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Dysphagia Symptoms In People With Diabetes: A Preliminary Report

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DYSPHAGIA SYMPTOMS IN PEOPLE WITH DIABETES:

A PRELIMINARY REPORT

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ABSTRACT

BACKGROUND: Diabetes mellitus is a systemic disease affecting whole-body functioning. The underlying mechanisms and associated concomitant conditions suggest an increased risk for the occurrence of oropharyngeal dysphagia. **PURPOSE:** This is a qualitative study designed to assess perception of symptoms of oropharyngeal dysphagia in people with diabetes. **METHODS:** Participants were recruited by word-of-mouth and asked to complete a survey by answering questions on a Likert-type scale indicating the frequency with which they experience each symptom. Responses were weighted and analyzed according to frequency, providing a percentage of responses in each dysphagia category. Symptoms of dysphagia were examined in an overall manner, and by the following variables: age, ethnicity, duration of diagnosis, presence of oral phase difficulty, management of diabetes, and oral health. **RESULTS:** Overall, people with diabetes do report a variety of symptoms of swallowing problems. The proportion of dysphagia symptoms appears to be greater among older individuals, individuals with type 2 diabetes, those who have been diagnosed for less than 50% of their lives, and those with poorer oral health. **CONCLUSIONS:** People with diabetes indicate symptoms of oropharyngeal dysphagia on this self-report survey. Future studies would benefit from the inclusion of an objective swallow assessment following up on these reports.

Keywords: diabetes, dysphagia, cognition, oral health, diabetic cough, cough reflex threshold, vagus nerve, diabetic neuropathy, autonomic neuropathy

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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

General Statement of the Problem

Dysphagia, a medical term that describes difficulty or discomfort in swallowing, is a serious concern that can potentially be life-threatening. This problem is not a disorder of its own, but instead is a major symptom of more systemic disorders, such as traumatic brain injury (TBI) (Alhashemi, 2010), strokes (Singh & Hamdy, 2006), Parkinson's Disease (Kalf et al., 2012), amyotrophic lateral sclerosis (ALS) (Ruoppolo et al., 2013), and Alzheimer's Disease (Seçil et al., 2016), among others. Diabetes is another such systemic disorder that results from disruptions in the endocrine system. Unsupervised, these disruptions can cause further damage systemically, including nerve damage and permanent alterations to the digestive system. Swallowing difficulties often result from disturbances in the motor cortices of the brain and damage to the neurons involved in the swallow mechanism. Thus, any disease that can result in damage to these neurons or brain areas has the potential to cause dysphagia symptoms. Esophageal dysphagia symptoms have been documented in individuals with diabetes (Mandelstam & Lieber, 1967), including difficulty with esophageal motility (George et al., 2017) and peristaltic failure (Holloway et al., 1999). Relatively few studies have been conducted investigating

the presence or absence of dysphagia symptoms in individuals with diabetes. The purpose of the current study is to determine if diabetic individuals have concerns regarding swallowing difficulties. Ultimately, a dysphagia screener related specifically to diabetic patients may serve as a useful tool in preventing more serious complications resulting from these concerns being overlooked by either the patient or their medical team.

Significance of the Thesis

Investigation of the relationship between diabetic complications and dysphagia symptoms has the potential to reduce or eliminate life-threatening concerns related to swallowing disorders. Bringing awareness of this issue to both medical professionals and to patients has several benefits. First, it is possible that patients are unaware of the significance of these symptoms. It is relatively common for food or liquid to "go down the wrong pipe", as it is known colloquially. The frequency of such an occurrence is subjective – a normal frequency for one individual may be different than the normal frequency for another individual. An objective survey calculating these numbers may prove useful in detecting and identifying at-risk individuals.

Secondly, there are a number of surveys designed to detect dysphagia among individuals who had suffered TBI (Lee et al., 2016), stroke (Trapl et al., 2007) and Parkinson's Disease (Manor et al., 2007). A survey specific to diabetic patients may be of great value for both patients and medical professionals. Additionally, there may be an emerging need for standardized clinical evaluation of the swallow on intake of patients in neurorehabilitation centers (Kjaersgaard & Langhorn, 2007).

Lastly, the results of this study can lead to the development of a follow-up study which can further quantify the incidence of dysphagia symptoms among diabetic

individuals. Patients who indicate symptoms on the survey can be referred for a Modified Barium Swallow Study (MBSS), confirming or denying the presence of dysphagia. The ultimate significance of this research is the awareness it will bring to patients, and consequently the ability to advocate for themselves in this specific area of their health. In parallel, increasing awareness among medical professionals has the potential to improve the quality of life of their diabetic patients (Eisenstadt, 2010).

Review of the Literature

Diabetes mellitus refers to a group of endocrine disorders in which the body does not manipulate blood glucose effectively, resulting in hyper- or hypoglycemia and systemic changes corresponding to that (American Diabetes Association, 2010). Diabetes has a reported prevalence of 100 million adults in the United States; it is more common in men, and prevalence varies by education – individuals with a high school education or higher were less likely to have diabetes (National Diabetes Statistics Report, 2017). Diabetes also occurs in animals and is more common among older animals or animals that are overweight (Greco, 2001; Nelson & Reusch, 2014). Both type 1 and type 2 diabetes can be induced in a rat model, and new experimental methods of treatment are investigated in the animal model before human trials can be conducted (Etuk, 2010; Rees & Alcolado, 2005). Symptoms common to both types of diabetes include increased thirst, blurred vision, lethargy, and increased urination, with damage to the nervous system often resulting (diabetic neuropathy). Thus, individuals with diabetes are tasked with the constant management of their blood glucose levels. Damage to the nervous system can lead to decreased sensation in the muscles supplied by those nerves, including the larynx and pharynx. Although many studies on the effects of diabetes on the gastrointestinal

system have been done, few studies on the possible correlation between diabetes and dysphagia have been conducted. Decreased sensation in the pharyngeal area may be a factor in diabetic individuals being unaware of dysphagia symptoms. Research has indicated that in those patients who do have both diabetes and dysphagia, abnormal pharyngeal and esophageal functioning was severe (Borgström et al., 1988).

Diabetes mellitus is a pancreatic dysfunction that results in a deficiency of insulin or insensitivity of its receptors. Type 1, commonly thought of as the genetic type, involves a failure of the pancreas to produce insulin due to the loss of beta cells. Type 2, often thought of as the acquired version, is a result of failure of the insulin receptors to respond to insulin. Insulin is a hormone that regulates the uptake of glucose from the blood. It inhibits the breakdown of glycogen and converts carbohydrates to glucose. The body obtains glucose from 3 main sources:

(1) intestinal absorption of food

(2) glycogenolysis – the breakdown of glycogen (the form in which glucose is stored in the liver)

(3) gluconeogenesis – the generation of glucose from non-carbohydrate substrates in the body (e.g., during a period of fasting)

Another hormone produced by the pancreas, glucagon, is secreted by alpha cells and produces the opposite effect of insulin. Glucagon works to raise the concentration of glucose in the bloodstream (e.g., during a period of fasting when intestinal absorption of sugars is low). Insulin is secreted immediately following ingestion of carbohydrates to help cells absorb the sudden influx of sugars. Treatment of type 1 diabetes generally involves the injection of insulin, since insulin is not being produced by the pancreas.

Treatment of type 2 diabetes often consists of diet changes and increased exercise, but the prescription of a drug that lowers the production of glucose in the liver and increases cell sensitivity to insulin can boost the body's ability to handle glucose intake.

Abnormally high concentrations of glucose in the bloodstream is known as hyperglycemia. Symptoms of hyperglycemia generally do not appear until glucose values are elevated to an extreme level – usually above 200 milligrams per deciliter (mg/dL), which can develop slowly over several days. Left untreated, symptoms can become severe enough to cause a diabetic coma. Early signs of hyperglycemia include frequent urination, increased thirst, blurred vision, fatigue, and headache. Untreated symptoms will increase in severity, to nausea and vomiting, shortness of breath, dry mouth, weakness, and confusion, and eventually to coma. Hyperglycemia can be influenced by inactivity, stress, other illnesses or infections, patient inattention to blood glucose levels, and certain medications. On the other hand, hypoglycemia refers to an abnormally low concentration of blood glucose – generally under 70 mg/dL. Early symptoms of hypoglycemia include fatigue, shakiness, anxiety, irritability, and hunger. Left untreated, hypoglycemia can eventually cause confusion, abnormal behavior, blurred vision, seizures, and loss of consciousness. In diabetic patients, hypoglycemia is often caused by lack of insulin due to the body's inability to make it (as in type 1) or inability to respond to it (as in type 2).

Diabetes is known to affect more than just blood sugar levels. Due to its nature, it also has implications for cognition, oral health, urinary and digestive health, neurological issues, and swallowing problems, among others. In the short-term, diabetes tends to result in hyperglycemia or hypoglycemia, with relatively mild immediate consequences, but the

potential for severe long-term consequences. Long-term effects of diabetes on the body have serious implications for both the macrovascular and microvascular systems. Damage to the large blood vessels of major organs such as the heart, brain, and lungs, as well as damage to the smaller blood vessels that feed into the eyes, kidneys, and nervous system, can lead to increased risk of heart attack, stroke, and neuropathies. Reduced blood flow to the brain has implications for the state of cognition: a meta-analysis conducted in 2005 found that diabetes is correlated with a greater risk of, and greater rate of, cognitive decline (Cukierman et al., 2005). Interestingly, there is evidence that intranasal injections of insulin are associated with improved memory and mood (Benedict et al., 2004), implying that inadequate amounts of insulin may also play a role in cognitive decline in this population. In addition, people with type 2 diabetes are more likely to suffer from oral health issues (Leite et al., 2013). Diabetic patients complain of symptoms such as dry mouth, oral thrush, and a higher concentration of glucose in the saliva leading to increased risk of bacterial infections in the oral cavity (Ship, 2003; Turner & Ship, 2007). These symptoms may lead to residue in the oral cavity, on the pharyngeal wall, and in the pyriform sinuses, increasing the risk for clinical signs and symptoms of oropharyngeal dysphagia. Further complications include urinary/bladder issues and digestive health issues (Brown et al., 2005; Lifford et al., 2005). Bladder cystopathy, a condition describing decreased bladder sensation and poor contractility, is another common comorbidity with diabetes (Brown, 2009), which appears to involve both central and peripheral nervous system mechanisms (Yamaguchi et al., 2007).

Effects of Diabetes on Cognition

The effects of aging on healthy adults tends to result in patterns of cognitive decline and impairment. For adults with diabetes, these effects may be at risk for increased rate and severity. Women with diabetes, aged 65 years or older, were found to have lower baseline scores than women of the same age without diabetes on three tests of cognitive function (Gregg et al., 2000). Additionally, having diabetes for more than 15 years resulted in a risk of increased cognitive decline. Similarly, a longitudinal cohort study conducted by Arvanitakis et al. (2004) found that diabetes was associated with a greater risk of decline in perceptual speed, as well as lower baseline levels of global cognition, episodic memory, semantic memory, working memory, and visuospatial abilities. There is further evidence that comorbid diabetes and hypertension tends to exacerbate cognitive decline (Hassing et al., 2004). One study took into account diabetes management and management behaviors when assessing cognitive decline patterns – Yaffe et al. (2012) conducted a longitudinal study over 10 years involving more than 3,000 participants. Participants were asked to complete the Modified Mini-Mental State Examination and the Digit Symbol Substitution Test for baseline measures and at selected intervals over the 10 year time period. They were categorized into 3 groups: those with prevalent diabetes, those with incident diabetes, and those without diabetes. The researchers found that individuals with prevalent diabetes had lower baseline scores than participants without diabetes. Those with incident diabetes demonstrated patterns in which scores fell between the other two groups, but were not statistically different from the group of individuals without diabetes. Ultimately, the researchers found that diabetes and poor glucose control were associated with greater rates of cognitive decline when

compared to individuals without diabetes, suggesting that poor management behaviors and severity of the condition may contribute to accelerated cognitive aging (Yaffe et al., 2012).

Cognitive decline implies a subsequent decrease in the ability to identify and describe swallowing problems, including an awareness of what the symptoms are and when to bring them to the attention of a medical professional. The elderly population are at risk for both greater rates of dysphagia (Holland et al., 2011; Humbert & Robbins, 2008) and cognitive problems (Dal Forno & Kawas, 1995). Logically, elderly individuals with diabetes are thus at a greater risk for concomitant dysphagia and cognitive disorders. (Gregg et al., 2002). In fact, the prevalence of dysphagia in nursing homes is upwards of 50%, with contributing risk factors including age, gender, and history of dementia (Park et al., 2013). The severity of dysphagia symptoms has been associated with increasing age, as well as with depressive symptoms (Holland et al., 2011). It has been theorized that cognitive decline and dysphagia have a bi-directional relationship (Winchester & Winchester, 2015). One possible contributing factor for increased dysphagia problems as a result of poor cognition is the fact that the elderly may not be managing their diabetic symptoms as effectively as they could be. Again, decreased awareness of the symptoms and the importance of identification of these symptoms results in ignorance of the health care team regarding these problems. Such issues have been observed in patients with Parkinson's Disease (Kalf et al., 2012; Manor et al., 2007).

Effects of Diabetes on Oral Health

Oral health and oral care tend to show patterns of decline with aging. Oral mucosa, dental tissues, and salivary mechanisms change with age (Razak et al., 2014), placing the elderly population at risk for increased oral complications. Dehydration is one of the main symptoms of diabetes, and often leads to dry mouth (xerostomia), in turn contributing to increased risk of periodontal disease, infection, and oropharyngeal disorders. Diabetes is often associated with periodontal infection and other mouth and dental diseases (Southerland et al., 2005). Periodontal infection in the presence of hyperglycemia may result in increased tissue destruction and an altered inflammatory response (Lalla et al., 2000; Miller et al., 1992; Salvi et al., 1997; Tsai et al., 2002). Periodontal disease reflects the level of care that the mouth receives regularly, and subsequently has an effect on the swallowing mechanism. In addition, diabetes has the potential to cause a reduction or absence of saliva and secretory capacity of the salivary glands, known as xerostomia (Taylor et al., 1998). Lack of saliva can cause problems with eating, speaking, and swallowing. For example, sufficient saliva production is essential in forming a cohesive bolus – inadequate bolus formation can lead to residues left in the oral and pharyngeal cavities, increasing the risk for aspiration of particles into the trachea. Left untreated, xerostomia can result in secondary health concerns such as inflammation of the lips, inflammation or ulcers of the tongue and buccal mucosa, and salivary gland infection (Bauroth et al., 2003;Mandel, 1994). Furthermore, people with diabetes are at risk for slower recovery and greater risk of infection (Harrison et al., 1983). The elderly are at risk for decreased quality of life due to issues associated with dry mouth, that could potentially be prevented with ideal oral health care (Turner & Ship,

2007). Finally, lack of proper oral care is associated with an increased risk of aspiration pneumonia in elderly patients (Tada & Miura, 2012).

