Theresa Richard: 00:01 This is episode 94 of the Swallow Your Pride Podcast. Today's guest is Dr. Nicole Rogus-Pulia. She is an assistant professor in the Department of Medicine and Surgery at the University of Wisconsin Madison and director of the Swallowing and Salivary Bioscience Lab at the William S. Middleton Memorial Veterans Hospital. Dr. Rogus-Pulia also serves as director of the Multi-site VA Intensive Dysphagia Treatment Program. The goal of her research program is to systematically identify factors underlying dysphagia in older adults and to translate these findings into novel evidence-based treatments for prevention of negative health consequences including pneumonia development.

Theresa Richard: 00:39 Dr. Rogus-Pulia receives funding from the National Institute on Aging, the Veterans Health Administration, the University of Wisconsin Head and Neck Cancer Specialized Program of Research Excellence and the Wisconsin Alzheimer's Disease Research Center to support this work. Holy cow. Oh my gosh. Nicole is just a doll to talk to. I was going to say I hope you guys love this episode. I know you're going to love this episode.

Theresa Richard: 01:06 It's like I do these episodes and I'm like, "That's cool. That's cool. That's cool." Then I did this one and I was like, "Do I even know anything about anything in the world of dysphagia?" So Nicole, keep doing your research. This was just one of those like mind blowing episodes for me to listen to the research on saliva. I mean, we all know how important it is in what we do with dysphagia but holy cow this was awesome.

Theresa Richard: 01:33 I know I also want to thank my wonderful podcast manager, Stephanie Jacobson. If you guys know her, she's an awesome clinician in San Diego, but not only does she edit the podcast, but she writes all the show notes that you guys download. She said this one had so many notes and so many references. So if you're wondering what Dr. Rogus-Pulia is talking about in half of these and you're wanting to look up the papers, Stephanie does a stellar job with writing these show notes, so go ahead and you can go to bit.ly/syppodcast094 to download the show notes for this episode. Hope you guys love this.

Theresa Richard: 02:13 Welcome to the Swallow Your Pride Podcast. I'm your host Theresa Richard. I'm a board certified specialist in swallowing and swallowing disorders, and I know first-hand how much confusing and conflicting information there is out there about how we assess and treat swallowing disorders. This podcast is

all about bringing everyone together, getting on the same page, being open to new ideas, and using evidence-based treatment strategies for our patients with dysphagia. Let's get into it.

Theresa Richard: 02:43 Just a quick disclaimer that all statements and opinions expressed in this episode do not reflect on the organizations associated with the speakers and are their own opinions solely.

Theresa Richard: 02:54 Hello there and welcome back. Just have a big announcement for everybody. We are going to be opening the doors to the Med SLP Collective on July 12th. I'm so excited to finally be opening them. Thank you everybody who's been waiting so patiently. If you've been on the waiting list, you'll get an email right away. Yeah.

Theresa Richard: 03:14 So what is the Med SLP Collective, if you are not familiar with it? Well, it was actually designed for a very specific group of medical SLPs. If you're feeling unfulfilled in your career as a Medical SLP or perhaps a bit confused on how to move forward, if you're feeling completely overwhelmed, overworked, overstressed, misunderstood, underappreciated in your facility, if you feel like you're riding the therapy hamster wheel, unsure if you're even providing good care for your patients, if you are getting overwhelmed with how much medical SLP information was missing from your graduate education that you're now expected to know, maybe you're feeling a little bit angry that you receive the same training as clinicians who work with kindergartners and now you feel like you have huge gaps in what you need to know to treat these medical cases, maybe you've been working in the field for a while.

Theresa Richard: 04:03 Are you feeling frustrated that there's no one single centralized source to stay up-to-date on all the latest research and treatments that are coming out every year? Are you even sure that you're providing the right and best, the most up-to-date treatment techniques for your patients? Well, imagine if there was one place that you could go to receive all the support and resources to help you eliminate these feelings. Imagine how much time and frustration you would save if you have immediate access to one centralized location for blind peer-reviewed resources. Imagine if you had access to several clinical experts and university professors to help guide you in your clinical decision-making with personalized responses to your clinical cases. Do you think then your patients would receive

higher quality care and make progress towards their goals? Do you think you would get more rewarded and recognized for this progress among your patients?

Theresa Richard: 04:50 Well, this is exactly why I created the Medical SLP Collective. It's a monthly membership program and vibrant community of fellow medical SLP clinicians and researchers who are supporting each other to provide better care for their patients and therefore also advance their careers. What do you get in the collective? You get weekly done-for-you resources. So each week, you'll receive a new video created to help educate you all about all areas of medical SLP, including dysphagia, aphasia, motor speech disorders, voice disorders, NICU, peds, and cognitive-communication. You'll also get information on how to advocate for your patients within the organizational bureaucracies that often make you feel like your patients don't matter to the doctors and nurses.

Theresa Richard: 05:30 Each video also comes with a PDF handout that gives you links to all the resources and references you need to implement, and they can all be printed for convenience to take on the go. The resources never go away. The library just continues to grow. So you will always have access to all the previous videos and handouts. Also, of note, all resources are blind peer-reviewed. So you deserve to have confidence in knowing that the materials you are using for your patients are the latest evidence-based and designed to save you from weeding through all the crap.

Theresa Richard: 06:00 We cover aphasia, dysphagia, dysarthria, voice, cognitive-communication and NICU just to name a few. Additionally, each month we have two-hour live webinars that are offered for ASHA CEUs delivered by some of the most foremost clinical experts and researchers in the field. You'll get a chance to vote on the most relevant topics to you each month. Also if you can't attend the webinars live, the recording is always put in our library. So if you join now or July 12th when we open, you have access to all of the previous past webinars that you can take for ASHA CEUs.

Theresa Richard: 06:36 Lastly, but I think most importantly, we have our private forum and Facebook group. We have both a Facebook group and also a private forum that has its own app to ask all your clinical questions there. We have several, I believe 20 to 25 different

clinicians and researchers that act as moderators and mentors to ensure you receive personalized guidance supported by the evidence to help treat your patients as best as you can. Many of our members in the collective say that the private forum and the Facebook group is worth the price of admission alone as you get real life front line in the trenches support from your fellow clinicians with researchers to back it up and a team of trained guides to answer your every question.

