

**Xerostomia experience in those 60 and older and its correlations with dental care
experience**

by

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Abstract

Xerostomia, or dry mouth, is an important risk factor for increased dental disease. Having dry mouth can not only result in more decay and infections but can also result in difficulty chewing, speaking, swallowing, and lower quality of life. This study examines which risk factors are more significantly associated with dry mouth and the experience of those reporting dry mouth with their healthcare providers. A survey was administered to 296 participants via phone and email asking participants to answer both Xerostomia Inventory (XI) and Geriatric Oral Health Assessment Instrument (GOHAI) questions along with questions about demographics, medical history, dental history, and experience with dry mouth. Those having 10-15 medications, self-reporting poor/fair oral health, less dental visits, an emergency treatment visit as their last dental visit, and being female were all more likely to report dry mouth. Less than half of those reporting high symptoms for dry mouth actually self-reported having dry mouth when asked. A majority of those self-reporting dry mouth reported not speaking to their healthcare provider about it and not receiving a diagnosis from their provider. This is of public health significance because it demonstrates how dental and general healthcare providers can better aid their patients in preparing for, understanding, and dealing with dry mouth. The study also helps providers understand which patients may be more likely to experience dry mouth, and therefore helps them better serve those affected by the condition.

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Preface

I would like to express my deepest gratitude to my research advisor Dr. Steven Albert for his belief in this project and his constant support. Without his help along with Dr. Finegold and Dr. Polk, this essay would not be possible. Participants of this study that spent time with my survey online and on the phone gave of their time so freely, and I am indebted to them. Lastly, I would like to thank my fiancé, family, friends, and classmates for their prayers and the love they show me for it has allowed me to accomplish things much greater than myself.

1.0 Introduction

1.1 Xerostomia: Effects, Causes, and Prevalence

Xerostomia or dry mouth is a common, and often overlooked, condition that occurs with aging (Lu). The reduction in saliva manifests in many uncomfortable side effects, including difficulty swallowing, speaking, and chewing. The effect on mastication can result in a reduction in nutrition intake and manifest in greater dissatisfaction with life (Lu et al). Those with dysphagia and difficulty chewing due to dry mouth have reported lower quality of life overall, as they are prevented from eating foods they would like to eat, take longer to finish a meal than others, and embarrassed by the appearance or health of their teeth to the point of avoiding laughing or smiling (Lu et al) (Hopcraft). Saliva is vital for maintaining oral health; its components decrease the chance of developing dental decay, demineralization of teeth, tooth sensitivity, and oral infections like candidiasis. Patients with dry mouth can often rely on sipping or sucking on sweet or acidic drinks and confectionery to relieve the uncomfortable symptoms which then aggregates with the absence of saliva to increase dental caries. The incidence of dental decay is higher in those with dry mouth, and patients with dry mouth have fewer teeth remaining than those without dry mouth (Hopcraft). Dry mouth is also associated with oral symptoms like taste disturbance, bad breath, oral soreness and burning, painful ulcers, and retention difficulties for removable prostheses like dentures and partials (Locker).

Lack of saliva is often associated with polypharmacy (use of 6 or more drugs). More than 400 over-the-counter (OTC) and prescription medications including antihistamines (for allergy or asthma), antihypertensive medications, decongestants, pain medications, diuretics, muscle

relaxants, and antidepressants can contribute to dry mouth. Other causes of dry mouth include chemotherapy or radiation therapy, comorbid conditions like Sjogren's, Alzheimer's, diabetes, Parkinson's, depression, smoking, and aging (ADA). Low income, prescription medications, and stressful life change in the previous 6 months were all significantly associated with dry mouth (Locker). In a longitudinal study of participants from age 50 to 65, dry mouth prevalence linearly increased as participants aged (Johansson et al).