Cranial Nerve Involvement

The vagus nerve, or the tenth cranial nerve (CN X), interfaces with the parasympathetic divisions of the heart, lungs, and digestive tract. It also plays a crucial role in the control of certain skeletal muscles, including the cricothyroid muscle, some muscles of the tongue, the pharyngeal constrictors, and muscles of the larynx (Crumley, 1994; Fukushima et al., 2003). Evidence shows that this cranial nerve is critical to the functioning of the swallow mechanism (Erman et al., 2009). Because the vagus nerve plays a role in such diverse functions from bladder control to deglutition, the operation of one body system may indicate the functioning ability of another. It is well known that individuals with diabetes mellitus tend to suffer from digestive and bladder complications arising from damage to the vagus nerve (Duchen, 1980). As such, it can be posited that the functioning of the larynx may be affected as well. In fact, there is some evidence that shows that damage to the vagus nerve may occur asymptomatically (Britland et al., 1990) or affect sensory and autonomic components less severely (Jamali & Mohseni, 2005). More evidence includes the fact that botox injections help with swallowing disorders in diabetic patients (Restivo et al., 2006) as well as with vocal fold dysfunctions (Altman et al., 2000; Andrade Filho & Rosen, 2004), although with variable rates of success (Boutsen et al., 2002).

In addition to the above described systems, the vagus nerve also plays a direct role in the functioning of the esophagus (Erman et al., 2009; Mashimo & Goyal, 2006). Esophageal dysfunction as it relates to diabetes has been well documented since the late

1960s (Forgács et al., 1979; George et al., 2017; Hollis, 1977; Kuhlemeier, 1994; Loo et al., 1985; Mandelstam & Lieber, 1967; Russell et al., 1983). Specific esophageal dysphagia symptoms that have been documented in individuals with diabetes include difficulty with esophageal motility (George et al., 2017) and peristaltic failure (Holloway et al., 1999). But vagus nerve deficiency is not the only cause of esophageal dysphagia; additional data indicate that psychiatric disorders such as depression and anxiety may contribute to esophageal motility abnormalities in diabetic patients with neuropathy (Clouse et al., 1986). Other potential causes include fungal infections such as candidiasis that should be thoroughly investigated when diagnosing esophageal dysphagia in diabetic patients (Ippoliti, 1983).

Esophageal phase dysphagia has the potential to affect oropharyngeal phase deglutition as well (Triadafilopoulos et al., 1992). Delayed opening of the upper esophageal sphincter (UES) means that material is residing in the pharynx for an extended period of time, increasing the risk for aspiration and penetration into the laryngeal vestibule. Regurgitation of material from the UES may also result in that material spilling over into the laryngeal vestibule during breathing. Gastroesophageal reflux disease (GERD) has been shown to have effects on the temporal sequence of the oropharyngeal swallow (Henderson et al., 1976; Mendell & Logemann, 2007; Sivit et al., 1988). Delays in initiation of the pharyngeal swallow were found to be significantly associated with abnormal esophageal clearance (Gullung et al., 2012). Additionally, it has been hypothesized that cricopharyngeal functioning is implicated in both oropharyngeal dysphagia and esophageal disorders (Jones et al., 1985). The correlation between esophageal dysphagia and oropharyngeal dysphagia suggests involvement of an

underlying neuromotor disorder (Triadafilopoulos et al., 1992), likely involving the vagus nerve. Thus, if esophageal dysphagia is common to individuals with diabetes, it is possible that oropharyngeal phase dysphagia is occurring also.

The health and functioning of the cranial nerves are vital to the wellbeing of the body as a whole. Because cranial nerves act to oversee many smaller nerve systems, damage or deterioration of the cranial nerves will result in decreased performance of the smaller nerve pathways. Left unchecked, diseases that affect these pathways can result in damage to soft tissues via neuropathy.

Diabetic Neuropathy

Diabetic neuropathy occurs when there is nerve damage so severe that it leads to the loss of sensation (Charnogursky et al., 2014; Mayo Clinic, 2020) and is thought to be caused by prolonged hyperglycemia resulting in oxidative stress (Edwards et al., 2008). There are 4 main types of diabetic neuropathy: peripheral neuropathy, autonomic neuropathy, radiculoplexus neuropathy, and mononeuropathy. Peripheral neuropathy is the most common of the diabetic neuropathies. This form affects the distal limbs first, mainly the feet. Numbness, reduced sensitivity to pain and temperature, and a tingling sensation comprise the main symptoms. Additionally, the individual may suffer from lack of balance and coordination as well as muscle weakness.

Autonomic neuropathy affects the autonomic nervous system functioning. The individual may be unaware that their blood sugar levels are low, suffer from bladder problems and difficulty swallowing, and an increased heart rate. These symptoms, in particular difficulty swallowing, indicate that dysphagia may be a key factor among diabetic patients. Lack of awareness of blood glucose may extend to lack of awareness of

swallowing difficulties. The autonomic system includes the vagus nerve, and thus likely affects the entire swallowing mechanism.

Radiculoplexus neuropathy involves pain in the lower extremities from the hips down, weight loss, and possible abdominal swelling. Mononeuropathy is a temporary but sudden onset of pain in one localized area such as the shin, foot, or chest. This type of neuropathy may include nerve problems in the facial area, including: double vision, difficulty focusing, pain behind one eye, and Bell's palsy.

Because diabetic autonomic neuropathy (DAN) affects the vagus nerve, bronchial and esophageal systems, it is likely to have an effect on the oropharyngeal systems as well (Vinik et al., 2003). An early study of DAN notes that patients presented with diminished pharyngeal contraction strength and diminished contractions throughout the esophagus (Mandelstam & Siegel, 1969).

Diabetic Cough and Cough Reflex Threshold

One possible symptom of diabetic neuropathy is the phenomenon known as the 'diabetic cough', a dry, hacking cough observed in people with diabetes. Individuals with type 2 diabetes report a chronic cough and phlegm more frequently than individuals without diabetes of the same age (De Santi et al., 2017). Furthermore, there appears to be an association between diabetes and risk of respiratory disease mortality (Wang et al., 2019).

Cough reflex threshold refers to the point at which a person begins to cough in response to an irritant. Among healthy, non-smoking individuals, there is evidence that there is no significant difference between young and elderly participants in cough reflex threshold, although there may be a decrease in awareness of the urge to cough among the

elderly (Ebihara et al., 2011). However, individuals with diabetes and autonomic neuropathy were found to be more likely to have a raised cough reflex threshold compared to individuals with diabetes without autonomic neuropathy (Behera et al., 1995; Ciljakova et al., 2009; Vianna et al., 1988), suggesting vagal denervation of the respiratory tract. Patients with an increased cough reflex threshold require a higher concentration of an irritant before producing a cough response compared to patients with a lower cough reflex threshold, indicating that the larynx is not functioning at maximum efficiency. Vianna et al. (1998) used citric acid to induce a cough response in non-smoking diabetic patients, and found that those with diabetic neuropathy demonstrated a higher median threshold for the cough response compared to those without diabetic neuropathy, suggesting that not only is the bronchial system damaged by neuropathy but that the larynx is deficient as well, due to the innervation of both structures by the vagus nerve. In 1995, Behera et al. conducted a similar study comparing patients with diabetic neuropathy to diabetic patients without neuropathy and control individuals without diabetes and obtained results in agreement with Vianna et al. (1998). Another study comparing the cough reflex sensitivity in children with type 1 diabetes found that those with autonomic neuropathy were more likely to have a decreased sensitivity than those without autonomic neuropathy (Varechova et al., 2007). This team used capsacin aerosol instead of citric acid aerosol, and compared the cough reflex sensitivity of 37 diabetic children against 27 age-matched controls. The researchers found that the cough reflex sensitivity did not differ between the two groups, but that children with subclinical diabetic autonomic neuropathy (sDAN) demonstrated decreased cough reflex sensitivity compared to children without sDAN. These results imply downregulation of the cough

reflex in diabetic neuropathy, even when the symptoms are at a subclinical level. The researchers posit that cough reflex sensitivity may be a useful indicator of diabetic neuropathy. Thus, this cough reflex sensitivity may also serve as a useful indicator of dysphagia.

Management of Diabetes

As with any long-term health issue, diabetes must be managed on a daily basis. Individuals with diabetes have to consider a plethora of behaviors and situations, including but not limited to: blood glucose, medication, diet, and physical activity (Ahola & Groop, 2013; Nam et al., 2011). Even for the careful diabetic, levels of glycemia may exceed recommendations, suggesting that that those who are actively managing their lifestyle are still likely to struggle with optimal self-care. Additional barriers to ideal health management include presence of depression (Gonzalez et al., 2007), fear of hypoglycemia, perceived lack of social support (Heisler & Piette, 2005; Vesco et al., 2010), and beliefs that one has little control over life events (e.g., locus of control) (Sloan et al., 2009). Despite the fact that active engagement in self-care impacts the progression of the disease, compliance with effective diabetic management activities is still found to be low (Shrivastava et al., 2013). Additionally, the chances of compliance with proper management behaviors is even smaller when considering the adolescent population (Weissberg-Benchell et al., 1995). Given that some symptoms may be overlooked due to these psychosocial barriers, it is possible that swallowing problems are also being overlooked in the plan of care for this population.

Inability to effectively monitor and manage diabetes symptoms in youth may carry over into adulthood, potentially leading to long-term systemic effects in later years.

These factors are important to consider when looking at the possibility of swallowing problems in the presence of diabetes. Individuals who do not monitor their diabetes, or do not adhere to management plans for this disease, are at an increased risk for several more health problems. It can be argued that these individuals would also be at risk for increased difficulty with the swallowing mechanism due to the systemic effects that diabetes has on the body. For example, poor long-term glycemic control and diabetes duration of greater than 10 years were correlated with increased risk of pneumonia-related hospitalization (Kornum et al., 2008).

Untreated or mismanaged diabetic complications also have the potential to be ignored by the individual. These individuals likely would not bring up subsequent health concerns with their medical care team. For these individuals, a screener designed to assess the functioning of the swallow is of paramount importance. The need for dysphagia screeners has been documented in both the hospital setting (Altman, 2011) and in nursing homes (Park et al., 2013), as well as in specific populations such as Parkinson's Disease (Kalf et al., 2012; Manor et al., 2007). Early intervention, making the patient aware that these issues are a possibility, and informing the patient of the dangers of mismanagement of their diabetes are all potential outcomes of distributing a dysphagia screener among this population.

Overview of Normal Swallow

A typical healthy swallow pattern consists of 4 main, but overlapping, events: the oral preparatory phase, the oral phase, the pharyngeal phase, and the esophageal phase.

Oral preparatory phase. The oral preparatory phase involves chewing solid and semisolid food and mixing it with saliva (mastication), transforming it into a bolus.

Adequate salivary production is necessary for this stage. Proper oral care will have an effect on the overall health of the oral cavity, the teeth, and the tongue, all of which are necessary for mastication. Thus, lack of proper oral care, or poor oral health, implies a higher risk of deficits in the oral preparatory phase.

Oral phase. The oral phase begins with anterior-to-posterior tongue movement, pushing the bolus from the center of the tongue to the back of the mouth. Optimal timing for the oral phase is between 1 and 1.5 seconds. The pharyngeal phase begins at the end of the oral phase; that is, when the bolus reaches the anterior faucial arches. This phase should be completed within 1 second.

Pharyngeal phase. The main event of the pharyngeal phase is the reflexive action of the swallow. The velopharyngeal port closes, the larynx elevates, respiration is paused, and the cricopharyngeal muscle contracts to push the bolus down toward the esophageal sphincter. The consistency of the bolus may result in a change in the swallow reflex timing; thicker consistencies will correspond to a slightly increased swallow reflex timing (Steele et al., 2019).

Esophageal phase. Once the bolus arrives at the esophageal sphincter, the swallow is no longer under voluntary control and is now considered in the esophageal phase. Entry of the bolus into this sphincter results in relaxation of the larynx and soft palate and breathing is restored.

Overview of Abnormal Swallow

Because the swallow consists of several interconnecting phases, there are many points at which the swallow can be interrupted or disordered.

Oral preparatory and oral stage. In the oral preparatory and oral phases, disorders may include problems with mastication and oral transit time due to reduced strength and range of motion of the tongue, mandible, and lips. Residue on the tongue and in the oral cavity post-swallow as a result of inadequate musculature presents a risk for aspiration. Prolonged mastication time in the oral preparatory phase can affect the timing of the oral phase; additionally, it can also lead to piecemeal swallow patterns and increase the risk of aspiration. Clinical signs and symptoms of dysphagia at the oral stage include: anterior bolus loss, oral/lingual stasis, prolonged mastication, increased oral transit time, and multiple swallows.

Pharyngeal stage. Disorders of the pharyngeal phase, such as insufficient pharyngeal constriction, reduced movement of the base of the tongue, and inadequate laryngeal excursion can result in residue on the pharyngeal walls, pooling in the valleculae and the pyriform sinuses, and delayed pharyngeal transit. Clinical signs and symptoms of pharyngeal phase dysphagia include coughing, choking, throat clearing, and wet vocal quality post-swallow.

Esophageal stage. Disorders of the esophageal phase include achalasia, diffuse spasms, esophageal strictures, esophageal tumors, and GERD, among others. These disorders result in the feeling of food/ liquids "getting stuck" several seconds post-swallow. Regurgitation of material from the esophagus back into the pharynx is possible following these, increasing the risk for aspiration into the trachea. Esophageal phase dysphagia can also affect the timing of the oropharyngeal swallow sequence (Gullung et al., 2012; Mendell & Logemann, 2007; Sivit et al., 1988).

The temporal sequence of the swallow is dependent on several factors, including bolus consistency and the age of the individual (Mendell & Logemann, 2007; Steele et al., 2019). Concomitant neurological disorders will affect the timing of the swallow mechanism as well, placing individuals with these disorders at an increased risk for aspiration and penetration.

Need for Dysphagia Screeners

Many screeners for dysphagia have been developed for use with stroke patients (Trapl et al., 2007), Parkinson's disease (Manor et al., 2007; Simons et al., 2014), and other neurological problems (see Kaspar & Ekberg, 2012). Manor et al. (2007) documented the need for a dysphagia questionnaire for patients with Parkinson's Disease. A total of 57 participants with Parkinson's Disease were asked to complete a swallowing disturbance questionnaire that consisted of yes/no questions related to swallowing problems. Following completion of the questionnaire, all participants underwent clinical swallowing examinations. Of the participants, 24 answered "no" to swallowing problems; on the basis of the survey alone, 12 of these 24 noncomplaining patients would have been referred for further evaluation. These results suggest that a dysphagia screener is a valuable tool in early detection of dysphagia symptoms for Parkinson's patients. A meta-analysis analyzing the prevalence of oropharyngeal dysphagia in Parkinson's disease further corroborates these results: subjective dysphagia symptoms were much less frequently reported than objective dysphagia rates among Parkinson's patients would suggest (Kalf et al., 2012). Underreporting of dysphagia symptoms, and perhaps unawareness of either the symptoms themselves or the significance of the symptoms, highlights the need for a more proactive clinical approach in this population. Similarly, it

is logical that people with diabetes may also be underreporting dysphagia symptoms. Reduced sensitivity of the oropharyngeal system due to damaged innervation of the vagus nerve may cause dysphagia symptoms to be overlooked or unnoticed by the patient. The serious nature of dysphagia and risk of undetected penetration and aspiration mean that this issue is highly important when assessing and implementing care routines for diabetic patients. This study proposes that the use of a screener will help identify patients with subtle clinical symptoms of dysphagia.