Theresa Richard: 07:15 Again, medslpcollective.com. It is opening July 12th. It's a monthly membership site. So if you join us and you decide it's not for you, no biggie. We also have a seven-day money back guarantee. Again, if you jump in, download every single resource, watch every single webinar, and still decide you don't like it, you can get your money back. I do hope that you will see the value of what it is. It's a wonderful community. I could not be more proud of how it's turned out. Yeah. I really don't have anything to say other than I love it so much and I really truly hope you'll join us. That will be opening on July 12th.

Theresa Richard: 07:53 Hi, Nicole.

Dr. Nicole R.: 07:54 Hi, Theresa.

Theresa Richard: 07:55 How are you?

Dr. Nicole R.: 07:56 I'm doing well.

Theresa Richard: 07:57 Thank you so much for coming on.

Dr. Nicole R.: 07:59 Thank you so much for having me. It's an honor to be invited.

Theresa Richard: 08:03 Yes, I hope all your grad students will... I hope you'll make them proud on this episode.

Dr. Nicole R.: 08:08 Yes. I definitely need a cool factor these days, so this will help.

Theresa Richard: 08:13 Awesome. Awesome. All right. Tell the people a little bit about yourself if they don't know who you are.

Dr. Nicole R.: 08:17 Sure. Yeah. I'm an assistant professor at the University of Wisconsin Madison. My tenure home is in the division of geriatrics and gerontology, but I also have a joint position in the department of otolaryngology where I hold a clinical SLP

position. I have a pretty low amount of clinic time and inpatient these days just because most of my time is research, but I do still maintain clinic time at the university hospital, which is mostly inpatient swallowing evaluation and treatment.

Dr. Nicole R.: 08:49 Then I also have a position at the Madison VA Hospital where I direct a lab called The Swallowing and Salivary Bioscience Lab. I also hold clinic specific to individuals with dementia from diagnosis through end-of-life at the VA as well.

Theresa Richard: 09:05 Awesome. Lots of cool stuff.

Dr. Nicole R.: 09:07 Yeah. It's really fun. Lots of different things going on, but it's just a great place for collaborations and- Yeah.

Theresa Richard: 09:14 Yeah. I love to talk to you guys that are knee-deep in the research but also doing clinic and teaching students. I know it's so hard for you guys to manage your time with which one, but I think it's so cool when you get to kind of do all three.

Dr. Nicole R.: 09:29 Absolutely. I think it's so important. I always joke that the clinical team, they keep me grounded and they make my questions practical.

Theresa Richard: 09:37 Yeah. Awesome.

Dr. Nicole R.: 09:37 Like that's interesting, but you're never going to actually be able to answer it.

Theresa Richard: 09:42 Right.

Dr. Nicole R.: 09:44 So move on.

Theresa Richard: 09:45 Yeah. That's such a good point because I think sometimes we say, we're like, "Why haven't the researchers studied this?" And they're like, "We'll never get an IRB grade for this, or we'll never get IRB approval for this."

Dr. Nicole R.: 09:54 Yeah, exactly. Exactly. So true.

Theresa Richard: 09:58 All right. Well, I just love looking through this outline, Nicole. I thought it was super fascinating. What are we going to talk about today?

Dr. Nicole R.: 10:05 I thought I would just give you a little overview of what my lab focuses on. As I mentioned, I'm in the division of geriatrics, so most of my work is focused on dysphagia in older adults. I'm very interested in how we can improve identification of dysphagia in the older adult population, but then also have several studies focused on testing the efficacy of treatments, some that have been evidence-based in other populations but maybe haven't been applied to older adults specifically to determine what's the best approach to managing dysphagia in older adults as well.

Theresa Richard: 10:40 Awesome.

Dr. Nicole R.: 10:41 So one particular area of focus that I have in my lab that is funded is focused on persons with early-stage dementia. And so I thought we could talk a little bit about that. Then, I thought I would delve into some of the work that we're doing focused on oral health and saliva production and how that kind of applies to persons with dementia as well.

Theresa Richard: 11:02 Yeah. Awesome.

Dr. Nicole R.: 11:03 One of the things that we know, I think most of your listeners can relate to this especially if they are working with people with the diagnosis of dementia, a lot of times we do not become involved in the care of these patients until they have some sort of complication. At least that's been my experience on inpatient. We'll see an individual when they've already been sort of in the moderate to severe stages of Alzheimer's disease and maybe they're admitted to the hospital with a UTI or mental status changes or in a lot of cases pneumonia and then we're consulted to do our evaluation and then we have to figure out what's going on.

Dr. Nicole R.: 11:43 I think this can be really difficult as the SLP in that setting because we often don't have an understanding of the specific subtype of dementia, the neuropsychological profile, if there's been imaging done. And a lot of times, the diagnosis of dementia is just sort of given while they're an inpatient but they haven't gone through a very thorough process for diagnosis. We know that other patient populations like those with ALS and Parkinson's disease also experience changes really early in their disease process. I don't know how familiar you are with some of the work that's been done by Dr. Ianessa A. Humbert and

Georgia Malandraki, actually at University of Wisconsin Madison, looking at early changes in swallowing biomechanics and neural activation in persons with dementia, so very early stage changes that may be more subtle and may not actually result in some of the clinical outcomes that we're most concerned about, like aspiration and residue, or pneumonia development, but are really already there very early.

Dr. Nicole R.: 12:54 So a lot of my work is focused on how can we sort of enact a paradigm shift in terms of our role, and with these patients and how we can become involved earlier and also justify to the geriatrics teams, the attending physicians, that we really need to be integrated early in the care of these patients.

Theresa Richard: 13:15 Yeah. Awesome, because I think of like ALS, you think like the sooner we can get in with those patients, the better. I think that's great.

