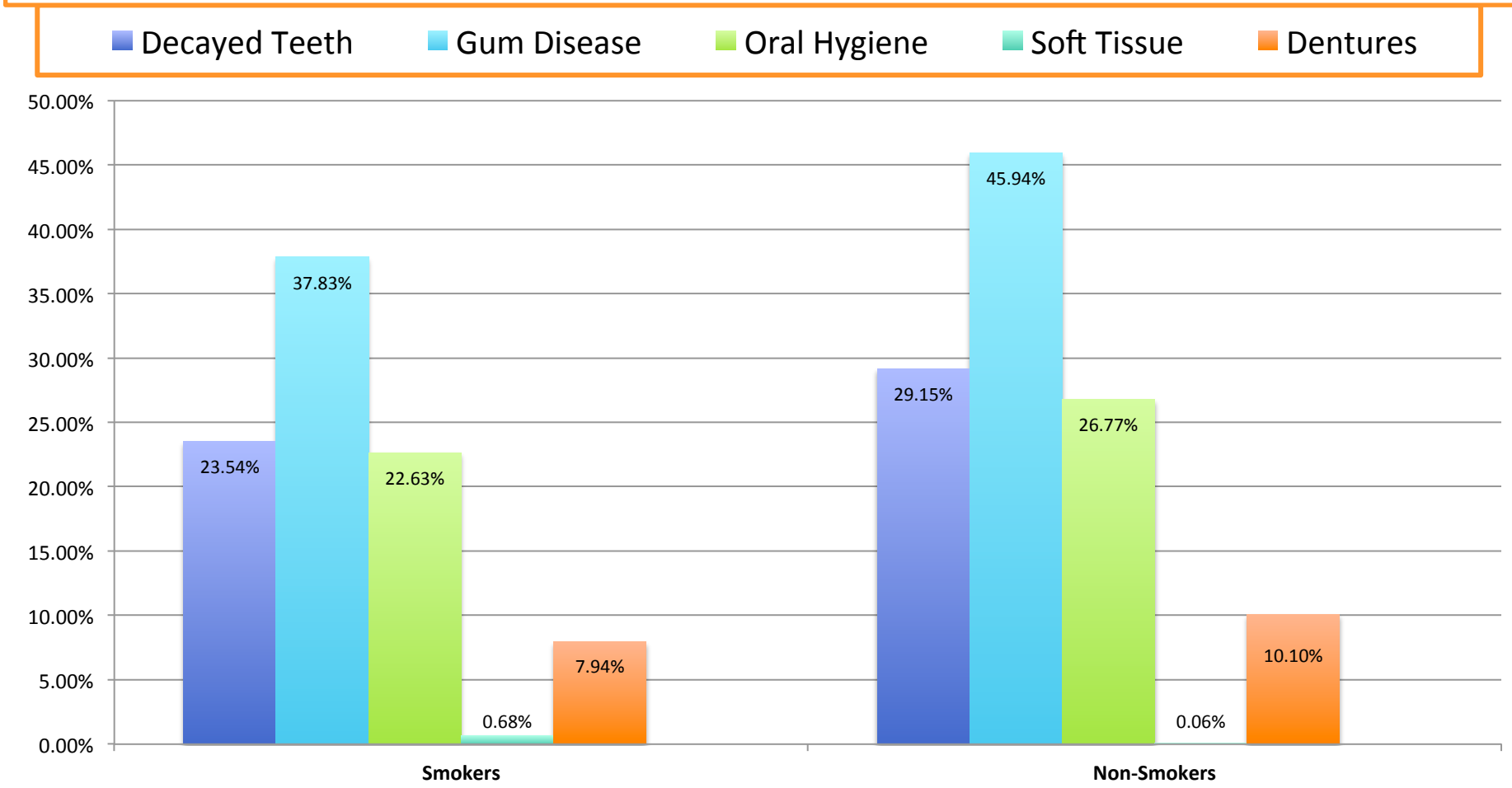


Figure 9: Chi square analysis indicated there was not a significant difference between alcohol intake and recommendation of oral health care. Thus, all p-values for each chi-square run for each oral health outcome was >0.05. There were no data for "no significant findings" in this data set. Refer to **Table 3** for details.