Oropharyngeal Stage Dysphagia in Individuals with Diabetes

Mandelstam and Siegel (1969) documented 12 case studies of diabetic individuals who demonstrated differences in the amplitude of pharyngeal contractions compared to that of controls. They used esophageal manometry to measure pharyngeal contraction amplitude and peristaltic contractions following the swallow, and found that the amplitude of pharyngeal contractions for the diabetic participants was substantially less than the amplitude of pharyngeal contractions of the control subjects. This is one of the first studies to show swallowing disturbances among diabetic patients. Vela and Balart agreed with these findings in 1970 with further manometric examination of the esophagus in diabetic patients, adding their opinions that the change in esophageal motility was likely due to vagal neuropathy secondary to diabetes.

Continuing to build on these results, Borgström et al. (1988) analyzed the pharyngeal and esophageal functioning in patients with diabetes. A total of 18 diabetic patients (of which 6 had type 1 diabetes) with swallowing complaints were monitored for pharyngeal and esophageal functioning using radiography techniques during a barium swallow. Fourteen patients demonstrated pharyngeal dysfunction, with eight of them also

demonstrating abnormal esophageal functioning. Specifically, four patients showed defective epiglottic motility, and nine had defective closure of the laryngeal vestibule. Five patients showed paresis of the pharyngeal constrictor musculature. The participants in this study had already indicated swallowing problems; the prevalence of oropharyngeal swallowing problems among diabetics who are unaware or do not come forward with swallowing complaints may be even higher. A proactive approach to identify and follow up with this population can be a key component in preventing dysphagia-related medical conditions.

Research Questions

Diabetes mellitus involves a number of symptoms that occur systemically throughout the body, many of which can be controlled via behavior modification and careful moderation of diet. The purpose of the present study is to assess and describe any symptoms relating to dysphagia as reported by individuals with diabetes. This is a preliminary data collection stage that will ideally serve as a precursor for future objective studies that will more closely investigate a link between diabetes and dysphagia. This is a qualitative study design that intends to examine patient perception of their swallow. Swallowing problems can be expected due to the effects of diabetes on cranial nerves, specifically the vagus nerve (Crumley, 1994; Erman et al., 2009; Fukushima et al., 2003), the effects of diabetes on oral health (Southerland et al., 2005; Taylor et al., 1998), and the degree to which long term diabetes is monitored and managed (Shrivastava et al., 2013). It is hypothesized that individuals with diabetes will describe various symptoms of oropharyngeal phase dysphagia due to the systemic nature of the complications of the disorder.

CHAPTER II

METHODS

Participants

This study was approved by the Internal Review Board of Cleveland State University. Consent was obtained from all individuals before participating in the study (see Appendix I). Participants were recruited via word of mouth and from doctor's offices in the Northeast Ohio area. To take part in the survey, participants had to be at least 18 years of age. Individuals who indicated that they were on dialysis or had medical conditions that may have affected the swallowing mechanism (e.g., Parkinson's Disease, traumatic brain injury, stroke, chronic renal failure, and chronic smokers) were excluded from the study. A total of 11 participants completed the survey. One participant was excluded due to presence of end stage renal disease resulting in dialysis. This participant also indicated having a previous Modified Barium Swallow Study done, indicating some reason to suspect that he had a history of dysphagia. It could not be substantiated that the current perceived swallowing problems were from diabetes as opposed to the renal disease. Because the purpose of this study was only to describe the experiences of people with diabetes, no control group consisting of people without diabetes was included for comparison.

Data from the remaining 10 participants was analyzed (age range 23-85, mean = 53.1, SD = 21.7). There were 8 females and 2 male participants. Of the female participants, 4 had type 1 diabetes. One male had type 1 diabetes. Participants older than 60 years of age all reported a diagnosis of type 2 diabetes, while participants under 60 years of age all reported a diagnosis of type 1 diabetes. There were 2 African American individuals, one male and one female. There was an event split in type of diabetes between the different ethnic groups represented, with half of African Americans and half of Caucasian individuals having a diagnosis of type 1. Only 7 participants reported their date of diagnosis. Of these, half of those who had been diagnosed for less than 20 years were type 1. One-third of those who had been diagnosed for more than 20 years were type 1. All of the participants who have been diagnosed for less than 50% of their lives were type 1. All of the participants who have been diagnosed for more than 50% of their lives were type 2.

Table I.

Demographics of study sample.

		Type of Diabetes	
Factor	Total sample	Type I	Type II
Gender			
n	10	5	5
% male	20%	50%	50%
% female	80%	50%	50%
Age			
n	10	5	5
< 60 years	50%	100%	0%
≥ 60 years	50%	0%	100%
Ethnicity			
n	10	5	5
Caucasian	80%	50%	50%
African American	20%	50%	50%
Years with Diagnosis			
n	7	3	5
< 20 years	57%	50%	50%
≥ 20 years	43%	33%	67%
Percent of Life with Diagnosis			
n	7	3	5
< 50% of life	57%	0%	100%
≥ 50% of life	43%	100%	0%

Procedures

Data was collected over a period of 6 months, from October 2019 through March 2020. The full survey completed by participants can be found in Appendix II. Participants completed the survey independently, either on a computer and returned via email or by paper-and-pencil and returned via postal mail. Participants were asked a number of

demographic questions, including the age at which he or she was diagnosed with diabetes, and if their diabetes was managed with medication or not. Participants were asked to disclose any current smoking habits or history of smoking, as this information may affect the health and performance of the swallow mechanism.

Questions regarding specifics of the swallow were answered on a frequency scale. Question 1 asked participants to rate his or her difficulty with swallowing solid food, liquids, and pills. Question 2 asked participants to rate the frequency with which they are aware of clinical signs and symptoms of aspiration on liquids, including coughing before, during, and after the swallow, as well as experiencing liquids going through the nose. Questions 3-5 represented other overt signs and symptoms of dysphagia (refer to Appendix II).

CHAPTER III

RESULTS

Data were analyzed in a qualitative manner. Four domains were identified and classified as such: (1) clinical signs and symptoms of dysphagia, (2) interaction of oral phase difficulty with symptoms of dysphagia, (3) interaction of management of diabetes with symptoms of dysphagia, and (4) interaction of oral health with symptoms of dysphagia. Table 2 illustrates the relationship between each domain and its associated questions in the survey.

Table II.

Breakdown of survey questions into distinct domains. Question numbers correspond to questions in the survey as seen Appendix 1.

Domain	Question #	Question Identifies:
1. Clinical Signs and Symptoms of Oropharyngeal Phase Dysphagia	1b-1e	difficulty with swallowing: liquids, solid textures, pills, oral secretions
	2a-2e	when drinking liquids do you: cough, cough before you swallow, cough after you swallow, have difficulty starting the swallow, or experience liquids coming through your nose
	3a, 3b	when swallowing solid food, do you have a sensation of food being stuck in your throat or chest
	5e	do you experience frequent throat clearing after you swallow
2. Oral Phase Difficulty	1a	do you have difficulty chewing solid foods
	3c	when swallowing solid food, do you have a sensation of food being stuck in areas of your mouth
	5f	do you experience fatigue during chewing
3. Management of Diabetes	medication management	do you take medication to manage your diabetes
4. Oral Health	5a, 5b	do you experience ulcers/ sores of mouth or dry mouth
	dentition	natural, edentulous, dentures, partial/bridges

Dysphagia was further broken down into 4 sub-categories: difficulty swallowing, coughing before, during, or after swallowing liquids, sensations/ perception of food being stuck in the throat or chest, and frequency of throat clearing (see Table 3).

Table III.

Breakdown of dysphagia into sub-categories. Question numbers correspond to questions in the survey as seen Appendix 1.

Sub-Category	Question #	Question Identifies:
Difficulty Swallowing	1b-1e	difficulty with swallowing: liquids, solid textures, pills, oral secretions
Coughing	2a-2e	when drinking liquids do you: cough, cough before you swallow, cough after you swallow, have difficulty starting the swallow, or experience liquids coming through your nose
Sensation of food being stuck in the throat or chest	3a,3b	when swallowing solid food, do you have a sensation of food being stuck in your throat or chest
Throat Clearing	5e	do you experience frequent throat clearing after you swallow

Initially, raw data were used to illustrate the overall distribution of answers regarding signs and symptoms of dysphagia. An overall frequency percentage was calculated by totaling the number of each type of response ("frequently", "sometimes", and "never") and dividing by the total number of responses for a given variable. In addition, when broken down by category, responses were analyzed according to frequency and converted to percentages to allow for comparison of variables. For any given category, each type of response was totaled and divided by the total number of possible responses to create a percentage. Therefore, charts represent the percentage of

responses indicating "sometimes" or "frequently" responses to each question within the sub-category, rather than the percentage of individuals.

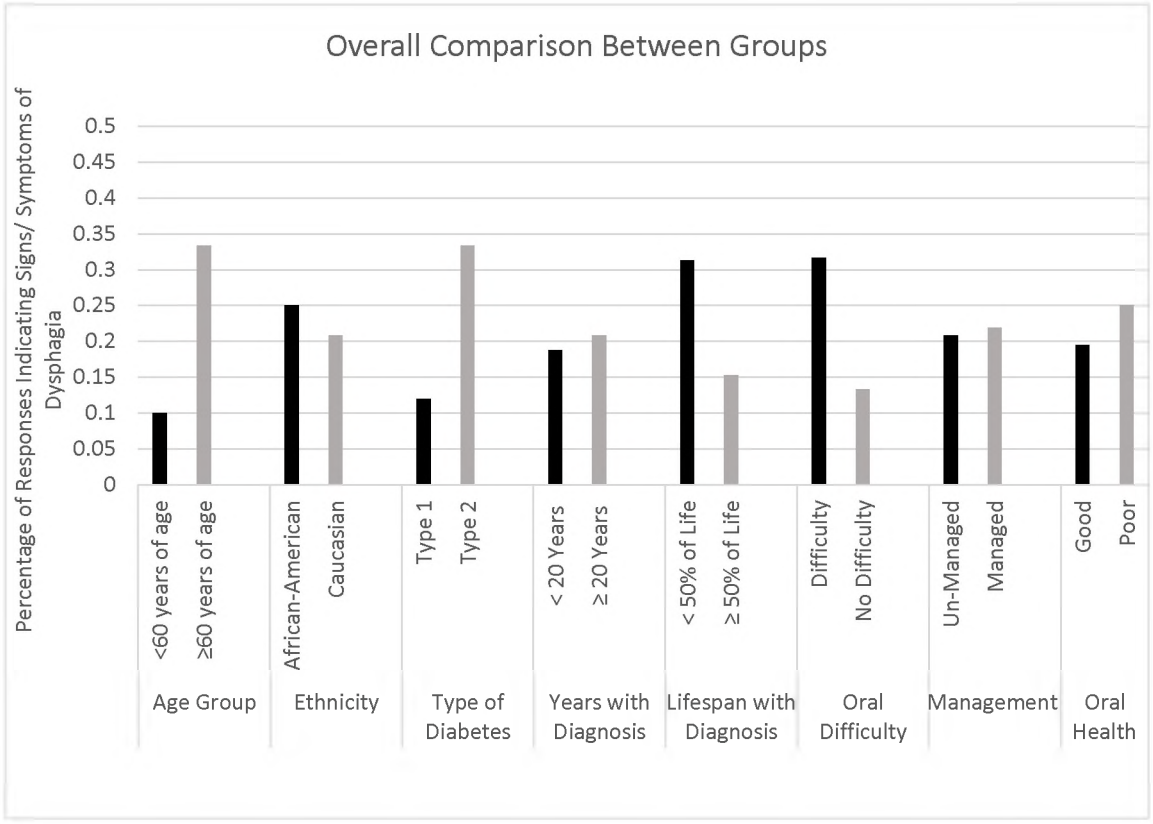
A total of 10 participants completed the survey, 8 females and 2 males, with an age range of 23-85 years (mean = 53.1, SD = 21.7) (refer to Table 1). One individual (age 23) denied any swallowing difficulty, answering "never" to all questions. Two others responded "sometimes" to fewer than 2 questions in any given category. Two individuals consistently indicated "sometimes" on 3 or more questions in each category; both participants listed their ages as greater than 60 years of age and having a diagnosis of type 2 diabetes. Another participant reported a history of pneumonia and respiratory problems. None of the participants reported a history of traumatic brain injury, stroke, or Parkinson's disease.

Reports of Dysphagia Symptoms

An overall comparison of the percentage of responses indicating dysphagia for the variables of age, ethnicity, type of diabetes, duration of diagnosis (years with diagnosis, percent of life with diagnosis), medical management, and oral health can be found in Figure 1. The variables showing the largest difference in percentages include age and type of diabetes, with differences of 23% and 21%, respectively.

Figure 1.

Comparison of percentage of responses indicating signs or symptoms of dysphagia for each variable.