Dr. Nicole R.: 13:24 Absolutely. Yeah. And most of the work looking at treatment for dysphagia and dementia has focused on compensatory techniques. I'm sure most of your listeners are familiar with what we call Protocol 201 which is the large clinical trial that Jeri Logemann and JoAnne Robbins conducted where they looked at chin tuck and thickened liquids in dementia and I think that's just a great example of how we've sort of had this assumption that especially as there's more cognitive decline, there's not a whole lot more we can do than enact these compensatory approaches, but if we become involved early, we know that other exercise-based approaches have been used in early-stage dementia for instance to prevent fall risk and improve physical activity. So if we start early in the disease process, we may be able to implement some of those rehabilitative approaches as well.

Theresa Richard: 14:18 Are there any specific approaches that you guys have looked at?

Dr. Nicole R.: 14:21 Yeah. I actually just received funding this past fall from the National Institutes on Aging to conduct a clinical trial focused on early-stage dementia. One of the arms of that study is looking at tongue strengthening. First of all, we want to know is tongue strengthening even feasible in this population. Like can we even use that approach? Our primary outcome for that study is oral pharyngeal residue, actually just pharyngeal residue using Katrina Seal's Normalized Residue Ratio Scale. So we're really

focused on efficiency with sort of the hypothesis that tongue strengthening would result in improved efficiency.

Dr. Nicole R.: 14:59 But what's nice is that we hopefully at the end of this study where we're looking to enroll about a hundred patients, we should have some idea of which patients at baseline based on their swallowing profiles are most likely to benefit from that approach so that we're not using sort of a one-size-fits-all approach. That's-

Theresa Richard: 15:17 Got you.

Dr. Nicole R.: 15:19 ... just getting going.

Theresa Richard: 15:21 Awesome. Are you guys just looking at tongue strength or are you looking at other exercise protocols too?

Dr. Nicole R.: 15:27 Yeah. One of the pieces of the study that I think is a bit novel and different is that we do have another arm where we're looking just at regular application of a saliva substitute. So I don't know if you're familiar with saliva substitutes, but they're basically... they can be gel these products or you can have a spray that you apply to the oral cavity that basically attempts to mimic saliva. And with efficiency or I guess residue as our primary outcome, we're really interested in whether we can sort of influence efficiency by increasing the amount of lubrication in the oral cavity and pharynx.

Dr. Nicole R.: 16:06 So we have a usual care arm, we have a combined tongue strengthening plus saliva substitute, and then just tongue strengthening and just saliva substitute.

Theresa Richard: 16:16 Cool.

Dr. Nicole R.: 16:18 Hopefully we'll get-

Theresa Richard: 16:18 That's really fascinating.

Dr. Nicole R.: 16:19 Yeah. Hopefully we'll get some information that will lead to larger multi-site studies.

Theresa Richard: 16:27 Let me back you up a little bit. I guess what inspired your work with wanting to look at the saliva arm?

Dr. Nicole R.: 16:34 For my doctoral work, I trained with Jeri Logemann at Northwestern University. She was very interested in changes in saliva production post chemoradiation. She has a couple studies where she examined the relationship between saliva production and swallowing in that population. So that's really where I became interested in this as a topic. Then the specific application to dementia, I actually just recently went through the process of disease progression with my own grandmother and saw how much it can impact family and the joy of eating. So I thought with this interest in saliva, it was something that we need to look at in this population as well.

Dr. Nicole R.: 17:18 You know, one of the main issues that we have, is that while we may be able to implement rehabilitative interventions early in the disease as the disease progresses, even if there is some at least sustained motor learning component, if we've implemented something early, we hope we can carry it through, there comes a point when that's just not going to be feasible. So are there other ways that we can optimize health and prevent pneumonia in the context of a known dysphagia, known aspiration event? That's really kind of how I have applied some of that saliva-focused work to this population.

Theresa Richard: 17:58 Cool. Awesome. Well, I guess from there do you want to go into oral health.

Dr. Nicole R.: 18:02 Yeah. We can kind of transition and I can talk a little bit about... I know you've had some discussions on just sort of oral health in general, dental health, but I'm going to focus specifically on saliva production and kind of go through some of the basics. I don't know. A lot of this was new to me as I started delving into the literature, so I hope it's helpful, and I also provided a link for a blog that one of my students, Joanne Mi and I wrote for Karen Chesler that's really helpful and it gives a nice overview of some of these different just basic components of saliva physiology.

Theresa Richard: 18:39 Awesome.

Dr. Nicole R.: 18:40 Yeah. We know that saliva plays a really important role in maintaining oral health, yet the quantity, the amount of saliva that's produced and the composition can be affected in many of our patients especially older adults. We know that a decrease in the flow rate, which is sort of how we quantify the amount of saliva... So we look when we're measuring salivary flow, we look

at how much saliva is produced in a certain amount of time. Typically that's five minutes but it can be shorter, you just need to look at what the amount of flow is in a standard time period.

Dr. Nicole R.: 19:15 We know that the flow rate is also decreased in individuals with Alzheimer's Disease as well, and across a whole host of other patient populations that we work with. It has been thought traditionally that the changes that we see in saliva production with advancing age are really just due to medication use or this sort of concept of polypharmacy, but thanks to some recent work by Rebecca Affoo, she's an assistant professor at Central Michigan University, she trained with Ruth Martin, and they did a really nice systematic review and meta-analysis looking at whole saliva as well... Whole saliva is saliva from all of the salivary glands. I guess maybe I can back up there a little bit.

Dr. Nicole R.: 20:00 We have three different types of salivary glands. We have the parotids that are in our cheeks, and then we also have the submandibular and sublingual glands that are under our jaw basically in the floor of mouth region. They each contribute different components of saliva to what we call whole saliva. So when you collect saliva from someone just by having them spit or expectorate into a tube, you're essentially looking at whole saliva. You're not collecting from one particular gland.

Dr. Nicole R.: 20:31 So when Dr. Affoo and Dr. Martin looked at changes in whole saliva production with advancing age, they found that there were decreases in overall production of saliva regardless of whether patients were taking medication. So there is an age independent reduction in saliva production. I think it's really interesting. I know in our field we talk a lot about this concept of functional reserve. We think of swallowing as a submaximal task and we know that for instance if you think about tongue pressure production, we can measure the maximum isometric pressures, but we know that we don't really need that full capacity to swallow. It's sort of the same thing with saliva.