The prevalence of xerostomia ranges from 5.5% to 46% in the general population (Villa et al). In general, rates tend to be higher for women than men (Locker). The wide range of percentages noted by current research is due to the variability in the method of measure and in the populations studied. Previous studies have mainly focused on older individuals in community-dwelling or the hospital setting (Viljakainen et al). In this study, the aim is to examine the prevalence of dry mouth along with how it correlates with demographics, frequency of dental visits, number of medications, certain health conditions, smoking, self-rated oral and general health, and quality of life assessment. Ultimately, the questionnaire given to participants will gauge if conversations about dry mouth occur with providers. The study also examines participants' understanding of antidotes to dry mouth. By carrying out this study, the purpose is to learn how dental and general healthcare providers can better aid their patients in preparing for, understanding, and dealing with dry mouth. The study also helps providers understand which patients may be more likely to experience dry mouth.

2.0 Methods

This cross-sectional study is based on information gathered from a questionnaire administered by email and phone to members of the University of Pittsburgh Claude D. Pepper Older Americans Independence Center. The University of Pittsburgh institutional review board approved all study procedures. Participants were recruited from the Pittsburgh Pepper Center Research Registry with the inclusion criteria being those older than 60 years old. Funding for the Pepper Registry is provided by NIH P30 AG024827. Those contacted by email were 921, 45 of which had invalid emails and 290 of which completed the survey before closing date. Those contacted by phone were 32, 26 of which did not respond or hung up and 6 of which completed the survey on the phone. The total number of participants was 296.

The Xerostomia Inventory (XI), an eleven-item summated rating scale on the severity of chronic xerostomia, was used to measure the presence of xerostomia (Figure 1). The XI has been used in research worldwide and modified in length and in scale with each iteration (Villa et al; Thomson; Weiner et al). The Geriatric Oral Health Assessment Instrument (GOHAI) was used to assess the impact of oral disease on elderly individuals. GOHAI has been validated in elderly populations and translated for use in several countries (El Osta et al; Ikebe et al; Tubert-Jeannin et al; Kressin et al). The remainder of the survey asks questions on demographics, medical history, dental history and care, and experiences with dry mouth and healthcare providers.

Limitations of this study is the lack of understanding of what constitutes having dry mouth by participants. There is a question that directly asks if the participant believes they experience dry mouth, and there is lack of familiarity with what that means to the participant. A community engagement session with eight individuals (6 males and 2 females) allowed us to discover that this

question can be misunderstood. Other limitations include the reliance on self-report for all data. We did not have access to health records or dental records for each patient to understand their interactions with healthcare professionals and their experiences with getting care overall. The demographics of our sample is over 90% white and does not fully represent our population.

Results were analyzed using RStudio. Data was examined with the use of logistic regression analyses.

XEROSTOMIA INVENTORY	GOHAI Index
<p>1) My mouth feels dry 2) I have difficulty in eating dry foods 3) I get up at night to drink 4) My mouth feels dry when eating a meal 5) I sip liquids to aid in swallowing food 6) I suck sweets or cough lollies to relieve dry mouth 7) I have difficulties swallowing certain foods 8) The skin of my face feels dry 9) My eyes feel dry 10) My lips feel dry 11) The inside of my nose feels dry</p> <p>Never = scoring 1 Hardly ever = scoring 2 Occasionally = scoring 3 Fairly often = scoring 4 Very often = scoring 5</p>	<p>1. How often did you limit the kinds or amounts of food you eat because of problems with your teeth or dentures? 2. How often did you have trouble biting or chewing any kinds of food, such as firm meat or apples? 3. How often were you able to swallow comfortably? 4. How often have your teeth or dentures prevented you from speaking the way you wanted? 5. How often were you able to eat anything without feeling discomfort? 6. How often did you limit contacts with people because of the condition of your teeth and gums, or dentures? 7. How often were you pleased or happy with the looks of your teeth and gums, or dentures? 8. How often did you use medication to relieve pain or discomfort from around your mouth? 9. How often were you worried or concerned about problems with your teeth, gums, or dentures? 10. How often did you feel nervous or self-conscious because of problems with your teeth, gums, or dentures? 11. How often did you feel uncomfortable eating in front of people because of problems with your teeth or dentures? 12. How often were your teeth or gums sensitive to hot, cold, or sweets?</p> <p>all the time = 5 very often = 4 fairly often = 3 sometimes = 2 seldom = 1 never = 0</p>