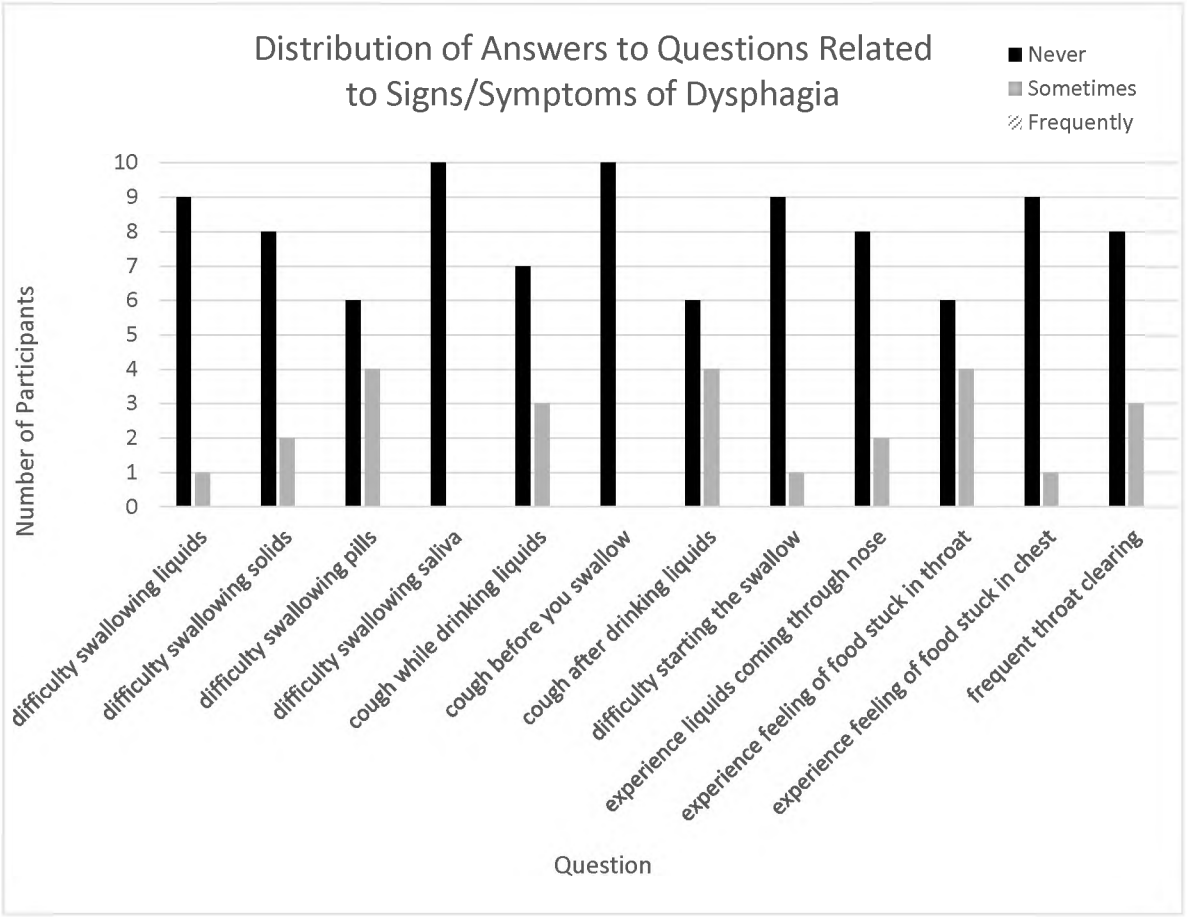


Domain 1 – Clinical Signs/ Symptoms of Dysphagia

Of the 10 participants, the most frequently reported symptoms of dysphagia were difficulty swallowing pills, coughing after drinking liquids, and experiencing a sensation of food being stuck in the throat or chest (Figure 2). One participant denied symptoms on every question, and two others reported experiencing only one symptom on the survey. The other seven participants indicated experiencing symptoms of dysphagia on two or more questions out of the twelve questions that involve signs of dysphagia. None of the participants rated any of their symptoms of dysphagia as occurring "frequently".

Figure 2.

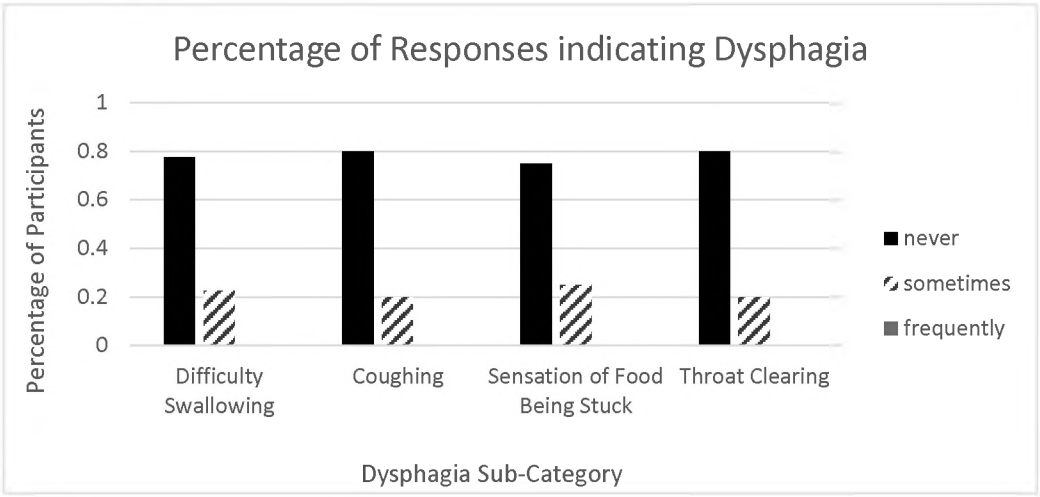
Overall distribution of responses to questions regarding signs and symptoms of dysphagia.



The most commonly experienced sub-category of dysphagia was a sensation of food being stuck in the throat or chest, with 25% of participants indicating they experience this "sometimes" (Figure 3). Difficulty swallowing was the next most frequently reported experience, with 22.5% of participants experiencing any of these symptoms. Coughing before, during, or after swallowing liquids, and frequently throat clearing were tied at 20% of responses reporting. Demographic variables were explored to observe where specific differences occurred.

Figure 3.

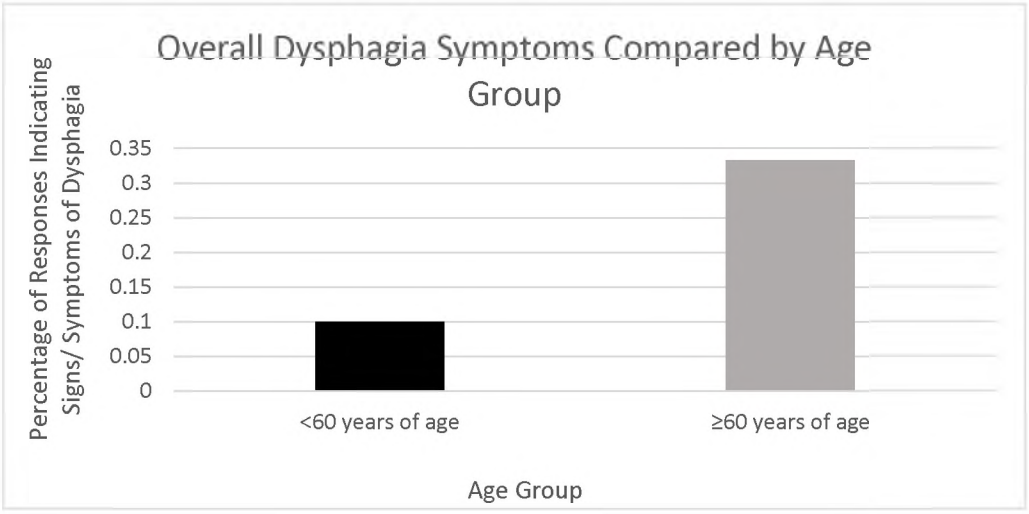
Percentage of responses indicating frequency of experiences with each sub-category of dysphagia for all participants.



Association with Age. When divided into age groups of less than 60 years of age and 60 years of age or greater, a distinct difference in frequency of reported symptoms of dysphagia emerged. Of the 5 individuals who were 60 years of age or older, 33.3% of responses indicated overall dysphagia (Figure 4).

Figure 4.

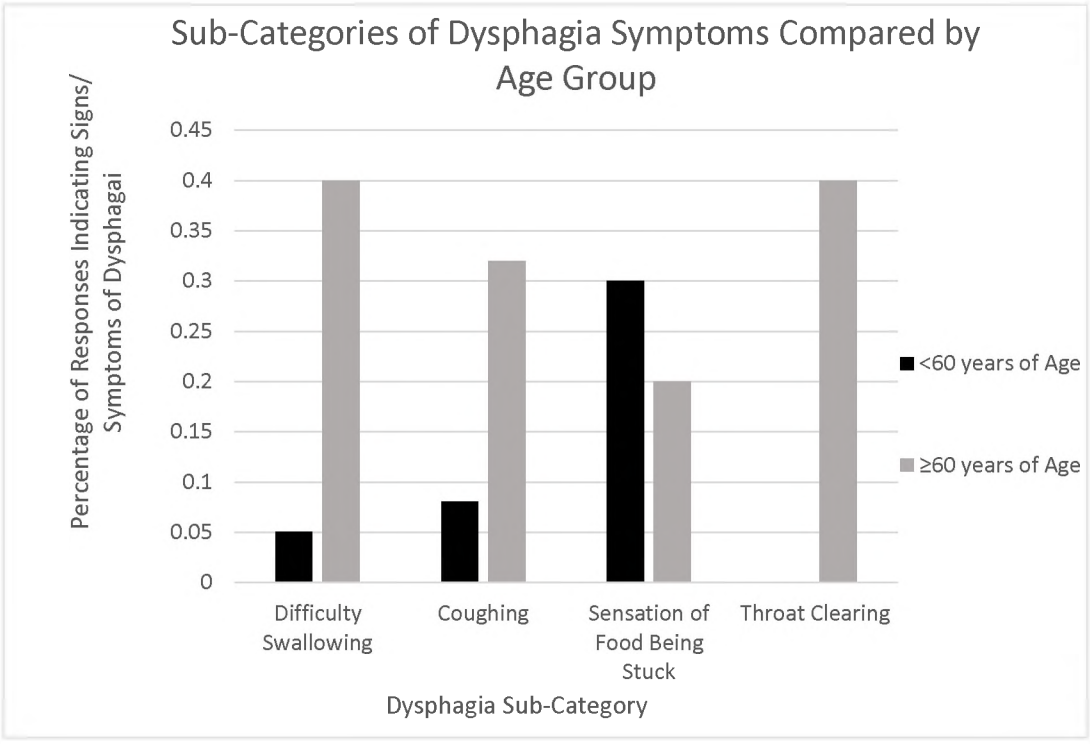
Age comparison of percentage of responses indicating "sometimes" to any question within the domain of signs/ symptoms of dysphagia.



These results were then broken down into sub-categories to obtain more detail regarding the differences observed. Specifically, within the sub-category of difficulty swallowing, 40.0% of responses from individuals over 60 years of age indicated "sometimes" experiencing difficulty swallowing solids, liquids, or pills (Figure 5). Older individuals more frequently reported coughing while swallowing and throat clearing.

Figure 5.

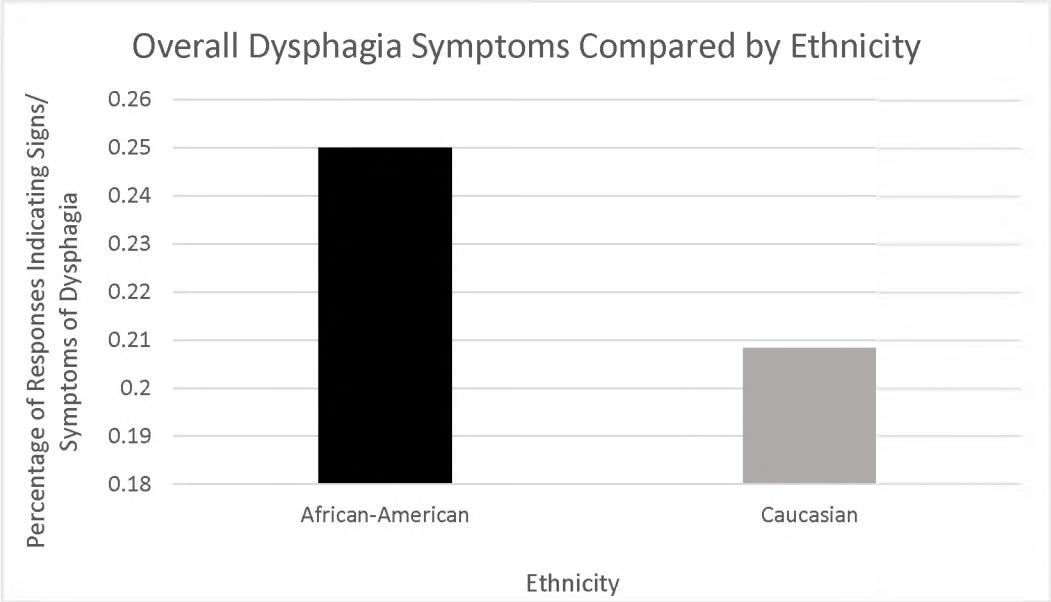
Age comparison broken down by dysphagia sub-category.



Association with Ethnicity. There were 2 African American participants and 8 Caucasian participants. Of the African American group, 25% of reported responses indicated overall dysphagia. Of the Caucasian group, 20.8% of responses indicated overall symptoms of dysphagia (Figure 6).

Figure 6.

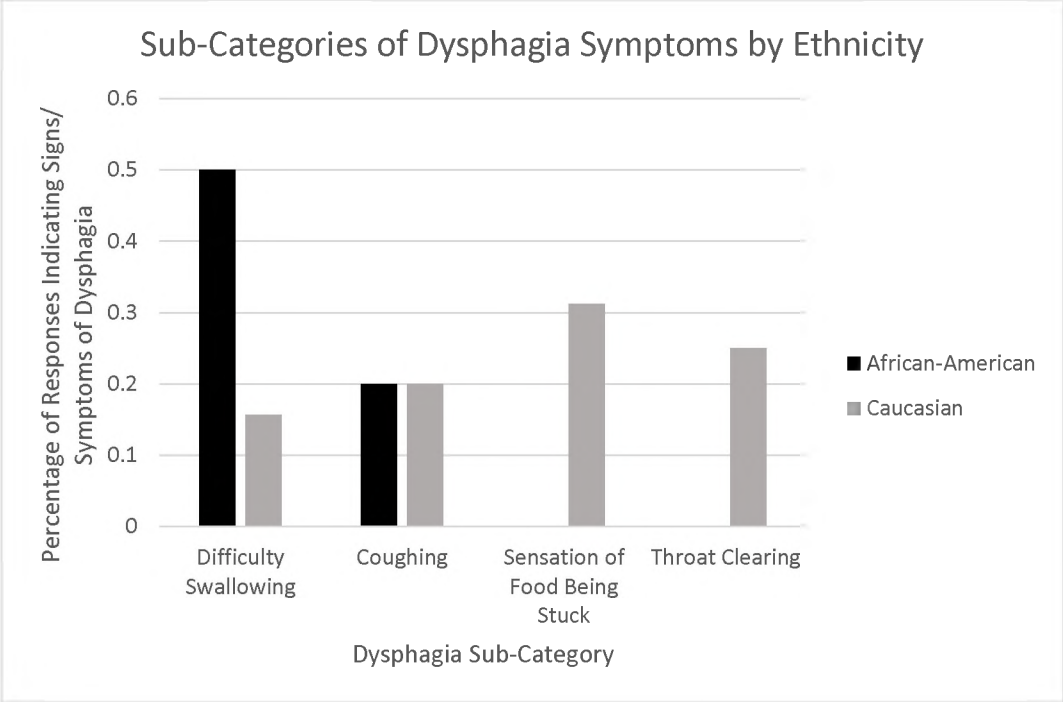
Percentage of responses indicating "sometimes" to any question within the domain of signs/ symptoms of dysphagia, compared by ethnicity.