Dr. Nicole R.: 21:18 So there is a really interesting study where they administered an anticholinergic drug called glycopyrrolate which basically decreases the amount of saliva that you produce, and they administered it to a young healthy group and then also an older healthy group. They look to see how that drug influenced saliva production in those two groups, and they found that there was

more of an effect in the older healthy group, even though those individuals had normal salivary flow rates kind of at baseline.

Dr. Nicole R.: 21:51 So it's a similar concept to functional reserve. They call it secretory reserve. It's the idea that as we age, we do lose some of the cells in our salivary glands and that puts us at increased risk for developing hyposalivation or decrease in abnormal saliva production.

Theresa Richard: 22:13 Awesome.

Dr. Nicole R.: 22:15 That's something I think is... You'll hear pretty frequently from geriatricians, "Well, the reason that their mouth is dry is because of the meds that they're taking." So it's important to understand that yeah, the meds are a component, but that's also just a normal part of aging.

Theresa Richard: 22:30 Yeah. I'm so glad you said that because I feel like sometimes we get sent on these like wild goose chases of like why is their mouth so dry? Why do they have low saliva production? I'm like, "I don't know. None of these meds look like anything that would be causing it. I don't know." So I'm glad there is just an independent factor that could be the cause.

Dr. Nicole R.: 22:48 That can contribute. And you know the other thing that I think is really interesting is if you look at the list of side effects for most meds that older adults are given, I mean almost everything has xerostomia as a potential complication. So it's really difficult anyway even to piece apart what that particular... which med is actually most contributing to the problem. And in a lot of cases, there's not a whole lot you can do. You can't take someone off a heart medication or even sometimes decrease the dose. So that can be an issue too.

Dr. Nicole R.: 23:22 I thought another important point that I personally didn't understand until I started reading more about this is that if you look in a lot of the notes from physicians, nurses, they'll generally use the term xerostomia, and they'll use that to refer to any abnormal change in saliva production. But xerostomia is actually just referring to the individual's perception of mouth dryness. So if I were to ask you, "Is your mouth dry?" And you said yes, we would say, "Okay, you have xerostomia," but the actual measured decrease in saliva production is called hyposalivation.

Dr. Nicole R.: 24:02 You would assume that if someone has xerostomia, if they say, "Yeah, my mouth is dry," that they're hyposalivating, they're not producing enough, but it's actually not a one-to-one relationship. So there are cases where individuals report mouth dryness but then when you actually measure their rate of salivary flow, it's not abnormally low. One of those cases I think is really interesting is this group of patients with this diagnosis called idiopathic burning mouth syndrome. This occurs much more frequently in women. It's often a postmenopausal condition where the main symptom is just that the mouth is burning. And when you ask these individuals, "Is your mouth dry?" They'll often say, "Yeah, it's really, really dry," and then you measure their saliva and it's normal.

Dr. Nicole R.: 24:55 What that sort of tells us is that there's something we're not really paying attention to. And it's not just the amount of saliva you produce, it's also the composition of the saliva. Saliva has a whole host of different components within it that I can get into a bit more, but we know like for instance in this burning mouth syndrome population that those individuals have a higher viscosity of their saliva, so their saliva is thicker, and then there's also a specific component, immunologic component in saliva called Secretory IgA that's reduced. The reason that there's a discrepancy between xerostomia and hyposalivation in that population is because of these compositional changes.

Theresa Richard: 25:42 Crazy.

Dr. Nicole R.: 25:43 Yeah, it's really interesting. It's definitely not something that we typically think about clinically. We often will think about, especially in the head and neck cancer population, we'll do a measure of salivary flow rate, but oftentimes that's just only part of the story.

Theresa Richard: 26:02 Yeah. Yeah. Cool.

Dr. Nicole R.: 26:04 Then we also know that the perception of mouth dryness is driven by... It's not just the overall production of saliva, but it also has to do with the specific location and thickness of the salivary film. After you swallow, there's a film of saliva that stays on all the structures in your oral cavity. It stays in the mucosa, the roof of your mouth, your tongue, your teeth. The thickness of that film, what they've shown is that the thickness at the hard palate is actually the most important location. So if that's

less than 10 microliters, individuals are more likely to report xerostomia.

Dr. Nicole R.: 26:44 Clinically, the clinical take home for this, I think, is with a lot of my patients who have xerostomia or.. and a measured decrease in production, I'll recommend if they're going to apply a saliva substitute like a gel or a spray that they focus on the hard palate because that's going to have the biggest impact in their perception.

Theresa Richard: 27:06 Awesome.

Dr. Nicole R.: 27:07 Then I think it's important to mention that you can also have a condition called xylaria, which is overproduction of saliva. One issue that I have with this is you can see a lot in the literature they talk about the occurrence of xylaria in many of the neurodegenerative populations that we see like Parkinson's disease. What's really interesting is we don't, in a lot of cases, actually know that these patients are overproducing saliva. So I think this is a great example of the interaction of swallowing and saliva production that in many cases patients have a reduced swallow frequency rate. So it's not just that they're overproducing. They may be overproducing, but they're also just not swallowing frequently enough and so they're not managing their saliva well.

Dr. Nicole R.: 28:01 Sometimes, treatments like a Botox injection can be used and then, unfortunately, patients complain of mouth dryness because they actually weren't overproducing. It's a great example of a case where if we can develop some interventions that target frequency of swallowing, we may actually be able to address symptoms related to overproduction which often manifest as like drooling.

Theresa Richard: 28:26 Yeah. I feel like I've heard that kind of a lot lately, which is good because I feel like I never used to hear of that at all. It's like, "My patient's drooling, what do I do about it?" It's like, "Well, there's kind of a few different things that could be going on."

Dr. Nicole R.: 28:38 Yeah, it seems like the go-to in a lot of cases is the Botox injection and it can be problematic and oftentimes it doesn't just stay in the salivary gland itself, so it can also spread to other regions. So seeing if there are other ways we can stimulate swallowing first might be a good approach.