Figure 1 - Xerostomia Inventory and Geriatric Oral Health Assessment Instrument

3.0 Results

Table 1 - Demographics and Percent Self-reporting Dry Mouth

	n	Self-Reported Dry Mouth	
Overall	296	22.6%	
Sex			**
Female	206	26.2%	
Male	90	14.4%	
Age			**
60-70	88	21.6%	
71-80	148	20.9%	
81+	50	26.0%	
Ethnicity			
White	284	22.2%	
Non-White	12	33.3%	
Highest Level of Education			
high school/vocational school	20	10.0%	
college	104	28.8%	
graduate	172	20.3%	
Number of Medications Prescribed			**
0-4	209	18.2%	
5-9	71	26.8%	
10-15	13	61.5%	
16+	3	66.7%	
Self-Rated General Health			**
Excellent	46	8.7%	
Very good	144	20.8%	
Good	95	32.6%	
Poor/Fair	11	18.2%	
Self-Rated Oral Health			**
Good	234	17.9%	
Poor/Fair	62	40.3%	
Frequency of Dental Visits			**
Less than once a year	20	50.0%	
Once a year	33	21.2%	
More than once a year	243	20.6%	
Reason for your last dental visit?			**
Prevention	220	19.1%	
Treatment	63	30.2%	
Emergency treatment	13	46.2%	
Have you ever smoked tobacco products?			
No	166	22.3%	
Yes	130	23.1%	
Average Oral Health Score	8.6	8.6	**
Average Dry Mouth Score	28.2	28.2	**

* indicate significant correlates

Table 1 indicates the significance between the relationship of each category to those who self-report dry mouth using the chi-squared test of independence. Amongst those listed, sex, age, number of medications, self-rated oral and general health, frequency of dental visits and reason for last dental visit were all significant (indicated by the asterisks). Males reported dry mouth less than females. Those older, those with more medications, those with poor or fair self-reported oral health, those with less dental visits, and with an emergency treatment visit as their last dental visit were all more likely to report dry mouth.

Table 2 - Logistic Regression with Self-report of Dry Mouth

	<i>estimate</i>	<i>std. error</i>	<i>z value</i>	<i>p value</i>
Intercept	-8.144741	2.162078	-3.767	<.001 ***
Sex (male)	-0.029958	0.431149	-0.069	0.94
Education				
Graduate	-0.068417	0.380306	-0.180	0.86
High School/vocational school	-2.272167	0.967298	-2.349	0.02 *
Age	0.009462	0.025557	0.370	0.71
Self-rated general health				
Fair	-1.374748	1.234097	-1.114	0.27
Good	0.388671	0.688879	0.564	0.57
Very good	0.454794	0.639518	0.711	0.48
Self-rated oral health	0.802876	0.430561	1.865	0.06 .
Poor/fair	0.802876	0.430561	1.865	0.06 .
Number of medications				
5-9	0.136898	0.448415	0.305	0.76
10+	1.753736	0.776115	2.260	0.02 *
Dry mouth score	0.235856	0.036678	6.430	<.001 ***

Signif. codes: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

Table 3 - Regression Model with Dry Mouth Scores (XI)

	<i>estimate</i>	<i>std. error</i>	<i>z value</i>	<i>p value</i>
Intercept	26.08757	3.40755	7.656	<.001 ***
Sex (male)	-4.05052	0.80496	-5.032	<.001 ***
Education				
Graduate	-0.29693	0.79192	-0.375	0.71
High school/vocational school	2.65452	1.50154	1.768	0.09 .
Age	-0.06806	0.04685	-1.453	0.15
Self-rated general health				
Fair	2.75296	2.23516	1.232	0.22
Good	2.50602	1.20720	2.076	0.04
Very good	0.98999	1.07390	0.922	0.36
Self-rated oral health				
Poor/fair	2.63246	0.92602	2.843	0.01 **
Number of medications				
5-9	0.40881	0.90379	0.452	0.65
10+	3.50364	1.79084	1.956	0.05 *

Signif. codes: '****' 0.001 '***' 0.01 '**' 0.05 '.' 0.1

A logistic regression model was made using the self-reported dry mouth, and a linear regression was made with the dry mouth score acquired from the XI assessment. When examining independent association for sex, education, self-rated general health and oral health, and number medications, those with 10-15 medications were significantly more likely to report dry mouth. Males and those with high school and vocational school education were significant for being less likely to self-report dry mouth. When examining the same correlates, those with 10-15 medications and those self-reporting poor/fair oral health were significant for having higher dry mouth scores.