Detailed analysis showed that the most frequently reported sub-category of dysphagia among the African American group was difficulty swallowing liquids, solids, and pills, at 50.0% of responses (Figure 7). The percentage of responses indicating coughing while swallowing was equal between the two groups, at 20.0% of responses for both. None of the African American participants indicated sensation of food being stuck in the throat or throat clearing behaviors.

Figure 7.

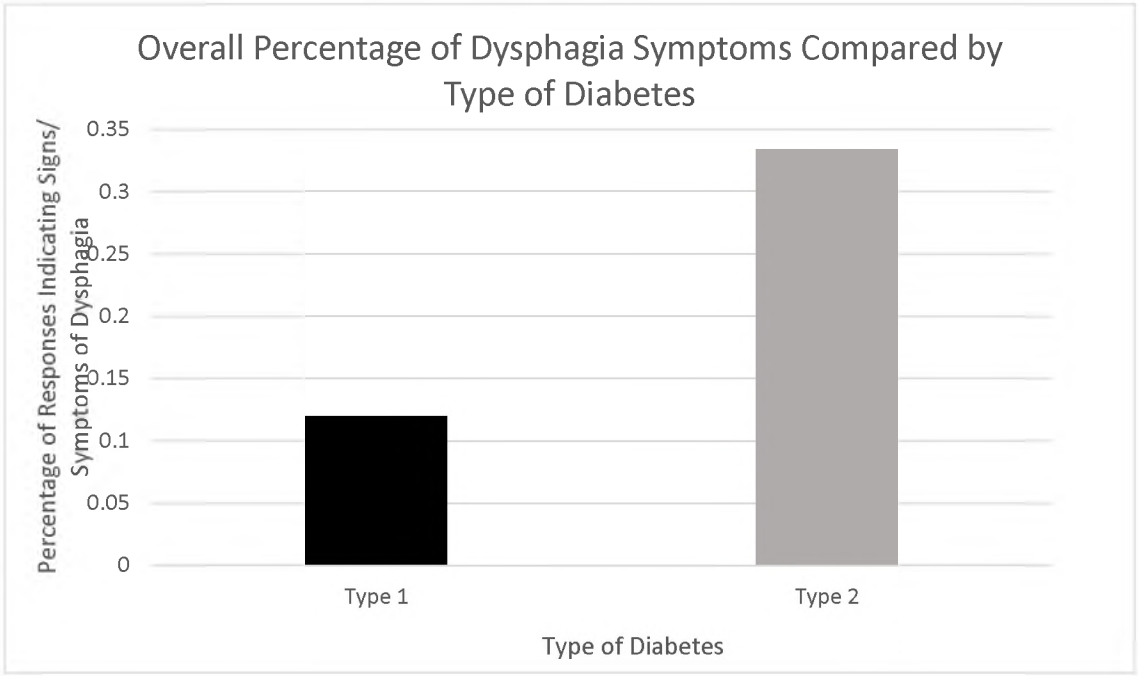
Ethnicity comparison broken down by dysphagia sub-category.



Association with Type of Diabetes. Individuals with Type 1 diabetes reported fewer signs and symptoms of dysphagia than individuals with Type 2 diabetes, at 12.0% of responses and 33.3% of responses, respectively (Figure 8).

Figure 8.

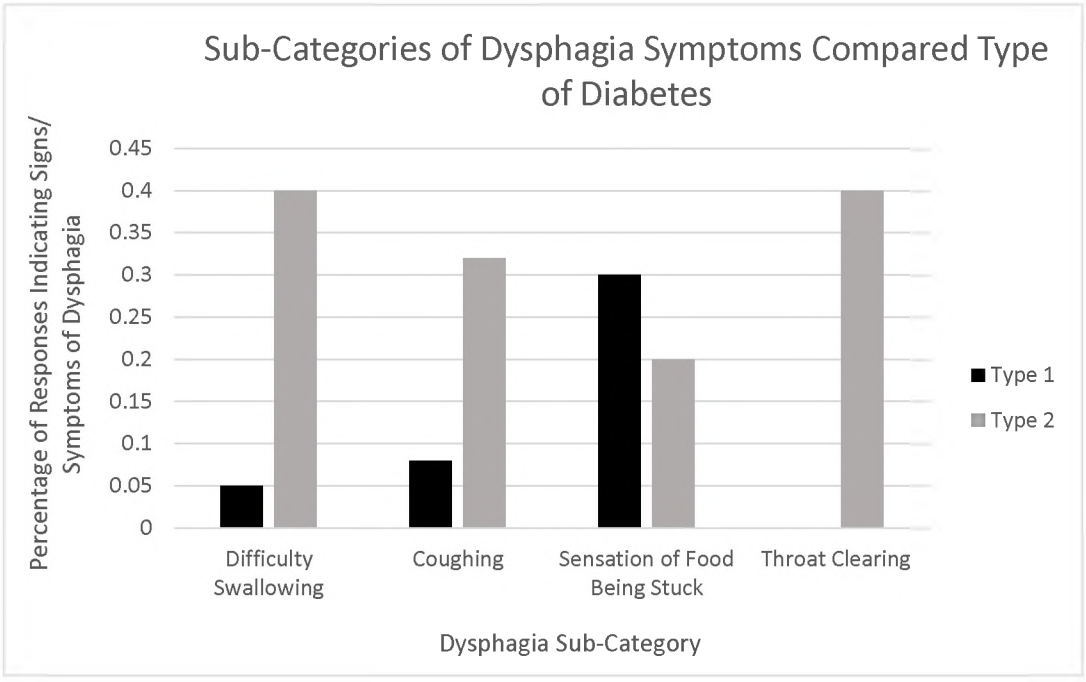
Comparison between type of diabetes and percentage of responses indicating "sometimes" experiencing symptoms of dysphagia.



Across each sub-category, individuals with Type 2 diabetes reported symptoms of dysphagia more frequently than individuals with Type 1 diabetes, with one exception: individuals with Type I diabetes reported a sensation of food being stuck in the throat or chest more frequently than individuals with Type 2 diabetes (Figure 9).

Figure 9.

Type of diabetes comparison broken down by dysphagia sub-category.

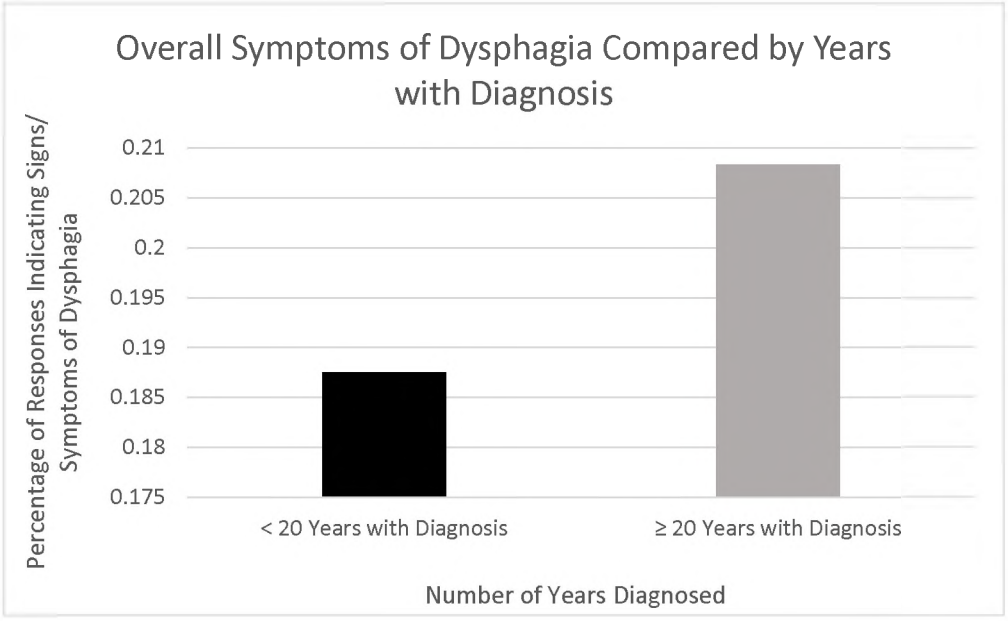


Association with Duration of Diagnosis. Duration of diagnosis was examined in two ways: number of years with a diagnosis of diabetes, and percentage of life spent with a diagnosis of diabetes. Three participants did not report date of diagnosis and were excluded from both analyses.

To observe differences in year duration, participants were divided into 2 groups: those who have been diagnosed for less than 20 years, and those who have been diagnosed for 20 years or more. Overall dysphagia was indicated in 18.8% of responses for individuals who have been diagnoses for less than 20 years, compared to 20.8% of responses in individuals who have been diagnosed for a longer period of time (Figure 10).

Figure 10.

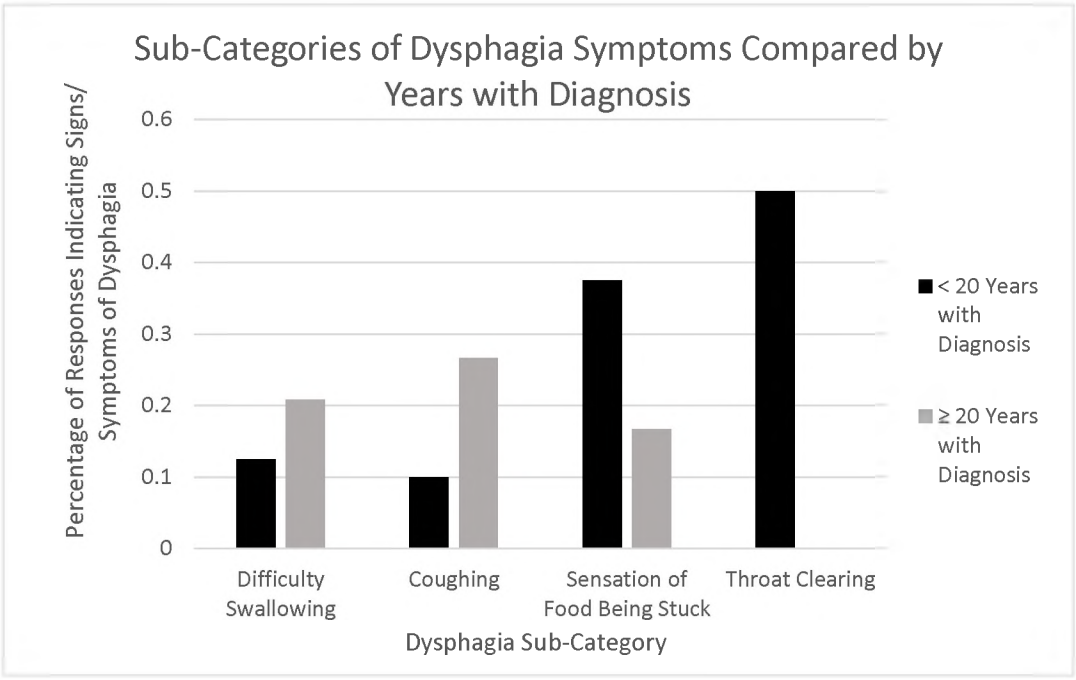
Percentage of responses indicating "sometimes" experiencing symptoms of dysphagia compared by years with diagnosis.



Individuals who have been diagnosed for a longer period of time demonstrated an increased frequency of responses for the sub-categories of difficulty swallowing and coughing while swallow (Figure 11). However, individuals who have been diagnosed for less than 20 years demonstrated a higher percentage of responses indicating sensations of food being stuck in the throat or chest and frequency of throat clearing.

Figure 11.

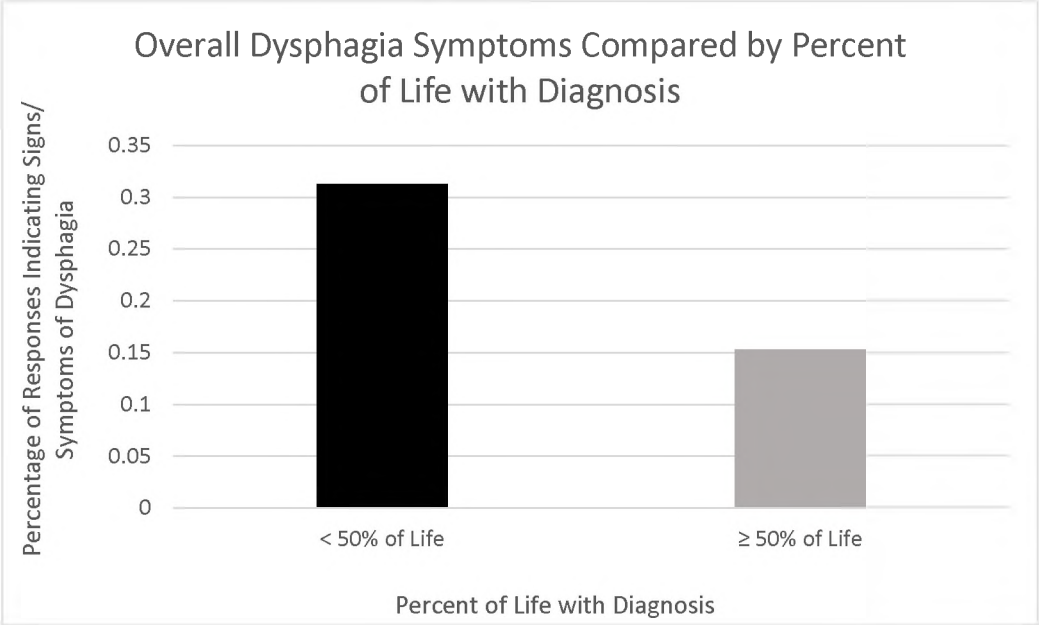
Years with diagnosis comparison broken down by dysphagia sub-category.



Individuals who have been diagnosed with diabetes for more than 50% of their lives demonstrated a smaller proportion in percentage of overall indications of dysphagia compared to those who have been diagnosed for less than 50% of their lives, with a 16.0% difference (Figure 12). Note that all individuals who classed into the group of being diagnosed for less than 50% of their life were Type 2 diabetics.

Figure 12.