Theresa Richard:	28:59	Yeah. Cool.
Dr. Nicole R.:	29:01	And some education around that, too. I think I mentioned that there are different glands, three different glands. I should say those glands are bilateral, so we have them on either side of the oral cavity, and they actually contribute different components to saliva. So there are different cell types within the salivary glands. There are what we call serous cells and mucous cells. And the serous cells contribute more of the watery content of saliva. Our parotid glands in our cheeks have a higher concentration of serous cells, whereas the sublingual and submandibular glands in the floor of mouth have a higher concentration of mucus-producing cells.
Dr. Nicole R.:	29:42	You can sort of then take away from that that more of the watery component of saliva comes from the parotids, whereas the thicker protein-rich components of saliva come from the submandibular and sublingual glands. The reason that this matters clinically is that if you are a clinician working with patients with head and neck cancer or if you see a patient who's had some type of salivary gland issue even potentially a salivary gland resection of some kind, understanding what glands were affected and what glands were included in the radiation field should help you to be able to make some assumptions about how that would influence saliva.
Dr. Nicole R.:	30:27	We know that if the parotids are primarily affected, then not only are we going to see a reduction in the overall volume of saliva, but we're also going to see thicker saliva. I think this is a pretty common occurrence after chemoradiation, where we have patients that complain of this thick, ropey saliva.
Theresa Richard:	30:47	I think when I think of things like that, my brain just goes right to like this nasty residue that they're probably going to end up with and-
Dr. Nicole R.:	30:57	Exactly. Exactly. No, absolutely. I mean, when you think about what's the important role of saliva, it's to spread out throughout the oral cavity and coat, protect the mucosa, create a film on the teeth to protect the teeth. If it's thick and ropey, it's not going to have those functions. So yeah, absolutely, you will see lots of gunk and ropey things in the mouth and essentially the pharynx too.

Theresa Richard: 31:29 I think my brain, with this now, goes to like... we do have some clinicians that are so stuck way back in the stone age and they just will give like one teaspoon of pudding or one teaspoon of purée and then it's just coated everywhere, and they say like, "Oh, they can't manage it," and they discontinue the study or something and I'm like, "No! Please, no!" Like, "Give them some water and let them clear it!" That's what I'm screaming right now.

Dr. Nicole R.: 31:55 Yes. Give them something that will actually be able to move it through. Yeah, and I think that's actually such an important point to touch on is that when we think about residue, whether it be oral or pharyngeal, we often make the assumption that strength or force generation is the underlying problem. So you know if you see oral, it's like, "Oh, I see residue on the tongue. That must mean we need to strengthen the tongue." It's like, "Well, actually it could be that this patient's really dry. And did you get a baseline assessment?"

Dr. Nicole R.: 32:26 I mean, I know it's not practical with every patient to actually measure the amount of saliva produced but you can do at least an oral inspection of the oral cavity to see do the structures look dry before you actually administer something. Then, there are some standardized tools for measuring xerostomia. There's a visual analog scale for measuring the amount of mouth dryness and then there's also a quality-of-life scale that looks at how xerostomia affects quality of life, and eating is one of the components in that. So it's important to get an understanding of what that baseline salivary function is like before you give someone something to eat or drink. Yeah.

Theresa Richard: 33:11 Yeah. Is there any way that just us clinicians can measure that, you know, in a SNF or something like that?

Dr. Nicole R.: 33:18 Oh yeah, absolutely. I was going to talk a little bit about measurement of salivary flow. There are a lot of ways that saliva can be affected. Basically, anything that stimulates the oral cavity will affect the flow of saliva. Taste, temperature, I mean anything, touch, just putting something in the mouth alone will up regulate saliva production kind of as a response.

Dr. Nicole R.: 33:42 There are two conditions that we typically measure salivary production. One is called the unstimulated condition. So this is where we just have an individual sit quietly, not talking, which is

the hardest part, not moving the jaw, and just allow the saliva to flow out of the mouth into a tube. Really all you need is just a basic scale. For a lot of the research that we do, we have scales that get down to very small, small numbers, but you can get a good idea of just sort of just salivary flow by looking at grams and most of those scales are available and you can grab them at... like food scales, you can grab at Walgreens or whatever and just carry with you. They have smaller ones.

Dr. Nicole R.: 34:27 So you can do it two ways. You can use a tube that you just measure empty, get a baseline weight, and then have the patient just allow the saliva to kind of fall out of their mouth into the tube and then weigh the tube after. And the change in weight from before to after saliva collection will tell you the rate, the flow rate of that unstimulated condition.

Dr. Nicole R.: 34:51 Then we also measure in a stimulated condition. So you can do that in lots of different ways. In the literature, sometimes investigators will use like citric acid, which is awful, really unpleasant. You can use an unflavored chewing gum to stimulate, but a lot of our patients have difficulty managing that. Paraffin wax has been used. Then another, a method that I think is most common in our literature, Dr. Logemann uses in all of her studies is called the Saxon test. This is just a four by four inch gauze pad. You just put it in a cup and you weigh it. Then you hand the gauze pad to the patient, you have them put it in their mouth.

Dr. Nicole R.: 35:31 I would usually say move it around in your mouth like you're chewing. Don't actually chew it, because chewing gauze is awful, but try to integrate it in your mouth and get as much saliva in it as possible, and then they will spit the gauze back out into the cap and then you weigh it again. That will give you, again, the change in weight from before to after will give you an idea. There are normative values for both of those collection techniques that then you can compare and say, "Okay, this is either within the normative range or lower," and that can give you an idea.

Dr. Nicole R.: 36:04 Sometimes I mean unstimulated flow is important because just having that sort of baseline saliva production without stimulation does really affect that perception of mouth dryness throughout the day, but for our purposes, I think stimulated is much more applicable because we're stimulating the glands

when we eat and drink. I typically, if I would have to choose, I would say I would look under a stimulated condition if you have limited time.

Theresa Richard: 36:36 Where would you be able to find the norms for that?

Dr. Nicole R.: 36:39 I can actually send you some of the papers where those are norms. We actually do have... I'm not sure if what we have in our blog is the Saxon test, but we do have numbers in the blog. For instance, the unstimulated salivary flow would be about .3 milliliters per minute and stimulated is 7 milliliters per minute, and that's for a whole saliva flow rate, so you're not collecting directly from one gland but rather looking at the contribution of-

Theresa Richard: 37:09 All over?