Table 3: Chi-Square Analyses of Lifestyle Choices against Recommendations of Oral Health Care

Fruit Juice Drinkers and Non-Drinkers						
Chi Square Statistics	**Decayed teeth**	**Gum Disease/Problem**	**Oral Hygiene**	**Soft Tissue Condition**	**Dentures/Plates**	**No Findings**
df, n	1, 1233	1, 1489	1, 1052	1, 46	1, 434	1, 2038
X^2	0.898	0.791	0.602	0.058	0.004	0.869
p-value	0.343	0.374	0.438	0.809	0.948	0.351
Phi coefficient	0.027	0.023	0.024	0.036	0.003	0.021
Alcohol Drinkers and Non-Drinkers						
Chi Square Statistics	**Decayed teeth**	**Gum Disease/Problem**	**Oral Hygiene**	**Soft Tissue Condition**	**Dentures/Plates**	**No Findings**
df, n	1, 1233	1, 1489	1, 1052	1, 46	1, 434	1, 2038
X^2	1.639	0.611	0.453	0.218	0.504	0.342
p-value	0.200	0.434	0.501	0.596	0.478	0.559
Phi coefficient	0.036	0.020	0.021	0.078	0.034	0.013
Smoking Status						
Chi Square Statistics	**Decayed teeth**	**Gum Disease/Problem**	**Oral Hygiene**	**Soft Tissue Condition**	**Dentures/Plates**	**No Findings**
df, n	1, 575	1, 758	1, 490	1, 22	1, 257	1, 696
X^2	1.541	0.237	--	0.321	0.661	1.60
p-value	0.214	0.626	--	0.571	0.416	0.206
Phi coefficient	0.052	0.018	--	0.121	0.051	0.048

df: degrees of freedom

Oral Health Care Recommendations based on Fruit Juice Drinkers stratified by race (n=2498)