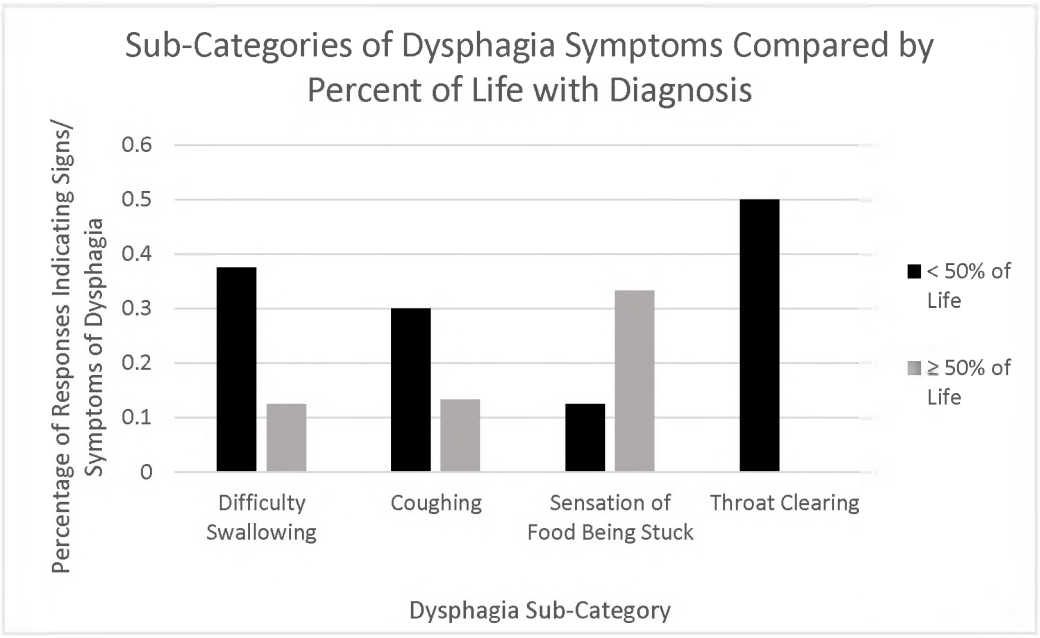
Percentage of responses indicating "sometimes" experiencing symptoms of dysphagia compared by percent of life with diagnosis.



Individuals who have been diagnosed for a shorter percentage of their lives demonstrated a higher percentage of responses for difficulty swallowing, coughing while swallowing, and throat clearing (Figure 13). Individuals who have been diagnosed for a longer percentage of their lives demonstrated a higher percentage of responses indicating a sensation of food being stuck in their throat or chest.

Figure 13.

Percent of life with diagnosis comparison broken down by dysphagia sub-category.

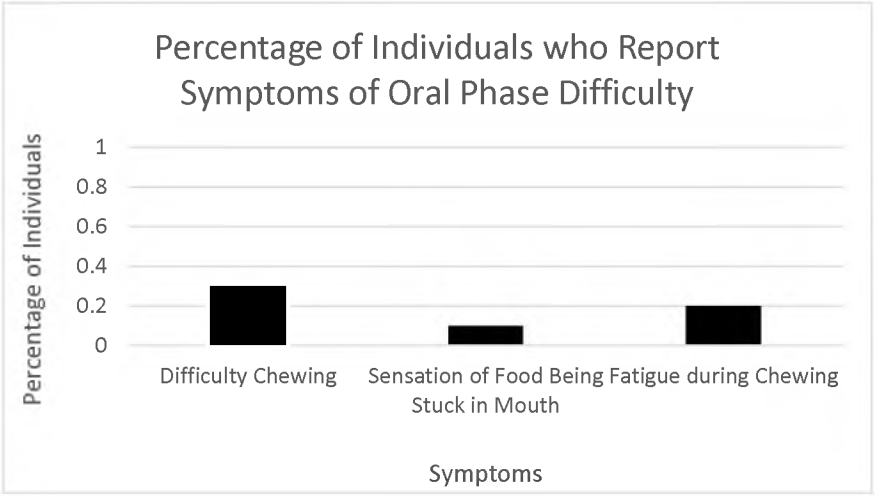


Domain 2 – Association of Oral Phase Difficulty with Dysphagia Symptoms

Of all 10 participants, 30.0% indicated difficulty chewing, 10.0% indicated sensations of food being stuck in the mouth, and 20.0% indicated fatigue during chewing (Figure 14).

Figure 14.

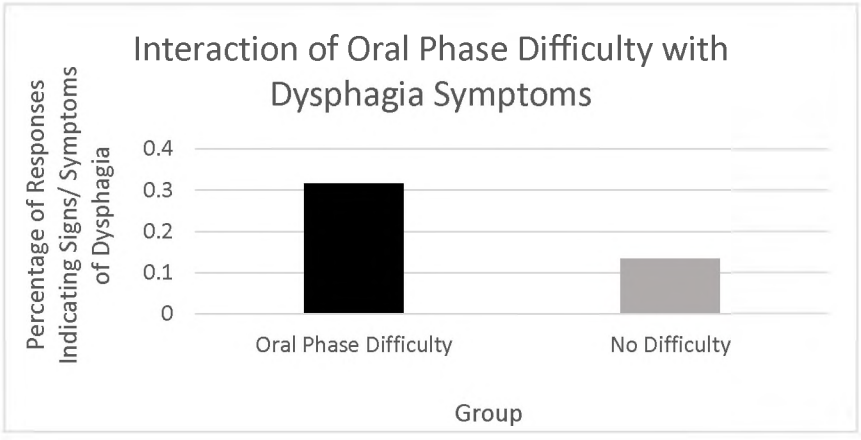
Number of participants indicating they experience oral phase difficulty. For the category "difficulty chewing", all 3 participants indicated that they have dentures.



Of those who had an oral phase difficulty, 31.7% of responses further indicated one or more symptoms of oropharyngeal phase dysphagia (Figure 15).

Figure 15.

Association of presence of oral phase difficulty with dysphagia symptoms.

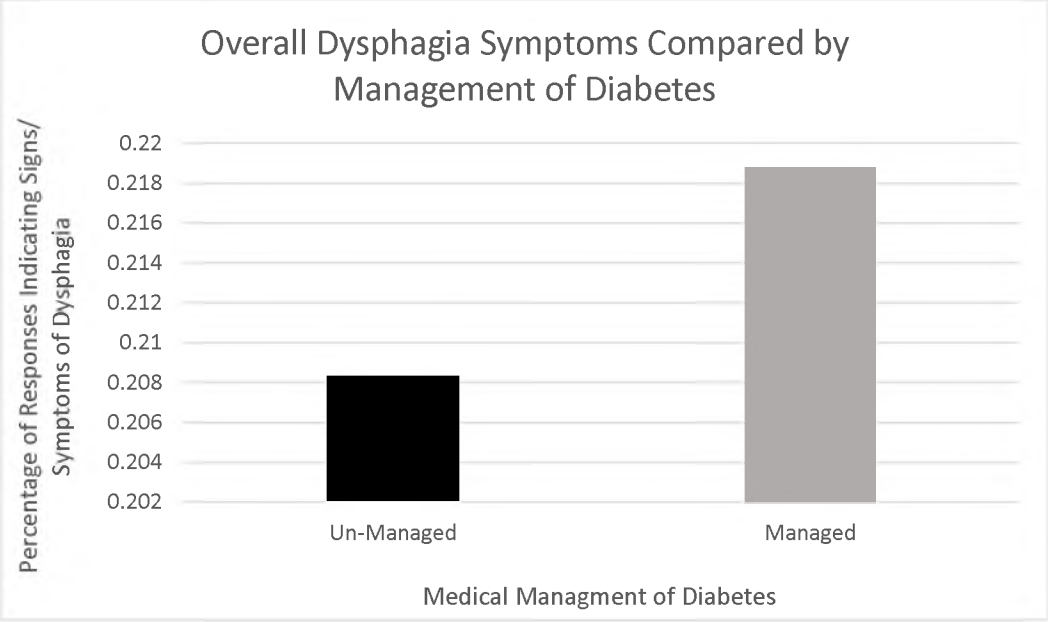


Domain 3 – Dysphagia Associated with Management of Diabetes

Two participants reported that they do not manage their diabetes with medication. One individual reported "never" on all questions in this survey. The other indicated "sometimes" on one or more questions in each sub-category with the exception of throat clearing. Overall, participants who engage in a medical management of diabetes demonstrated a very slightly higher proportion of responses indicating symptoms of dysphagia (21.9%) compared to those who do not manage their diabetes (20.8%) (Figure 16).

Figure 16.

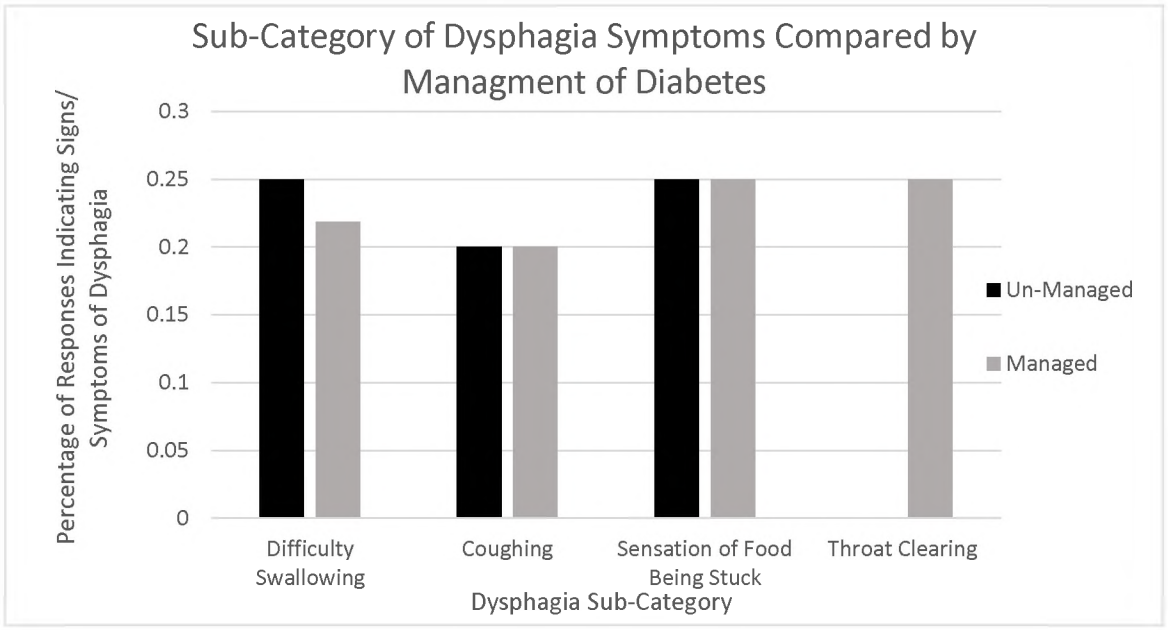
Percentage of responses indicating symptoms of dysphagia compared by presence of medical management of diabetes.



The two groups demonstrated equal percentages of responses indicating coughing while swallowing (20.0%) and sensation of food being stuck in the throat (25.0%) (Figure 17). Individuals with un-managed diabetes demonstrated a higher proportion of responses indicating difficulty swallowing, while individuals with managed diabetes demonstrated a higher percentage of responses indicating throat clearing behaviors.

Figure 17.

Percentage of responses indicating symptoms of dysphagia in each sub-category compared by medical management of diabetes.

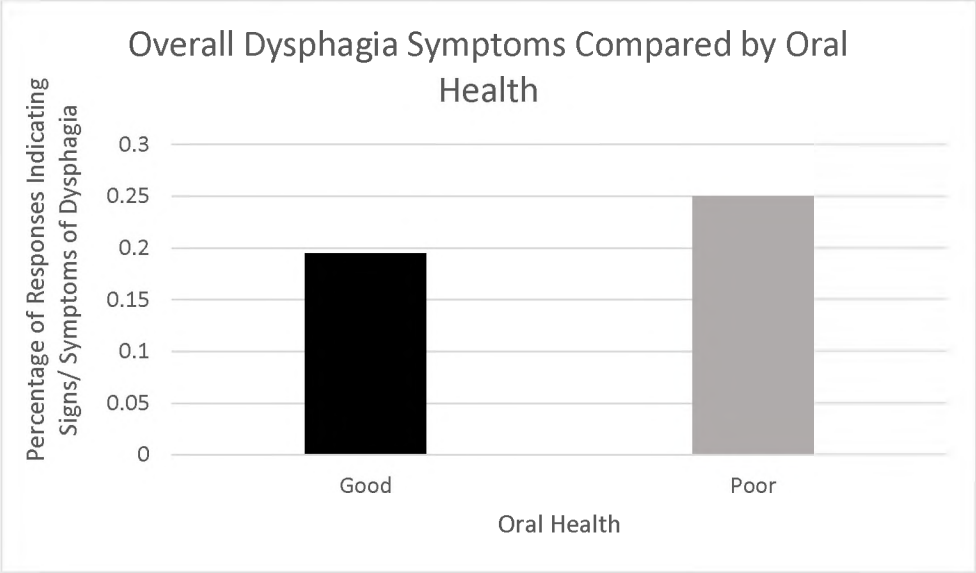


Domain 4 – Association of Oral Health with Diabetes and with Dysphagia Symptoms

For the purposes of this study, "good" oral health was defined as answering "no" to experiencing ulcers/ sores of the mouth, "no" to experiencing dry mouth, and reporting natural dentition. Three participants fell into this category. "Poor" oral health was defined as answering "yes" to any of the above or indicating missing dentition/ dentures, with 7 participants represented in this category. Individuals with poor oral health reported symptoms in 25.0% of responses. Individuals with good oral health reported symptoms of dysphagia in 19.4% of responses (Figure 18).

Figure 18.

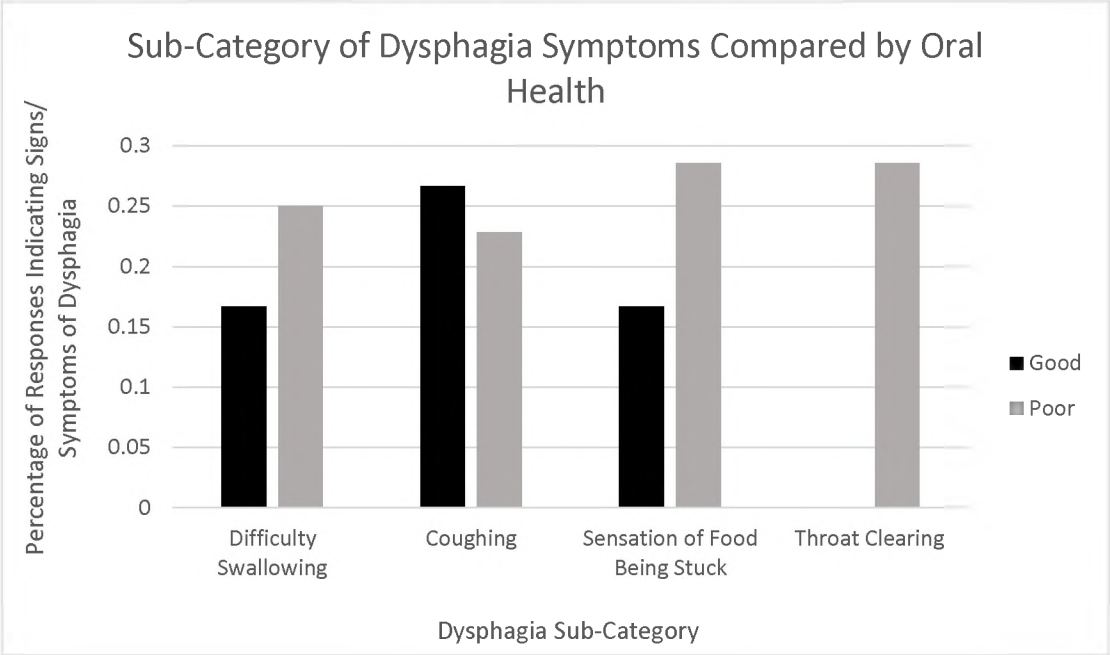
Overall percentage of dysphagia symptoms compared by oral health.



