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Dysphagia In Covid-19 Patients From the Speech Language Pathologists Perspective

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DYSPHAGIA IN COVID-19 PATIENTS FROM THE SPEECH LANGUAGE PATHOLOGISTS PERSPECTIVE

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DYSPHAGIA IN COVID-19 PATIENTS FROM THE SPEECH LANGUAGE PATHOLOGISTS PERSPECTIVE

ASHLEY M. COCHRAN

ABSTRACT

The purpose of this study was to establish whether dysphagia presented concomitantly with COVID-19 from the perspective of speech language pathologists. Three main research questions were examined (1) Does dysphagia occur as a symptom or a secondary condition to COVID-19? (2) What is the nature of dysphagia seen in COVID-19 patients? (3) Does dysphagia occur as a result of COVID-19 treatment protocols? This qualitative study involved 20 participants who were medical speech language pathologists in hospitals across several states. A survey was submitted to participants via Qualtrics. Although the answers to some research questions were not conclusive, it appeared that most individuals with severe cases of COVID-19 experienced some form of dysphagia. It was found that the breathe-swallow coordination played an important role in the onset of dysphagia following use of respiratory support devices such as oral endotracheal intubation, mechanical ventilation and enteral nutrition through a nasogastric tube.

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CHAPTER I

INTRODUCTION

There are many etiologies of dysphagia. Dysphagia results from stroke, traumatic brain injury, progressive neurological diseases, and head and neck cancer. Dysphagia is defined as problems involving the oral cavity, pharynx, esophagus, or gastroesophageal junction (American Speech and Hearing Association [ASHA], n.d.). Dysphagia can affect individuals at any age. However, dysphagia is more prevalent in older populations, and the occurrence of dysphagia increases with age (ASHA, n.d.). Etiologies of dysphagia are not well defined, because there are various neurological diseases or concomitant medical conditions that may present signs or symptoms of dysphagia.

The swallow is comprised of four different phases. The first phase being the oral prepatory phase. In this phase, food or liquid is placed inside the oral cavity. Then the food or liquid is manipulated and masticated into a cohesive bolus. The second phase of the swallow is the oral phase. During the oral phase, the tongue begins to move the bolus posteriorly toward the pharynx. The bolus is squeezed against the hard palate as it moves back. Once the leading edge of the bolus has reached the anterior faucial arches the third phase occurs. The pharyngeal phase is

when the bolus moves through the pharynx toward the esophagus. There are a multitude of physiological processes occurring simultaneously during the pharyngeal phase. Lastly, the esophageal phase happens when the bolus enters the upper esophageal sphincter. A peristaltic wave then pushes the bolus into the stomach.

Coronavirus Disease 2019 (COVID-19) is an infectious disease that is caused by Acute Respiratory Distress Syndrome (ARDS) associated with Coronavirus 2 (SARS-CoV-2). Many individuals infected with COVID-19 require invasive or non-invasive support in the intensive care unit (Mohan & Mohapatra, 2020). Support devices may include endotracheal intubation, mechanical ventilation, or enteral nutrition through a nasogastric tube. These devices typically pass through the oral cavity, oropharynx, larynx, and down into the trachea. They pose a risk to laryngeal and tracheal injury, postintubation voice disorders, and dysphagia. These support devices increase the risk of dysphagia, aspiration, and aspiration pneumonia in intensive care unit patients (Frajkova et al., 2020).

Literature Review

Currently, there is an ongoing pandemic of COVID-19. Research is being conducted daily and new findings are being reported about this virus. To date there is not much information available through research about the effects of COVID-19 on swallowing.

Researchers have reported that patients with COVID-19 may develop ARDS and require some form of respiratory support, including endotracheal intubation, mechanical ventilation, and enteral nutrition through a nasogastric

tube. These devices increase the risk of dysphagia and aspiration pneumonia. As stated by Panara and Padalia (2020), "swallowing is a complex process requiring interaction and proper coordination of sensory and motor mechanisms". Thus, if coordination of the sensory and motor mechanisms is impaired, patients could be at risk for dysphagia.

Post intubation dysphagia is described as the inability to swallow upon the removal of the tubes. It is often associated with reintubation, pneumonia, and a high risk of mortality (Macht et al., as cited in Frajkova et al., 2020). It is believed that post intubation dysphagia may be due to multifactorial changes, that can be mechanical or cognitive.

Macht et al. (2013) suggest that there are six potential processes that may contribute to the development of post oral tracheal intubation dysphagia (Macht et al., 2013, as cited in Frajkova et al., 2020). One process that is thought to contribute to post oral tracheal intubation dysphagia is oropharyngeal and laryngeal trauma. Intubation can cause problems with the oral phase of the swallow. This includes injury to the lips, which may result in dripping of saliva or the bolus and dental damage in patients with known dental diseases (Komasawa et al., 2017; Vogel et al., 2009, as cited in Frajkova et al., 2020). Intubation may affect the pharyngeal phase of the swallow by impairing the elevation of the larynx and laryngeal sphincter, which may increase risk of aspiration. Additionally, oral tracheal intubation can cause edema of the oropharyngeal and laryngeal structures increasing the risk for dysphagia, development of respiratory distress, and voice disorders (Matta et al., 2017, as cited in Frajkova et al., 2020).