Dr. Nicole R.: 37:09 Yeah. Which again when we think about swallowing, it's really whole saliva that we care about.

Theresa Richard: 37:17 Right.

Dr. Nicole R.: 37:17 I mean, there may be some situations like after radiation where you'd want a gland-specific measurement but for the most part whole saliva. So that's just sort of a general idea but there are ranges obviously around those values and I'm happy to provide some references for that.

Theresa Richard: 37:35 Yeah, but I think that's super helpful clinically, like what we were just saying. It's like is it really tongue strength? Or are they just really low on saliva?

Dr. Nicole R.: 37:45 Mm-hmm (affirmative). Exactly, yeah. Then thinking about ways that we can intervene then with salivary production. The saliva substitute products can be helpful. I know, unfortunately, a lot of the patients that I see feel like they don't really do much, so I'm hoping that we can influence that, but I do hear that the gel-based products are more effective than the sprays just that they last longer, but then I mean even just this... It's sort of like you can get at something just with one intervention, just simple toothbrushing can stimulate salivary flow so then we're sort of addressing two issues at once. We're cleaning the teeth, improving the general health of the teeth, and then also stimulating flow.

Dr. Nicole R.:	38:32	So something to think about would be could you implement or help the nursing staff or the CNAs to implement toothbrushing before a meal? We often think about doing that after, but cleaning the mouth before a meal and then actually stimulating flow before is one idea clinically that we can use.
Theresa Richard:	38:49	Cool.
Dr. Nicole R.:	38:49	Yeah. Thought I would also touch a little bit on... Like we've talked about the idea of increased residue with decreased saliva production, and there are a whole host of studies that have looked at how changes in saliva production relate to swallowing function. Back in 1987, Barbara Sanis was at the NIH and she did some studies. I think the first author in her papers was Hughes, but they measured parotid salivary flow and then they also looked at... they compared patients who had complaints of difficulty swallowing with those who did not to see whether the salivary flow was related to the perception of swallowing difficulty. Then they also measured the oral transit time using ultrasound. They found that the production of saliva was related to higher complaints of difficulty swallowing and longer oral transit times.
Dr. Nicole R.:	39:47	Then Jeri Logemann and her colleagues did some studies looking at salivary flow after chemoradiation. What I thought was really interesting about those studies is that they did find an influence of salivary flow rate on the perception of swallowing, but when they actually did objective frame by frame analysis of the video fluoroscopic swallow studies, they didn't find a relationship. So that sort of leaves this question, is video fluoroscopy sensitive enough to the changes that we might see as a result of changes in salivary flow?
Dr. Nicole R.:	40:23	So thinking about other ways that we can look at this potentially with FEES, manometry, but we may see some differences that aren't always apparent on fluoro.
Theresa Richard:	40:35	Yeah. I think that's one thing that I do. I do FEES, so that's just what I'm so passionate about, but I just always see... like you said, I'm always able to see all this dryness and all the residue and all that stuff and I can tell that that's obviously the huge problem here.

Dr. Nicole R.:	40:50	Absolutely. I know Jo Murray developed a secretion grading scale. I think clinically it'd be interesting to look at like when you actually do make an assessment of mouth dryness just by looking, but then if you also have a measurement of salivary flow and then you have some idea of what you're seeing in the pharynx during FEES, I think you can kind of correlate all of those things together to figure out what's going on.
Theresa Richard:	41:16	Yeah. Awesome.
Dr. Nicole R.:	41:18	But in my dissertation work, we also looked at a group of patients with Sjogren's syndrome. They also have a decrease in saliva production as a result of the disease process and we saw, again, that similar pattern of that the changes in salivary flow were driving the perception of swallowing more than what we were actually seeing in terms of the swallowing biomechanics.
Dr. Nicole R.:	41:41	We often talk about this discrepancy between patient perception and what we're actually seeing objectively. I think that it's sort of easy to say, "Well, there may be potentially changes in sensation or patients just aren't aware of their deficits," but there may actually be a contribution of changes in salivary composition that are contributing to decreases in oral and pharyngeal sensation. So there may actually be a reason related to saliva production that these patients feel that their swallowing is much worse than what we're actually seeing on the instrumentation.
Theresa Richard:	42:19	Yeah. Cool.
Dr. Nicole R.:	42:21	And that can be really validating I think for patients that are struggling.
Theresa Richard:	42:25	Yeah. You're not crazy.
Dr. Nicole R.:	42:26	Yeah, exactly. You're not. We could see that. Yeah. I think we definitely need more well designed controlled studies that maybe even potentially use administration of a drug like glycopyrrolate to see what are the actual changes in swallowing using some of these other instrumentation techniques besides fluoro to get at some of these changes and the role of saliva in swallowing biomechanics a bit more.

Theresa Richard: 42:55 Do you think that's where we're headed, Nicole, is perhaps these patients then need to take a medication to counteract the dryness to now help with saliva production?

Dr. Nicole R.: 43:04 Yeah, absolutely. I mean I think we need to understand which patients that's most appropriate for. One of the issues with a lot of the meds that are given to increase saliva production is that they are systemic. A lot of the complaints that we would get at least from the head and neck cancer patients that I saw at Northwestern is, "Well, yeah, my saliva has increased but I'm sweating like crazy." There's like these broader effects. So those meds can be really effective, but I think we need to understand in what cases they're most effective. Because again, we might increase the overall production of the parotid glands but for that particular patient, that might not actually help. So I think we need to delve into the details a little bit more.

Theresa Richard: 43:52 I'm so anxious to know, I guess, if once you do that, does that essentially treat their dysphagia or do they no longer need all these exercises and fancy things that we're throwing at them because we just found the magic bullet?

Dr. Nicole R.: 44:07 Yeah. Well, that'd be nice.

Theresa Richard: 44:09 I know.

Dr. Nicole R.: 44:10 Yeah.

Theresa Richard: 44:11 [Crosstalk]... Yeah.

Dr. Nicole R.: 44:12 Or is it a combination? You know, is it that we can facilitate... Maybe it is a case where we do need some level of strength or skill-based training in addition to facilitating increased lubrication, and not just sort of ignoring that as a potential contributor, which I think happens a lot.