Individuals with poorer oral health reported more frequent experiences with difficulty swallowing, sensation of food being stuck in the throat, and throat clearing than individuals with good oral health. The two groups were most similar in reports of coughing, at 26.7% of responses for the group with good oral health and 22.9% of responses for the group with poor oral health (Figure 19).

Figure 19.

Percentage of sub-category of dysphagia symptoms compared by oral health.



CHAPTER IV

ANALYSIS

Domain 1 – Association with Symptoms of Dysphagia

Overall, responses indicate that the most commonly experienced symptoms of dysphagia by people with diabetes are difficulty swallowing pills, coughing after swallowing liquids, and a sensation of food being stuck in the throat or chest, coughing while drinking, and throat clearing (see Figure 2). These results appear to be in line with the suspected 'diabetic cough' phenomena, in which individuals with diabetes frequently demonstrate a persistent dry cough. A raised cough reflex threshold in conjunction with difficulty swallowing, perception of food being stuck in throat, and in at least one case, history of pneumonia, suggest the possibility of silent aspiration in this population. The least experienced symptoms of dysphagia overall included difficulty swallowing saliva and coughing before swallowing liquids.

Each of the investigated factors (age, ethnicity, type of diabetes, duration of the diagnosis, medical management, oral health) potentially play a role in various sub-categories of dysphagia symptoms. These variables should be considered both independently of, and as influenced by, diabetes. Additionally, the factors interconnect and influence each other. For example, age contributes to duration of the diagnosis and to

management style, all (or none) of which may be contributing to dysphagia symptoms. In this study, participants who had been diagnosed with type 2 diabetes all fell into the same age group (60 years of age or older) and the same percentage of life spent with the diagnosis (less than 50% of their lives) (see Table 1). Although separated for the purposes of this analysis, the variables should be considered together as a whole.

Association with Age

One key finding from this study was that people over 60 years of age indicated an awareness of signs of dysphagia more frequently than people younger than 60 years (see Figure 4). Of the 5 individuals who were 60 years of age or older, 33.3% of responses indicated overall dysphagia compared to just 10.0% of responses of the 5 individuals under 60 years of age.

Specifically, within the sub-category of difficulty swallowing, 40.0% of responses from individuals over 60 years of age indicated "sometimes" experiencing difficulty swallowing solids, liquids, or pills compared to just 5.0% of responses from individuals younger than 60 years (see Figure 5). Older individuals more frequently reported coughing while swallowing and throat clearing. However, younger individuals reported sensations of food being stuck in the throat or chest more frequently than older individuals, at 30% and 20% of responses, respectively. These differences may be accounted for by the change in the temporal sequence that occurs as a natural part of aging. This is further substantiated by the relatively minor difference between frequency of reported symptoms of a sensation of food begin stuck in the throat or chest.

It is well known that normal aging causes many changes to the human musculature system, including the timing of swallowing mechanism (Logemann, 1990).

Normal aging results in changes in oropharyngeal functioning in a number of ways that do not necessarily reflect an impairment (known as presbyphagia). It is important to note that a change in any one of these functions is likely to affect the temporal sequence of the swallow.

Association with Ethnicity

Although relatively minor, another difference in reported frequency of dysphagia symptoms emerged between African American individuals and Caucasian individuals (see Figure 6). Detailed analysis showed that the most frequently reported sub-category of dysphagia among the African American group was difficulty swallowing liquids, solids, and pills, at 50.0% of responses (see Figure 7). This sub-category also represents the largest difference between the two groups, with Caucasians reporting difficulty swallowing in only 15.6% of responses.

The two groups were equal in percentage of reported symptoms of coughing while swallowing liquids. Only Caucasian participants indicated sensations of food being stuck in the throat and frequent throat clearing. Several interacting factors may account for these differences, such as socioeconomic status, psychosocial aspects related to seeking health care intervention, and genetics.

Association with Type of Diabetes

In this study, participants with type 1 diabetes reported fewer symptoms of dysphagia than individuals with type 2 diabetes, by a margin of 21.3% (Figure 8). Specifically, type 2 diabetics reported symptoms of difficulty swallowing, coughing while swallowing, and throat clearing more frequently than individuals with type 1 (Figure 9). However, the reverse is true for the sub-category sensation of food being

stuck in the throat or chest. Currently, there is no evidence that one type of diabetes experiences swallowing problems more frequently than the other. Differences in the pathologies of the two types may account for the results from this study.

Association with Duration of Diagnosis

The results of this study indicate that individuals who have been diagnosed for 20 years or more showed only a minor increase in dysphagia compared to individuals diagnosed for less than 20 years (see Figure 10). However, when adjusted to look at percent of lifespan with the diagnosis, the differences were both reversed and more extreme (Figure 12). Note that the majority of individuals who have been diagnosed for more than 50% of their lives all fall into the category of having type 1 diabetes, while all of the individuals who have had it for less than that time have type 2. This is in agreement with the findings related to type of diabetes in that individuals with type 2 diabetes consistently reported more frequent symptoms of dysphagia (Figure 8). Therefore, while duration of diagnosis in terms of the number of years represented a small difference in the percentage of dysphagia symptoms reported, the acuity of onset represented a stronger association.

Domain Two – Dysphagia Associated with Oral Phase Difficulty

Presence of oral phase difficulty was assessed according to responses to questions regarding difficulty chewing, sensation of food being stuck in the mouth, and fatigue during chewing. One-third of participants indicated difficulty chewing, with fewer indicating fatigue or sensation of food being stuck in the mouth (Figure 14). All of the participants who reported difficulty chewing also reported having dentures or missing teeth. Approximately one-third of participants who indicated symptoms of oral phase

dysphagia also reported symptoms of oropharyngeal phase dysphagia (Figure 15). However, 13.3% of participants who did not report any symptoms of oral phase dysphagia also reported symptoms of oropharyngeal phase dysphagia. This disparity may be a result of confounding variables such as increasing age, type of diabetes, and oral health.

Domain Three – Dysphagia Associated with Management of Diabetes

One surprising result from this study was that participants who reported medical management of their diabetes reported that they experienced symptoms of dysphagia more frequently than individuals who did not manage their diabetes through medication (Figure 16). A breakdown of symptoms into sub-categories reveals that the differences between the groups for each sub-category are minor, with the exception of throat clearing symptoms (Figure 17). However, this can be partially accounted for by the small sample size. It can also be inferred that regardless of management, the underlying mechanisms of diabetes still contribute to swallowing problems. Furthermore, it is possible that the survey used in this study did not target management questions in enough detail to gain an accurate picture of the overall effects. Poor self-management would still be considered management within the parameters of this study.

Domain Four – Dysphagia Associated with Oral Health

In this study, the majority of participants reported one or more symptoms indicative of poor oral health, such as ulcers and sores of the mouth or frequent dry mouth. Subsequently, participants with poor oral health demonstrated a higher proportion of overall dysphagia symptoms compared to participants with good oral health (Figure 18). The two groups were most similar in reports of coughing, at 26.7% of responses for

the group with good oral health and 22.9% of responses for the group with poor oral health (Figure 19). Difficulty swallowing, sensation of food being stuck in the throat, and throat clearing were all experienced more frequently by individuals with poorer oral health.

Good oral health is necessary for adequate mastication and deglutition. Reduced production of saliva and the presence of sores and ulcers can make chewing difficult and impact the efficiency of the oral and pharyngeal phases. The results from this study are in agreement, demonstrating that participants with self-reported poorer oral health do report more frequent indications of swallowing difficulty.

CHAPTER V

DISCUSSION

The purpose of this study was to investigate the existence of reported swallowing difficulties in individuals with both type 1 and type 2 diabetes. In this study, results from a self-report survey demonstrate that people with diabetes do report various signs of swallowing difficulty. With one exception, every participant indicated "sometimes" having difficulty in one or more areas of the swallow. Several individuals reported having difficulty with multiple aspects in all areas (see Figure 1).

Domain 1 – Signs and Symptoms of Oropharyngeal Dysphagia Associated with Diabetes

Two participants reported a higher proportion of severity of swallowing difficulties. Participant "A", a 63-year old male with type 1 diabetes who was excluded from data analysis due to being on dialysis, consistently reported "sometimes" and "frequently" in regard to swallowing difficulty, coughing while consuming liquids, and sensations of food being stuck in the throat and chest. There is some evidence that oropharyngeal dysphagia may be a comorbid condition with chronic renal failure (Pinto et al., 2016), with the authors noting that possible causes may result from changes in the neuromotor system. However, another study found that there were no differences in

frequency of oral discomfort or dysphagia symptoms between diabetic and non-diabetic patients with chronic kidney disease (Vesterinen et al., 2012), implying that the mechanism underlying the dysphagia was not correlated with diabetes. Ultimately, this individual was excluded from data analysis due to these possible confounding factors. Additionally, he reported having a Modified Barium Swallow Study done, indicating previous conference with a doctor about these symptoms. However, the date and outcomes of this objective assessment are unknown. Presence of a swallowing problem prior to the beginning of a kidney disease would suggest that the dysphagia is not due to the kidney disease.

Participant "B", a 65 year-old female with type 2 diabetes, also consistently reported swallowing difficulties. She reported a health history significant for respiratory problems, gastroesophageal reflux disease (GERD), and pneumonia. This participant reported that she does not take medication to manage her diabetes. It was communicated to the researcher by a close family member of the participant that she does not actively manage her diabetes and often complains of swallowing difficulty.

There were three participants unique for indicating less than 2 swallowing problems throughout the survey (ages 23, 27, and 80). Two of the three participants reported no problems with their oral health, implying that good oral health may be associated with a healthy swallowing mechanism.

Age

Normal aging results in changes in oropharyngeal functioning in a number of ways that do not necessarily reflect an impairment (known as presbyphagia). Oral transit time may be delayed (Shaw et al., 1995), swallow apnea may be increased (Leslie et al.,

2005), and there may be a decrease in oral/ pharyngeal pressures (Yokoyama et al., 2000). However, other elements remain preserved, such as coordination of upper esophageal sphincter opening and pharyngeal contraction (Shaw et al., 1995) and rate of pharyngeal contractions (Robbins et al., 1992). It is important to note that a change in any one of these functions is likely to affect the temporal sequence of the swallow. Additionally, some changes, such as the change in respiratory coordination, may be considered compensatory changes for more maladaptive changes such as increased oral transit time (Leslie et al., 2005). That is to say, swallow apnea may be an adaptive behavior that increases the safety of a delayed swallow pattern. It cannot be assessed from this study if the swallowing problems being reported are due to complications from diabetes or simply a result of normal aging. Ultimately, without an objective assessment of the swallow, the correlation between dysphagia and diabetes in individuals greater than 60 years of age cannot be substantiated. However, there may a small link between the length of the disease and the severity or frequency of reported swallowing problems.

Another consideration is the fact that all of the participants in the older age group had type 2 diabetes, and all had been diagnosed for less than 50% of their lives (see Table 1). These other two factors represent the largest disparities in proportion of reported dysphagia symptoms, as described in the following sections. Future studies might make an effort to differentiate and describe the effects of each variable on reported symptoms while controlling for the others, to identify predictive criterion for those at increased risk.

Ethnicity

In terms of general health care, individuals of all races and ethnicities of lower socioeconomic status suffer from poorer health and decreased access to health care than

individuals of higher socioeconomic status (Dubay & Lebrun, 2012). Dubay and Lebrun found that in both low and high socioeconomic status groups, blacks and Hispanics had poorer health outcomes compared to whites, suggesting that the relationship is not simply between socioeconomic status. Specific to diabetes prevalence, health risk environments may play a role in the disparities between African Americans and whites (LaVeist et al., 2009). There is evidence that African Americans tend to have a higher blood glucose average (A1C) than non-Hispanic white individuals (Kirk et al., 2006), implying that this group is at a higher risk for diabetes comorbidities. In addition, A1C levels were higher in African American individuals with type 2 diabetes who report having trouble obtaining medical care (Rhee et al., 2005). African Americans are also at a higher risk for diabetic end-stage renal disease, potentially indicating that they are likely to experience more severe effects from this disease (Cowie et al., 1989).

Minorities are more likely to wait until diabetic complications become acute, and then seek health care through an emergency department (Rhee et al., 2005; Shen & Washington, 2008). This is likely partially due to barriers in ease of access to primary care providers (Shen & Washington, 2008). The relationship between self-reported racial/ethnic discrimination and worse diabetes care and complications may be attenuated by sociodemographic status, health status, and access to care (Peek et al., 2010), suggesting that the higher proportion of diabetic complications among African Americans is likely involved with SES, access to care, and cultural views on healthcare.

Cultural differences may also be interfering, resulting in different approaches to self-care and management of diabetic symptoms (Samuel-Hodge et al., 2000). African Americans tend to demonstrate unique coping styles and unique perspectives on their

health care monitoring (Samuel-Hodge et al., 2000, 2008). In one city where a culturally-focused approach was used in a health care setting, African American individuals significantly improved self-care behaviors (Two Feathers et al., 2005). Distrust of white physicians and negative attitudes toward health care further contribute to decreased likelihood to adhere to care plans in this population (Peek et al., 2010). Additionally, the youth population is also at risk for decreased monitoring and management of diabetes, with an indication that African Americans report significantly lower adherence to diet and glucose testing than Caucasian counterparts (Auslander et al., 1997).

Lastly, it should be noted that differences in the presentation and underlying genetic factors have been observed between non-Hispanic white individuals and African American individuals with diabetes. In 1999, Boyle et al. found that the optimal rules for estimating prevalence of diabetes in African American populations differ than those for white populations due to variants of diabetes that have been described for African Americans. For example, the researchers describe a case study from Banerji and Lebovitz (1989) that reports an insulin-sensitive variant of type 2 diabetes in African Americans that was characterized by normal peripheral insulin sensitivity, decreased insulin secretion, and absence of autoimmunity to insulin-producing cells, among others. Using this altered diagnostic scheme, Boyle et al. (1999) found that type 1 diabetes was more prevalent in African American population. Another study suggests that African American children with a family history of type 2 diabetes are at risk for insulin resistance as evidenced by metabolic alterations observed early in life (Danadian et al., 1999). Furthermore, genotyping of African American type 1 diabetic patients has revealed unique and novel haplotypes with a greater variety of effects compared to European-

derived haplotypes (Noble et al., 2013). Taken together, these findings suggest that ethnicity and race may play a unique role in the presentation of symptoms, potentially including dysphagia symptoms, that cannot be accounted for by type of diabetes alone.