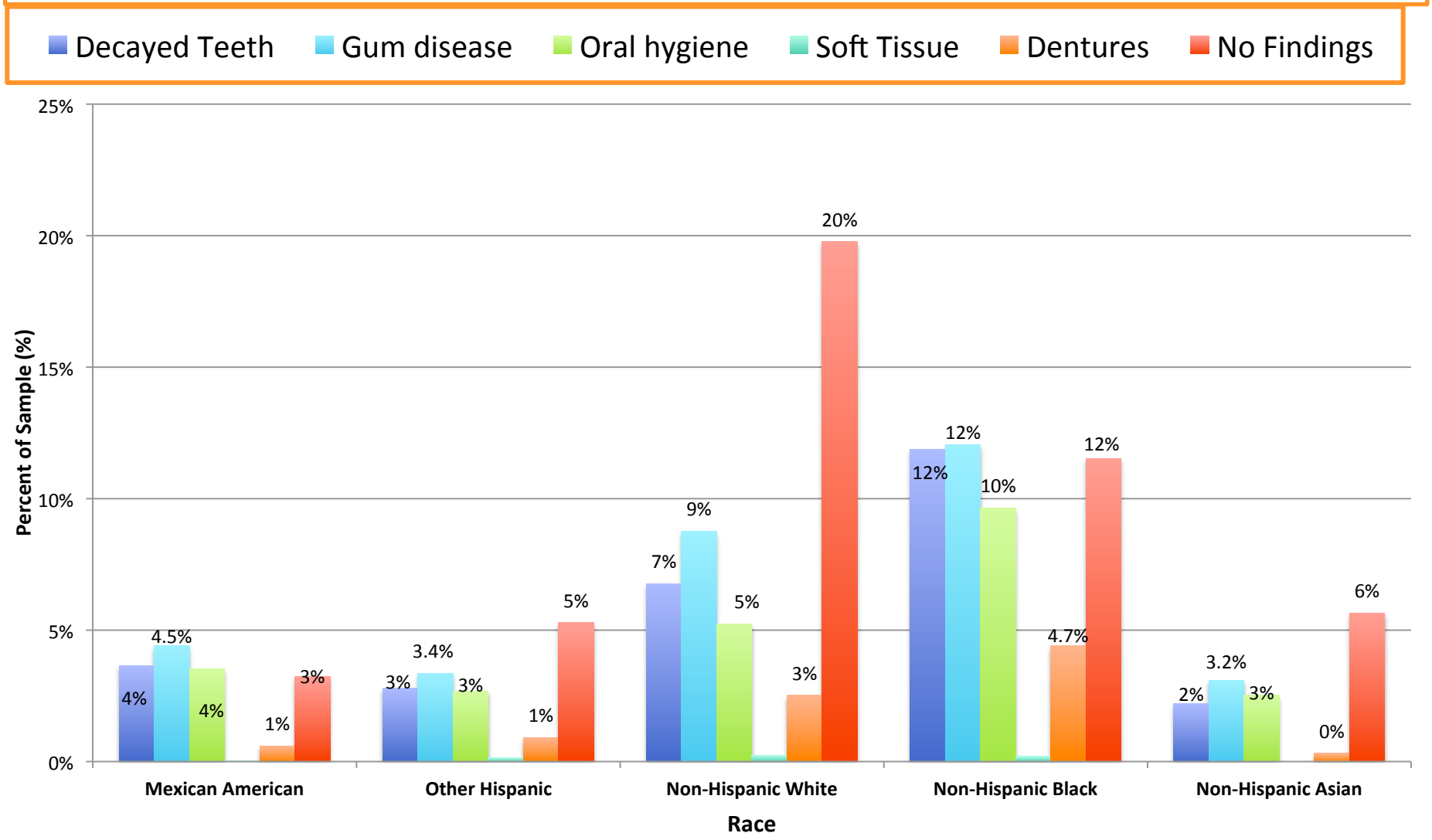


Figure 6 : Descriptive statistics were run for oral health care recommendations in fruit juice drinkers stratified by race. Refer to **Table 4** for details.

Oral Health Care Recommendations based on Alcohol Drinkers stratified by race (n=1177)