Theresa Richard: 44:29 Absolutely, yeah.

Dr. Nicole R.: 44:31 That's where I think it'll be interesting to see what effects we observe with regular application of a saliva substitute. Most of the studies that have looked at the efficacy of saliva substitutes have relied on a measure of xerostomia. Essentially, you apply your saliva substitute. “Is your mouth dry?” And that's kind of the outcome. “Oh yeah, they applied it and their mouth isn't as

dry.” It's like, "Well, there's a little more to this." Hopefully, we can see with regular application if we see an increase in salivary flow rates. I can get into this a bit more, but we're also measuring the oral microbiome. We're looking at bacterial diversity before and after application of the substitute, looking at dental health, and then obviously measuring swallowing function objectively, or as objectively as we can.

Theresa Richard: 45:23 Cool.

Dr. Nicole R.: 45:24 Yeah. I was also just going to talk a little bit about the other role for saliva. We know that saliva's important to provide lubrication. It provides this residual film. We've talked about that. But it also has some very important immunologic and antibacterial components. This is important because it helps us to maintain what we call bacterial homeostasis in the oral cavity. I know that's sort of a big term. But basically, it just refers to the fact that we need to have balance in the microorganisms that we have in the oral cavity. So I'm sure most people have heard the term microbiome. There's a lot of focus right now on the gut microbiome and how it influences many different disease processes. Just in the world I live in, there's a lot of discussion about the gut-microbiome-neural access, so essentially the interaction between the microbiome and the stomach and the colon and how that influences neural function.

Dr. Nicole R.: 46:26 So there's some thought that there may even be a contribution to the onset of Alzheimer's disease. This is a really interesting area of research, but unfortunately we haven't really delved into it much in terms of thinking about how these changes in oral microbiome influence oral health, but also influence pneumonia risk in our patients. So we think a lot about dental health but it's not really just the health of the teeth, it's also what is the general bacterial environment in the mouth.

Theresa Richard: 46:59 I think that's where we lose a lot of those patients that have the dentures, because they're like, "I don't have teeth. I don't need to brush my teeth." It's like, "No! Yes, you do! Please do!" Yeah.

Dr. Nicole R.: 47:11 This drives me absolutely insane. It's like, “First of all, you need to clean your dentures.” “Yes, you need to clean your mouth.” And one of the biggest reservoirs for bacteria is the surface of the tongue. So I tell all of my patients to get a tongue cleaner.

Theresa Richard:	47:24	Oh, okay. Like that little scraper thingy?
Dr. Nicole R.:	47:28	Yeah. And some of the toothbrushes actually have it even on the back, so you can just like flip the toothbrush and use that to clean the tongue, but I tell them to clean their tongue regularly.
Theresa Richard:	47:38	Cool.
Dr. Nicole R.:	47:38	We need more research looking at that, but there was one study out of Japan that showed a higher concentration of respiratory pathogens on the surface of the tongue.
Theresa Richard:	47:48	Wow.
Dr. Nicole R.:	47:48	That's kind of an easy one.
Theresa Richard:	47:48	Super fascinating.
Dr. Nicole R.:	47:50	Yeah. You're absolutely right. So many of our older patients say like, "Well, I'm not at risk because I don't have..."
Theresa Richard:	47:56	Yeah. I just, I had a guy yesterday. Just, his mouth was horrible. I was like, "Buddy, when's the last time you brushed your teeth?" He's like, "I don't have any teeth. I don't need to brush them." I'm like, " Well, but no. Come on, now."
Dr. Nicole R.:	48:07	I know. Well, probably you get to that point and you're like, "Oh good, I don't have to do this anymore."
Theresa Richard:	48:10	Right. That's what he said. Yeah. He's like, "One less thing I have to do. It's one less thing I got to spend my money on." I was like, "Oh my god. No. No. Please, no."
Dr. Nicole R.:	48:19	That's so funny. Yeah, I get it, a hundred percent. Actually, the oral cavity has the highest number of bacterial species of anywhere in the body, so it's really very important. And there are a lot of things that can affect the oral microbiome. Actually dentures are one of those things. Just having dentures in the mouth can affect the balance of bacteria. But we know that saliva plays a really important role in this balance. So there is a coating on the teeth called the salivary pellicle. That's important because there are components in saliva that help bacteria to actually adhere to the teeth so that the bacteria are not free-floating in the mouth.

Dr. Nicole R.: 49:03 If we think about this in our patients, if bacteria are free-floating, if we don't have enough saliva, if we don't swallow frequently enough, then we get a buildup of... we get an overgrowth of certain bacteria. Then when we're aspirating, we're actually carrying that bacteria down into the respiratory tract. So by not having enough saliva, that actually contributes, I think in lots of cases, to this. So when there's not a balance, we call that dysbiosis, oral dysbiosis.

Dr. Nicole R.: 49:37 So we're looking at this sort of balance. We're looking at... It's positive to have more diversity of bacteria in a specific location. So diversity of bacteria is one of the outcomes that we're looking in in a couple different studies where we're focusing on older adults with a diagnosis of dysphagia and we're diagnosing that using video fluoroscopy and using standardized tools like the MBSImp and the penetration aspiration scale and actual measurements of residue, pixel-based measurements of residue, and then measuring this bacterial diversity to see whether what is most contributing to the oral microbiome changes in these patients.

Dr. Nicole R.: 50:23 We're also measuring resting swallow frequency. So we actually observe the patient swallowing over five minutes, and then we also have respiratory bellows so we can see when that may have paused. We have a couple different ways of validating the occurrence of the swallow just at rest over a five minute period outside of video fluoroscopy. So we can look at the swallowing frequency rate, we'll measure saliva production, and then we'll also look at swallowing biomechanics on fluoro to see what are kind of the biggest contributors to these changes in the microbiome in patients.

Theresa Richard: 51:01 How cool.

Dr. Nicole R.: 51:02 It's a lot of fun.

Theresa Richard: 51:05 It is.