Males were significant for having lower dry mouth scores than females. When GOHAI score was regressed with self-report of dry mouth, there was significant evidence to suggest that oral health score increases for those who self-report. Increasing GOHAI score correlates with poorer oral health.

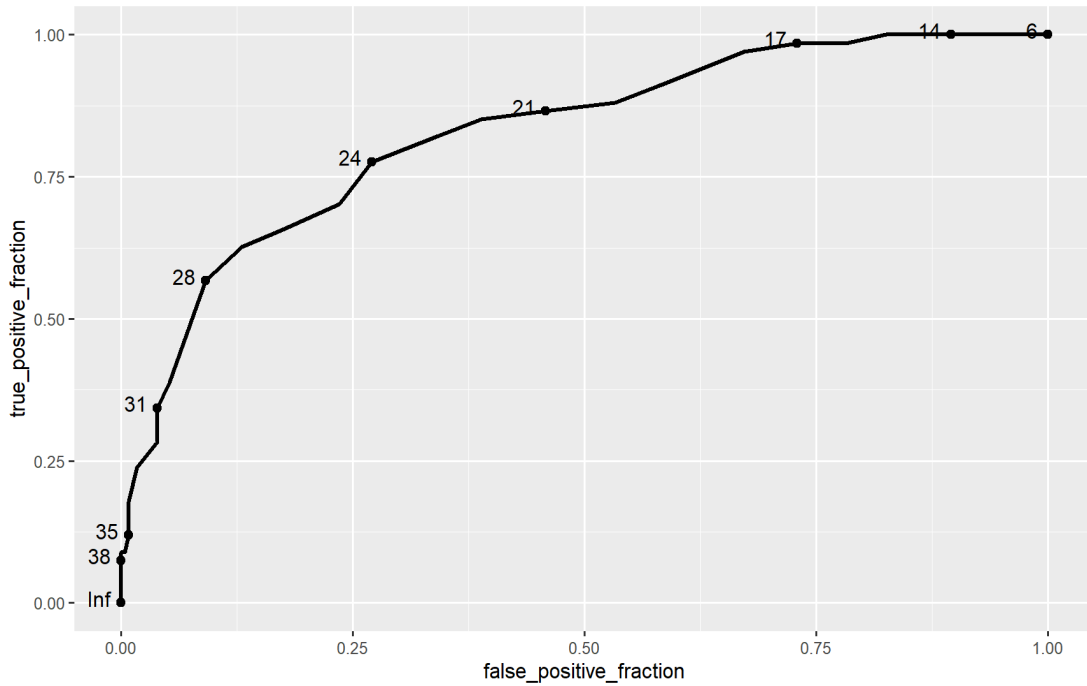


Figure 2 - Review Operating Characteristic (ROC) Curve

In Table 4, an ROC curve was created to compare the sensitivity and specificity of the test to the self-report of dry mouth. The curve shows that a score of 24 gives about 75% sensitivity and specificity. Knowing this, it is possible to study the group of individuals with higher symptoms being the group with a score greater than or equal to 24. In Table 5, the 114 participants that have a score greater than 24 were analyzed. Less than half (45.6%) of those with a score greater than or equal to 24 actually self-reported having dry mouth when asked if they experience dry mouth. Of the higher symptom group, those who self-reported having dry mouth proved to be predominantly

female, visit the dentist more than once a year and had a prevention visit as their last visit, and were more prevalently found in the college and graduate groups (Table 5).