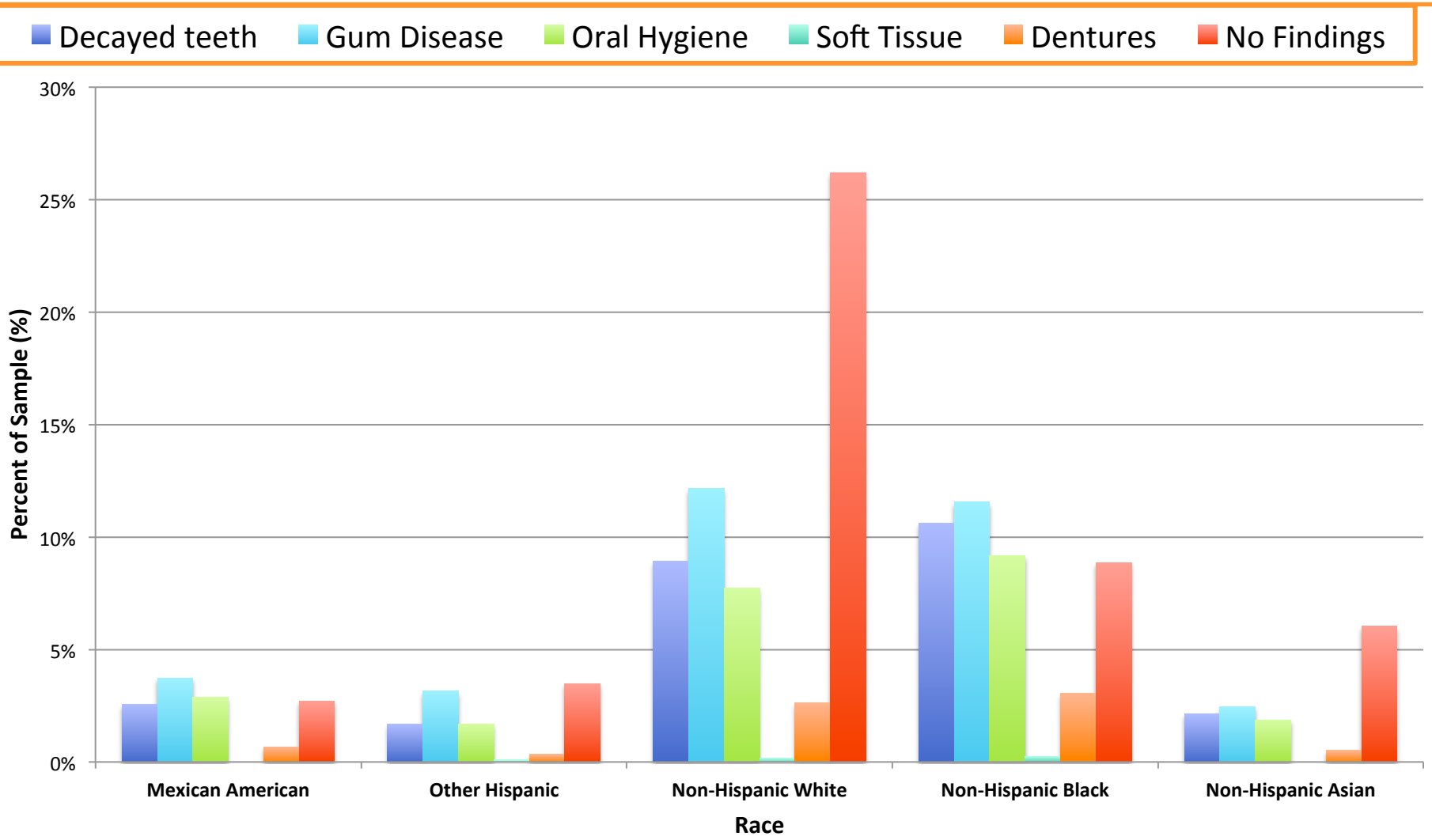


Figure 8: Descriptive statistics were run for oral health care recommendations in alcohol drinkers stratified by race. Refer to **Table 4** for details.

Oral Health Care Recommendations among Smokers stratified by race (n=783)