Dr. Nicole R.: 51:05 We have a study focused in just older adults with dysphagia, and then we're starting to do some of these measurements with these early stage Alzheimer's patients and then we also have some funding to look at patients before, during, and after radiation treatment as well. So hopefully we can elucidate some of those interactions. Then we're also really interested in how

the regular application of a probiotic may influence the oral microbiome. So a lot of that work has been focused in the gut, but again that could be something that potentially has application to our patients where as patients get further along in the degenerative processes, are there other things we can do that might optimize the oral environment a bit more.

Theresa Richard: 51:54 Yeah, cool. Can I ask why you chose dementia, Nicole, as the population?

Dr. Nicole R.: 51:59 Yeah. As I mentioned, I'm in a division of geriatrics and I'm in the geriatrics clinics. One of my closest colleagues at UW Madison, her name Amy Kind, she's a geriatrician. All of her work focuses in dementia. She looks more at care processes, like transitional care for individuals with dementia, but I've just had so much experience and so many questions coming from geriatricians about what do we do, how do we manage this, how do we identify dysphagia in our clinics.

Dr. Nicole R.: 52:30 As I started to delve into the literature a bit more, I realized we just don't... I mean, most of what we can offer that's evidence-based is really compensatory. I believe there's just so much more we can do for these patients.

Theresa Richard: 52:43 Completely.

Dr. Nicole R.: 52:43 Yeah.

Theresa Richard: 52:45 Yeah.

Dr. Nicole R.: 52:45 Yeah. I mean that's at every stage of the disease. If we're involved early, even if we're not seeing changes in swallowing that are manifesting in these clinical outcomes that we're concerned about in actual... I mean, we may see biomechanical changes, but a lot of times we don't see aspiration, we don't see residue early on, still being involved, talking to patients and families about how the disease can affect swallowing, educating on "These are the signs and symptoms," I just think that's so valuable. Then I also think that if we can implement some of these rehabilitative approaches, we may be able to increase this idea of functional reserve early in the disease process and then that decline may not be as sharp. So this idea that we may be able to maintain function longer into disease progression.

Dr. Nicole R.:	53:41	This is something I speak a lot at the American Geriatrics Society Meetings, at the Alzheimer's Association International Conference. A lot of the questions are, "Well, you know, dysphagia is an end-of-life issue. Like, we know it's going to happen, so what's the point of what you're doing?" And it's like, well, we don't have the goal of preventing the onset, and we know where this disease process is going, but… and the issues at end-of-life are very different I think than the issues in the early and even moderate stages of the disease. So what is something that optimizes quality of life the most for anyone? It's eating and drinking. So if we can continue to support and facilitate quality of life around meal time for longer, I think that's huge.
Theresa Richard:	54:32	Yeah. Totally.
Dr. Nicole R.:	54:33	Yeah. You know, one other plan I was going to make with this is I do want to acknowledge a lot of the work by Samantha Shune and Ashwini Namasivayam-MacDonald looking at caregiver burden because that's a huge piece. We think about the patients but if there's a lot that needs to be done with swallowing, that's really directly influencing caregivers. I think the longer we can to maintain function, the less we're adding to people's plates.
Theresa Richard:	55:04	Yeah, completely. I'm so fascinated by the whole kind of gut-oral-bacteria connection because we hear a lot of that in the news with dementia nowadays, so it's really fascinating to hear this is where the research is going.
Dr. Nicole R.:	55:20	Yeah. And it gives me hope that even if we're not able to change the biomechanics of swallowing, maybe we can find some ways, some interventions that can prevent pneumonia onset just because that's such a burdensome thing for patients and families to deal with, yeah.
Theresa Richard:	55:41	Right, and so hard to overcome constantly.
Dr. Nicole R.:	55:44	Yeah, absolutely. Yeah.
Theresa Richard:	55:47	Awesome. Well, thanks so much, Nicole. This has been wonderful.

Dr. Nicole R.:	55:50	Well, thank you so much for having me. It's been so much fun to talk about all these things we're working on.
Theresa Richard:	55:55	Yeah. It's so fun to talk about spit.
Dr. Nicole R.:	55:58	Well, I was going to tell you, so you know a lot of people go to like Space Camp when they're kids. Well, when I was a doctoral student, I went to a Spit Camp.
Theresa Richard:	56:05	That's hysterical.
Dr. Nicole R.:	56:07	No joke. It was actually called a Spit Camp.
Theresa Richard:	56:09	Oh my gosh.
Dr. Nicole R.:	56:10	[Crosstalk]... University of Arizona. Yeah, it was there's a salivary bioscience researcher there. His name is Doug Granger and he holds these...
Theresa Richard:	56:18	That's like the coolest, nerdiest thing I've ever heard in my life.
Dr. Nicole R.:	56:22	Yeah. It was so much fun.
Theresa Richard:	56:22	That's hysterical.
Dr. Nicole R.:	56:25	As you can see, I definitely needed your help to be cooler with my grad students.
Theresa Richard:	56:32	Hopefully this upped your cool factor, especially now that you've been to Spit Camp.
Dr. Nicole R.:	56:36	Yeah, exactly. Will help tremendously.
Theresa Richard:	56:39	Oh I love it. All right. Any final thoughts?
Dr. Nicole R.:	56:42	I don't think so. I think I know you typically ask what's the most influential article and I made sure to share the article by Jeri Logemann, where she looked at xerostomia and swallow function. I think that's a really good one for people to look at. I wanted to originally mention Susan Langmore's 1998 study but I think that's the most popular article, but the role of oral health and the independent contribution of oral health I think is huge too. So those are good articles to check out.

Theresa Richard:	57:14	Well, thank you so much.
Dr. Nicole R.:	57:16	Thank you so much.
Theresa Richard:	57:19	So if you would love to hear more of these episodes and get some easily digestible bites of swallowing knowledge, then please leave a review on iTunes or pledge a small amount on patreon.com/swallowyourpride because that is what keeps these episodes coming. Also, don't forget to subscribe, share with your closest colleagues, and the show notes will always be available for download over on swallowyourpridepodcast.com where you can also be notified of the latest podcast episodes. Also, credit to Stephanie Jacobson for her incredible editing skills, and thank you so much to all of you for listening.