Type of Diabetes

Type 1 diabetes is a result of the pancreas's inability to produce insulin, while type 2 diabetes is caused by the failure of the receptors to receive insulin. The end result is largely the same, with some minor differences that become represented in varying symptoms of each patient. In one study, more than half of individuals with type 2 diabetes were found to experience one or more symptoms of neuropathy, compared to nearly one-third of individuals with type 1 diabetes (Kästenbauer et al., 2004). A similar study found that both type 1 and type 2 diabetics frequently experience symptoms of sympathetic and parasympathetic neuropathies, with parasympathetic nerve function being more severely affected among type 2 diabetic patients (Freccero et al., 2004). Prevalence of mild autonomic impairment is likely to be higher in individuals with type 2 diabetes (Low et al., 2004). More severe changes to neurological functioning in individuals with type 2 diabetes may represent an underlying mechanism resulting in the increased severity or frequency of dysphagia symptoms, which is supported by the results of this study. Additionally, the presence of a cardiac autonomic neuropathy may be found in more than 40% of both type 1 and type 2 diabetes (Voulgari et al., 2011), implying that individuals with diabetes, regardless of type, are at risk for many types of neuropathic complications. Findings from these studies suggest that the observed proportion of reported dysphagia symptoms in individuals with both types of diabetes may be grounded in underlying metabolic processes that result in neurologic changes.

A more extreme difference may exist in diabetic polyneuropathy, possibly due to differences in early metabolic abnormalities (Sima & Kamiya, 2006). The researchers found that individuals with type 1 diabetes demonstrated progressive axonal atrophy to a larger extent than individuals with type 2 diabetes, as well as paranodal degenerative changes. The authors postulate that these differences are likely due to insulin action and signal transduction that have downstream effects on other proteins, implying that even though both types experience hypoglycemia, the unique metabolic causes result in differences in the neuropathies experienced. Thus, the differences in this study may be supported by the fact that different underlying mechanisms are at the root of each type of disease. Future studies may benefit from the inclusion and analysis of more specific questions regarding the different aspects of dysphagia that may be affected by the different types of diabetes.

The differences in diabetes complications can be seen in the younger population as well. Among youth with type 1 diabetes, retinopathy was found to be significantly more common than in youth with type 2 diabetes (Eppens et al., 2006). While the rates of peripheral and autonomic neuropathy were similar in the two groups at above 50%, microalbuminuria and hypertension were significantly more common in individuals with type 2 diabetes. The authors note that these differences occur despite these individuals having been diagnosed for a shorter duration of time and having an average lower A1C, implying that type of diabetes, rather than the duration of the disease, is more likely to correlate with the type of complications. This is in agreement with the findings from this study, in which there was a greater difference in the proportion of observed symptoms of

dysphagia between type 1 and type 2 diabetes than in the differences between the lengths of duration of the diagnosis.

Duration of Diagnosis

Logically, the longer one has any given condition, the more severe or frequent the side effects are likely to become. With diabetes, these effects include nerve damage, changes in cognition, urinary health, and digestive health. Thus, older individuals who have had diabetes for many years would appear to be at a greater risk for swallowing problems.

In one study describing the rate of complications in older individuals with type 2 diabetes, results indicated that for any given age group, the rate of complications such as hypoglycemia and microvascular complications increased with longer duration (Huang et al., 2014). For any given duration, rates of hypoglycemia and cardiovascular complications increased with increasing age. In contrast, Zoungas et al. (2014) found no interaction between diabetes duration, age, and the risk of macrovascular events, but did find an interaction between younger individuals, such that as duration increased risk of microvascular complications increased. The disparity between previously published research on the duration of diagnosis and the rate/ severity of complications and this study suggest that more research is needed in this area.

Domain Two – Dysphagia Associated with Oral Phase Difficulty

Oral phase difficulty such as difficulty chewing, sensation of food being stuck in the mouth, and fatigue during chewing is likely to disrupt the temporal sequence of the swallow, suggesting an increased likelihood for oropharyngeal dysphagia (Logemann, 1990). There are a multitude of factors that may contribute to oral phase difficulty, such

as missing teeth, decreased saliva production, and fatigue resulting from chewing for long periods of time. These factors further interface with several other variables such as age and oral health. The results of this study show that, as expected, participants who reported oral phase difficulty had increased frequencies of reported dysphagia symptoms. However, 13.3% of participants without oral phase difficulty also reported dysphagia symptoms. The disparity may be partially explained by these other contributing factors. These findings illustrate the importance of including questions of these types on dysphagia screeners and surveys.

Domain Three – Dysphagia Associated with Management of Diabetes

Receiving a diagnosis of diabetes has many psychological consequences that can affect overall health and well-being (Duangdo & Roesch, 2008; Macrodimitris & Endler, 2001). A newly diagnosed individual has to learn new habits and build a new framework in which to organize their food intake and monitoring. Failure to adhere to these new guidelines increases the risk for more frequent complications (Fukuda & Mizobe, 2017). In addition, individuals are likely to cope differently depending on which type of diabetes they have been diagnosed with; specifically that individuals diagnosed with type 1 were more likely to engage in denial and avoidance behaviors (Lo & Maclean, 2001).

Poor coping skills, and thus poor disease management skills, may be a factor in swallowing problems among individuals with diabetes. According to reports from this study, two participants did not use medication to manage their diabetes. Additionally, it was communicated to the researcher by a close family member of one of the participants that the individual does not manage her diabetes at all and does not engage in monitoring strategies. This participant, 65 years of age with type 2 diabetes and no diagnosis date

reported, indicated she "sometimes" experiences 2 or more indicators of dysphagia from 3 categories (difficulty swallowing, coughing while swallowing, sensation of food being stuck). The other individual, a 23-year-old female with type 1 diabetes, reported no swallowing difficulty at all. Future studies should include more detailed and descriptive questions regarding the management style used by each participant.

Effectiveness of self-management may also vary by ethnicity and culture. There is evidence that African Americans with type 2 diabetes demonstrate a unique coping style, as well as unique perspectives on their health care monitoring (Samuel-Hodge et al., 2000, 2008), which may contribute to differences in management of the disease.

Domain Four – Dysphagia Associated with Oral Health

There are several studies describing an association between diabetes and periodontal disease (Löe, 1993; Saremi et al., 2005; Shlossman et al., 1990; Southerland et al., 2005; Taylor et al., 2004), and furthermore that the association is bidirectional, with periodontal disease in turn having an adverse effect on glycemic control and incidence of diabetes complications (Grossi & Genco, 1998; Taylor & Borgnakke, 2008). In type 1 and type 2 diabetes, the severity of periodontal disease is likely to be linked with both the duration of the diabetes diagnosis and the presence of further diabetic complications (Al-Shammari et al., 2006; Pranckeviciene et al., 2014). However, there is some limited evidence that patients with type 2 diabetes experience more severe periodontal disease (Pranckeviciene et al., 2014). In agreement with previously published studies that individuals with diabetes are at an increased risk for periodontal disease, the majority of participants in this survey reported one or more symptoms of less-than-ideal

oral health. In addition, poor oral health is likely to increase the risk of dysphagia (Furuta & Yamashita, 2013).

Consequences from normal aging also include changes to oral health and the condition of the teeth. As noted by Logemann et al. in 2013, speech-language pathologists often see poor oral care in older patients with dysphagia. Proper oral care is necessary for adequate production of saliva, as well as for chewing and swallowing (Furuta & Yamashita, 2013). There is evidence that without proper oral care, there is a higher chance that bacteria in the oral cavity will be aspirated by those with dysphagia (Bassim et al., 2008; Seedat & Penn, 2016; Yoneyama et al., 2002), even in patients who are fed enterally (Maeda & Akagi, 2014). Daily oral care has been shown to be associated with a decrease in incidence of pneumonia (Tada & Miura, 2012) and an improvement in increased cough reflex sensitivity, which may also help to reduce the incidence of pneumonia (Watando et al., 2004). There is some evidence that patients with diabetes have increased incidence of pneumonia, among other pulmonary conditions (Ehrlich et al., 2010). Furthermore, older individuals with type 2 diabetes are at increased risk for dental diseases (Taylor et al., 2000), and because people with dental diseases are at an increased risk for aspiration pneumonia, it can be deduced that people with type 2 diabetes are therefore at an increased risk for aspiration pneumonia. It is possible that undiagnosed swallowing problems are placing patients with diabetes at an increased risk for these elevated incidences of pneumonia.

The results of this study indicate an association between relatively poor oral health and increased swallowing problems, regardless of type of diabetes. However, the majority of participants did indicate some issue with their oral health, likely impacting

their ability to swallow effectively. The purpose of this study was not to establish a link between diabetes and oral health, but between diabetes and dysphagia. Presence of diabetes implies a greater risk for worse oral health, and worse oral health implies a greater risk for swallowing problems.

CHAPTER VI

CONCLUSIONS

Overall, this study shows that people with diabetes do report various symptoms of swallowing problems. Frequency and severity of the dysphagia appears to be associated with increasing age, a diagnosis of type 2 diabetes, being diagnosed for less than 50% of life, and poorer oral health. There are many factors that allude to swallowing problems within this population, including being at increased risk for poorer oral health and more severe neurological complications that may affect the swallowing mechanism. There are relatively few studies looking at the direct relationship between diabetes and dysphagia, despite the numerous evidences that these factors are likely to interact with deglutition. Health care providers would benefit from an awareness of this potential issue. Individuals with diabetes would be well-advised to become informed about this possible issue with their health and to proactively seek assistance from a physician if they notice any of these symptoms.

Limitations

The major limitation of this initial study is the small sample size. Furthermore, this study was limited by the fact that patients will not be immediately referred for an objective analysis of the swallow. The presence of true dysphagia symptoms cannot be

substantiated until phase 2 of this study is conducted. Additionally, this study relies on the assumption that patients are both aware of these symptoms and are able to accurately identify what they are. The possibility that patients are silently aspirating cannot be addressed within the given parameters of the current study.

Future Planning

Future studies would benefit from an increase in sample size, recruiting patients from doctor's offices and other health care settings. Ideally, review of medical records would be useful for determining related health issues such as history of aspiration pneumonia or occurrence of an objective swallow assessment such as a Modified Barium Swallow Study. Following completion of self-report symptom survey, objective assessment of the swallow would provide useful data regarding oropharyngeal functioning.

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Appendix A

The Relationship between Diabetes and Swallowing

Informed Consent Form

Dear Participant:

I am McKenzie Witzke, graduate student in Speech-Language Pathology, working on my master's thesis under Dr. Violet Cox, Associate Lecturer and faculty member in the Department of Speech and Hearing at Cleveland State University. I would like you to participate in a research study. This study is to help me understand whether diabetes can cause swallowing problems. I will ask you to answer questions about your swallowing from a questionnaire sheet.

The information collected will be confidential. Your name and other identifying information will not be linked with the data collected. Your complete privacy is guaranteed. Results of this study will not be traced back to you.

You will be tested at a place of your choosing and for your convenience. Participation in this study is voluntary. You may withdraw at any time. There is no reward for participating, and there is no consequence for not participating. Outside of risks associated with those of daily living, there is a very slight possibility that you may cough when you swallow foods or liquids. This survey will take approximately 15 minutes to complete.

For further information regarding this research please contact McKenzie Witzke at (440) 783-2570, email: m.g.witzke@vikes.csuohio.edu. If you have any questions about your rights as a research participant you may contact the Cleveland State University Institutional Review Board at (216) 687-3630.

There are two copies of this letter. After signing them, keep one copy for your records and return the other copy to me. I thank you in advance for your cooperation and support. Please indicate your agreement to participate by signing below.

"I am 18 years or older and have read and understood this consent form and agree to participate."

Signature: _____

Name: _____

(Please Print)

Date: _____

Appendix B

DIABETES AND DYSPHAGIA SELF-ASSESSMENT PROTOCOL (DADSAP)

Name _____

Age _____ Gender: Male Female Ethnicity

_____

Type I Diabetes _____

Type II Diabetes _____

When were you diagnosed with diabetes? _____

Do you take medication to manage your diabetes? Yes No

Do you take any other medications? Yes No

If yes, please list all of your current medications:

_____

_____

_____

Are you on dialysis? Yes No

Do you currently smoke? Yes No

Do you have any history of smoking? Yes No

Have you ever been assessed by a doctor for swallowing problems?

(screening, modified barium swallow, endoscopy, etc) Yes No

Do you experience any problems with your bladder? Yes No

Check either “frequently” “sometimes” or “never” in response to the following questions.

			Frequently	Sometimes	Never
1)		**Do you have difficulty with any of the following?**			
	a.	Chewing solid foods			
	b.	Swallowing liquids			
	c.	Swallowing solid textures			
	d.	Swallowing pills			
	e.	Swallowing your oral secretions			

2)		**When drinking liquids do you**			
	a.	Cough?			
	b.	Do you cough before you swallow?			
	c.	Cough after you swallow?			
	d.	Have difficulty starting the swallow?			
	e.	Experience liquids coming through your nose?			

3)		**When swallowing solid/ textured food: do you have a sensation of the food**			
	a	Food stuck in your throat?			
	b	Food stuck in your chest?			
	c	Does food become stuck in areas of your mouth?			
		Are there foods or liquids that you avoid? YES NO			
		If “Yes” please list them: _____			

			Frequently	Sometimes	Never
4)		**Do you experience**			
	a	Heart burn after your meals?			
	b	Sudden coughing after you lie down?			
	c	Pain when you swallow?			
	d	Shortness of breath after you swallow?			
	e	Reflux after you have eaten?			
	f	Urinary Tract Infections			

5)		**Circle any of these conditions that you have had or are currently experiencing:**
	a.	Ulcers/sores of mouth
	b.	Dry mouth
	c.	Difficulty keeping food down
	d.	Significant weight loss
	e.	Frequent throat clearing after the swallow
	f.	Fatigue during chewing
	g.	Overactive bladder

PERTINENT MEDICAL INFORMATION: (Circle all that apply)

- History of stroke
- Heart problems
- Parkinson's disease
- Respiratory/pulmonary problems (asthma, pneumonia etc.)
- Head/neck cancer
- Chemotherapy/ Radiation
- GERD/Reflux
- Pneumonia
- Cleft palate
- Cleft lip
- Celiac disease
- Other (please describe) _____

OTHER MEDICAL HISTORY:

- Arthritis
- Blood sugar (high, low)
- High blood pressure
- Kidney/bladder disease
- Urinary tract infections

Describe your dentition/teeth:

- Natural
- Dentures
- Edentulous/No teeth
- Partial/Bridges
- Missing teeth - Upper/Lower

Additional comments:

_____

_____