Table 4 - Characteristics of Higher Symptom Group (Dry Mouth Score \geq 24)

	n	Self-Reported Dry Mouth
Overall	114	45.6%
Sex		
Female	94	37.7%
Male	20	7.9%
Highest Level of Education		
high school/vocational school	12	1.8%
college	42	21.1%
graduate	60	22.8%
Number of Medications Prescribed		
0-4	78	26.3%
5-9	10	4.4%
10+	26	14.9%
Frequency of Dental Visits		
Less than once a year	11	7.0%
Once a year	16	6.1%
More than once a year	87	32.5%
Reason for your last dental visit?		
Emergency treatment	10	5.3%
Prevention	77	27.2%
Treatment	27	13.2%

Table 5 - Self-Report of Experience with Dry Mouth

	n	%
Have you ever informed your dentist that you experience dry mouth?		
Yes	24	35.8%
No	43	64.2%
Has any health care provider ever informed you that you may have dry mouth?		
Yes	19	28.4%
No	48	71.6%
Dry mouth does not cause me to have a lower quality of life.		
Agree	59	88.1%
Disagree	8	11.9%

Participants reporting dry mouth revealed that a majority did not speak to their dental provider about dry mouth and were not informed that they have dry mouth by their dental provider (Table 6). From those reporting dry mouth, 71.6% do not report speaking to their health care provider about it. A majority also did not report dry mouth causing them to have a lower quality of life. When those reporting dry mouth were asked what is used as a remedy, 66% participants noted drinking a fluid. Others noted sucking on hard candy, mouth rinses, and other products more specifically like Biotene and Xylomelts.

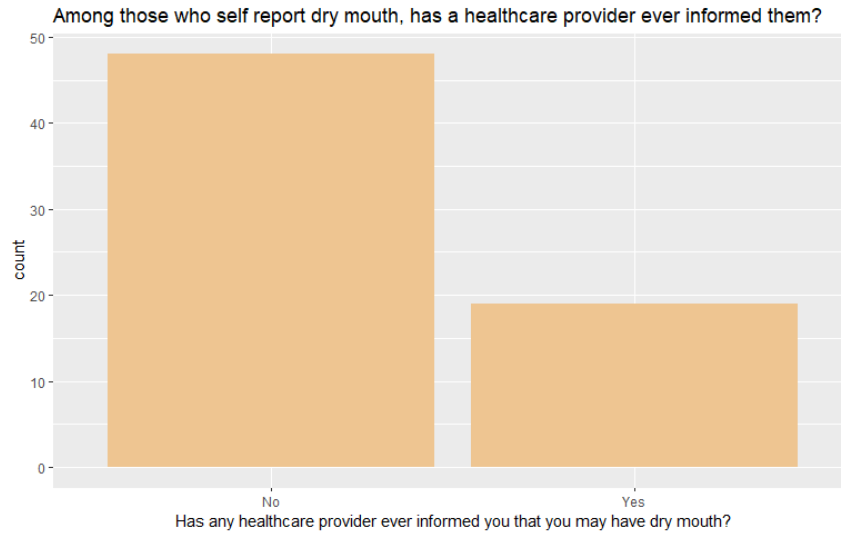


Figure 3 - Healthcare Provider Report of Dry Mouth to Patients

4.0 Discussion

The results represent that individuals who self-reported poor oral health, had infrequent dental visits, or 10-15 medications all reported dry mouth more significantly. Women were more likely to report symptoms and report dry mouth. GOHAI scores increased with self-report of dry mouth, showing that poorer oral health is associated with dry mouth. The group in the high school/vocational school category had the biggest discrepancy between the number reporting dry mouth and those that had a high dry mouth score. The lower education group reporting dry mouth less while having more symptoms can indicate the role of health literacy in addressing this topic. An understanding of the effects of dry mouth on the individual and what may cause it is pivotal in better tackling the issue of xerostomia.

Results demonstrated that a small proportion of those reporting dry mouth said it affected their quality of life. This finding could be due to those struggling with dry mouth symptoms may not correlate the discomfort they feel with chewing or speaking to the dry mouth. The community engagement session previously mentioned also revealed the possible disconnect between people's understanding of dry mouth and the true effects of dry mouth.