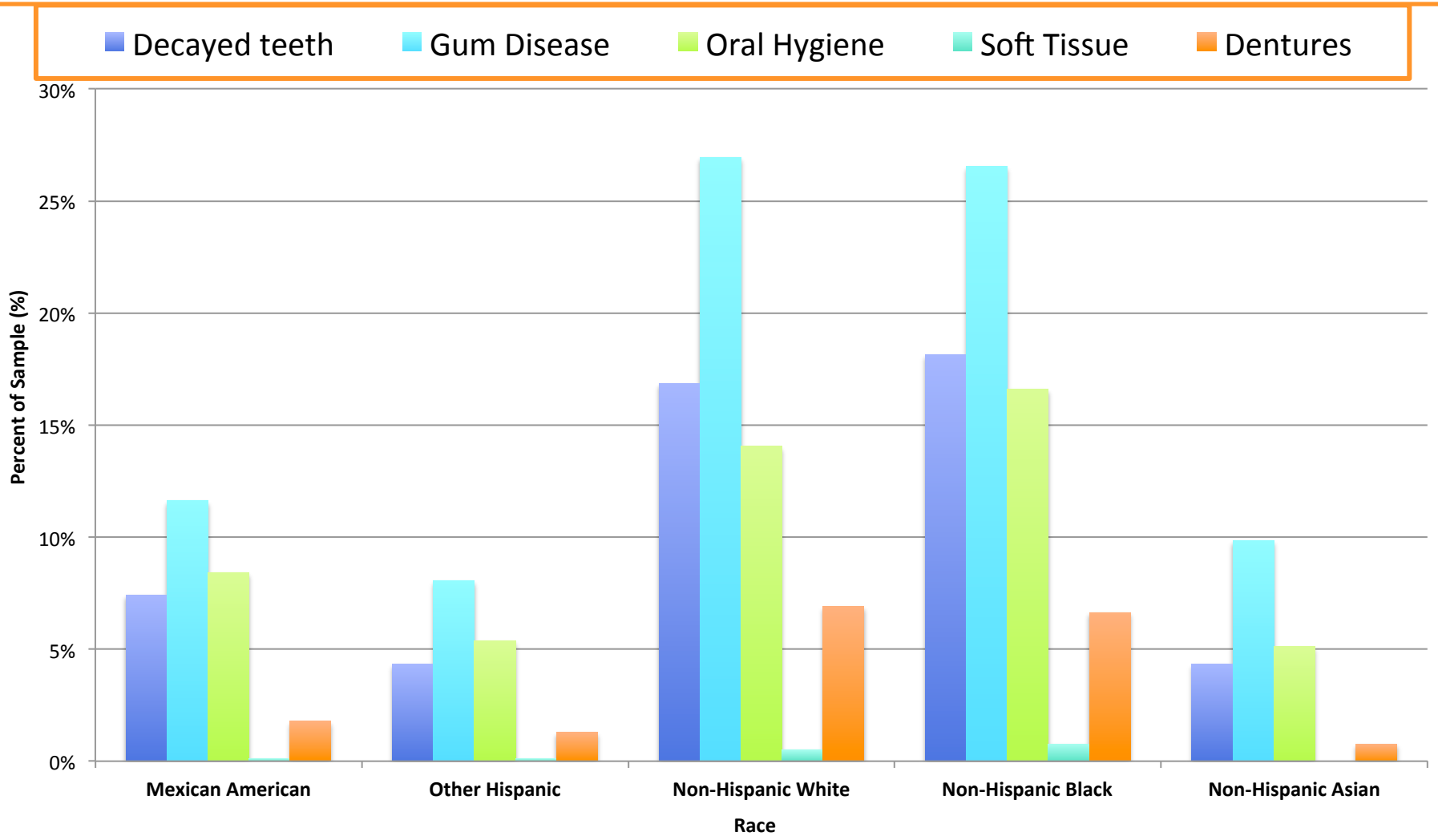


Figure 10: Descriptive statistics were run for oral health care recommendations in smokers stratified by race. Refer to **Table 4** for details.

Table 4: Prevalence of Recommendations of Oral Health Care among Fruit Juice Drinkers, Alcohol Drinkers and Smokers stratified by Race

Fruit Juice Drinkers (n=2498)						
n, %	**Decayed Teeth**	**Gum disease**	**Oral hygiene**	**Soft Tissue**	**Dentures**	**No Findings**
Mexican American	91, 4%	110, 4%	88, 4%	1, 0%	15, 1%	81, 3%
Other Hispanic	70, 3%	84, 3%	67, 3%	4, 0%	23, 1%	132, 5%
Non-Hispanic White	169, 7%	219, 9%	131, 5%	6, 0%	63, 3%	494, 20%
Non-Hispanic Black	297, 12%	301, 12%	241, 10%	5, 0%	110, 4%	288, 12%
Non-Hispanic Asian	55, 2%	77, 3%	63, 3%	0, 0%	8, 0%	141, 6%
Alcohol Drinkers (n=1177)						
n, %	**Decayed Teeth**	**Gum disease**	**Oral hygiene**	**Soft Tissue**	**Dentures**	**No Findings**
Mexican American	30, 3%	44, 4%	34, 3%	0, 0%	8, 1%	32, 3%
Other Hispanic	20, 2%	37, 3%	20, 2%	1, 0%	4, 0%	41, 3%
Non-Hispanic White	105, 9%	143, 12%	91, 8%	2, 0%	31, 3%	308, 26%
Non-Hispanic Black	125, 11%	136, 12%	108, 9%	3, 0%	36, 3%	104, 9%
Non-Hispanic Asian	25, 2%	29, 2%	22, 2%	0, 0%	6, 1%	71, 6%
Smokers (n=783)						
n, %	**Decayed Teeth**	**Gum disease**	**Oral hygiene**	**Soft Tissue**	**Dentures**	**No Findings**
Mexican American	58, 7%	91, 12%	66, 8%	1, 0%	14, 2%	0
Other Hispanic	34, 4%	63, 8%	42, 5%	1, 0%	10, 1%	0
Non-Hispanic White	132, 17%	211, 27%	110, 14%	4, 1%	54, 7%	0
Non-Hispanic Black	142, 18%	208, 27%	130, 17%	6, 1%	52, 7%	0
Non-Hispanic Asian	34, 4%	77, 10%	40, 5%	0, 0%	6, 1%	0

Discussion

- Sugar Intake
  - in the modern age of increased exposure to fluoride (toothpaste, mouthwash) there is less of a relationship between sugar intake and development/severity of dental caries [10]
  - NHANES III data also found a weak relationship between beverage intake (carbonated soft drinks) and dental caries especially in the older age groups (41-60 years and >60 years) [11]
  - Supported in current study
- Calcium and Vitamin D
  - Plays key role in bone mineralization
  - There was significant association between increased risk of tooth loss when calcium intake was lower than what was recommended [12]
  - Trends were seen in current study but not significant
- Alcohol, Fruit Juices, Smoking
  - these have all been shown to increase risk of oral health conditions, specifically plaque, periodontal disease, dental caries [3,13]
  - Not supported in current study

Conclusions

- There is no significant association between sugar, vitamin C, vitamin D and Calcium and oral health conditions
- Oral health conditions are likely multifactorial
- **Future Research Needed**:
  - Examine more within race/ethnicity
  - Look at diet quality rather than specific nutrients
  - Study prevalence of tooth brushing and type of toothpaste used
  - Does type of water have an influence

References

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