More than half of those self-reporting dry mouth did not have a conversation with their healthcare provider about dry mouth. The high number of people indicating this disconnect between patients and healthcare providers demonstrates that providers must actively work to firstly recognize dry mouth in their patients and secondly have conversations with their patients about it. This conversation could cover topics including prescribing fluoridated toothpaste, explaining palliative treatment options, explaining what not to do when the patient's mouth is dry, etc. Covering any of these topics in an interaction with the patient will significantly aid in slowing the

deterioration of the dry mouth patient's oral health while also giving them tools to better their condition.

5.0 Conclusions

As confirmed by previous studies, polypharmacy, decreased number of dental visits, and poor/fair oral health are associated with dry mouth. Women are more likely to report and experience dry mouth than men. More than half of those reporting dry mouth did not have a conversation with their healthcare provider about it. Of those with high symptoms reported by the XI, less than half reported dry mouth when asked.

The public health issue of xerostomia is often overlooked and unaddressed. The issue can be better tackled if all healthcare professionals work towards increasing awareness. When a physician prescribes a medication causing dry mouth or sees risk factors like increased number of prescription medications, they can inform their patient of the possible consequence of dry mouth. A pharmacist dispensing a medication causing dry mouth can make sure to inform the patient. A dentist performing a head and neck exam on a patient, after seeing the patient's intraoral condition, can act accordingly in tackling the presence of dry mouth. Increasing patient awareness with dental office signs, bus and supermarket posters, billboards, etc., is an avenue that could greatly benefit the population affected by dry mouth. By increasing awareness and patient education, the effects of dry mouth on our population can be diminished.

Appendix A - Survey (Excluding GOHAI and XI)

Demographics questions-

1. Age
2. Sex
3. What race/ethnicity(s) do you identify with?
White, Black/African American, American Indian/Alaskan Native Asian, Native Hawaiian/other Pacific Islander, Hispanic/Latino, Prefer not to answer, Other (please specify)
4. What is your highest level of education?
High school, GED, vocational, college, graduate
5. # of medications you are prescribed?
0-4, 5-9, 10-15, 16+
6. Self-rated general health-
Excellent, Very Good, Good, Fair, Poor
7. Medical Conditions

Has a doctor ever told you that you have had any of the following? (Please check all that apply)

- Diabetes, High blood pressure, Stroke, Congestive heart failure, COPD or asthma, Heart attack, Heart disease, Arthritis, Osteoporosis, Hearing problems, Inner ear problems, Macular degeneration, Glaucoma, Peripheral neuropathy (persistent numbness in feet), Vision problems, Anxiety, Depression, Memory problems, Incontinence, Sleep problems, Parkinson's disease
8. History of radiation to head or neck?
 9. Mobility-
Excellent, Very Good, Good, Fair, Poor
 10. Do you use an assistive device?
 11. Balance-
Excellent, Very Good, Good, Fair, Poor
 12. Have you ever used tobacco products?
Do you currently use tobacco products?
 13. Exercise-
How often do you currently participate in any physical activity or exercise? (on your own or in a group)
Daily, A few days a week, Occasionally (less than 4 times a month), Never

Dental care-

Self-rated oral health-

Good, fair, poor

Self-rated need for dental treatment:

Good, fair, poor

Frequency of dental visits-

Less than 1 year

More than 1 year
How many teeth do you have remaining?

No teeth have been lost

1-6

7-12

13-19

20-28

No teeth remaining

Do you wear a removable prosthesis (denture, flipper, partial)?

What was reason for last dental visit?

Prevention

Emergency treatment

Treatment

Would you say you have dry mouth?

If yes:

- What do you do when you experience dry mouth?
- Have you informed your dentist that you experience dry mouth?
- Has anyone ever informed you that you may have dry mouth?
- If dry mouth was brought up in your dental visit, what treatment or recommendations have you received if any?
- Dry mouth does not cause me to have a lower quality of life.
Agree or Disagree

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