Another process noted by Macht et al. (2013), that can contribute to post oral tracheal intubation dysphagia is neuromuscular weakness. A normal swallow requires the involvement of thirty muscles and six cranial nerves coordinating at the correct time (Dutra et al., 2018, as cited in Frajkova et al., 2020). Intubation may cause atrophy of the structures involved in a normal swallow because the glottis remains open for an extended period of time. The hindrance of natural movements and prolonged lack of muscle use leads to discoordination or weakness of the muscles, which could result in dysphagia (Brodsky et al., 2018, as cited in Frajkova et al., 2020).

Additionally, reduced sensitivity is thought to contribute to post oral tracheal intubation dysphagia. Insufficient sensitivity of the bolus or secretions in the pharynx could interfere with the protective reflexes of the swallow (Linden & Siebens, 1983, as cited in Frajkova et al., 2020). Altered sensorium may also contribute to post oral tracheal intubation dysphagia. Patients can have sensory changes or become delirious as a result of certain medications (Macht et al., 2013, as cited in Frajkova et al., 2020). Decreased consciousness increases the risk for aspiration and may delay therapy for dysphagia (Zuercher et al., 2019, as cited in Frajkova et al., 2020).

Furthermore, Macht et al. (2013) proposed that gastroesophageal reflux (GERD) may give rise to post oral tracheal intubation dysphagia in critically ill patients. Development of GERD is increased by having a nasogastric tube, extensive time lying down, and high doses of sedatives (Macht et al., 2013, as cited in Frajkova et al., 2020). GERD can affect the laryngeal sphincter function as well

as the upper and lower esophageal sphincter thus increasing the risk of aspiration (Mendel & Logemann, 2002; Noordally, 2011, as cited in Frajkova et al., 2020).

Researchers reported that impaired respiratory-swallowing coordination may also contribute to post oral tracheal intubation dysphagia. It is suggested that because swallowing and respiration are such highly coordinated functions, impaired synchronization of these actions could lead to dysphagia (Gross et al., 2009, as cited in Frajkova et al., 2020). The respiratory rhythm may change depending on whether an individual is eating a solid or liquid. The "exhale-swallow-exhale" relationship, which is the pattern of exhaling air then pausing to swallow and to the continuation of exhaling, must be timed precisely in order to avoid potential aspiration. These six processes may contribute to post intubation dysphagia and can lead to aspiration or aspiration pneumonia.

Additionally, Mohan & Mohapatra (2020) also suggested that the main cause of dysphagia in individuals with compromised respiratory systems and COVID-19 comes from incoordination between swallowing and respiration. Incoordination between these two actions can lead to aspiration pneumonia, dehydration, and malnutrition. Furthermore, deterioration of these systems may require intervention such as intubation. Oral tracheal intubation could result in laryngeal trauma that manifests as vocal fold and arytenoid edema, granulomas, and even vocal fold paresis. The authors stated that the duration of intubation may also contribute to an increase in the incidence of oropharyngeal dysphagia. The laryngeal and respiratory damage that is caused by intubation can have long-term effects. Many patients who recover from ARDS have persistent dysphagia six

months post discharge (Brodsky MB et al., 2017, as cited in Mohan & Mohapatra, 2020).

Prone positioning, which is the posture of lying down flat on your stomach, is another form of intervention used for patients with COVID-19. Patients who are on mechanical ventilators, are recommended to have twelve to eighteen hours of prone positioning in order to maintain oxygen saturation levels (Henderson et al., 2014, as cited in Mohan & Mohapatra, 2020). However, researchers have suggested that prone positioning may increase the risk of aspirating on saliva and secretions. This position also prevents good oral hygiene in the ICU, increasing the risk for aspiration of bacteria located in the oral cavity. Dental plaque and collecting of bacteria in the oral cavity were found to be the biggest risk for ventilator-associated pneumonia (Par et al., 2014, as cited in Mohan & Mohapatra, 2020). Management of individuals with compromised respiratory systems and COVID-19 may have received invasive or non-invasive ventilation, which is vital to their survival, but those who do survive will be at high risk for oropharyngeal dysphagia.

In a case study conducted by Yoichiro et al. (2020), it was reported that patients age sixty-five and older with COVID-19 frequently required hospitalization in the ICU. It was shown that 36% of COVID-19 patients and 46% of patients with a severe respiratory infection were found to have neurologic symptoms. This study reported that a 70-year-old male with a history of prostate cancer and hypertension developed symptoms of COVID-19 within nine days. He first noticed that he had lost his sense of taste and smell. Later, he had much worse symptoms such as fever and diarrhea. On the ninth day the patient was admitted to

the hospital. On the second day of being admitted into the hospital the man was moved to the ICU and placed on a mechanical ventilator for eleven days. Once the mechanical ventilator was removed the patient was seen to have developed dysphagia symptoms, as well as persistent taste impairment. The patient continued the use of parenteral nutrition due to limited oral intake. A videofluoroscopy study demonstrated that the patient had covertly aspirated on water. The patient experienced reduced pharyngeal contraction as well as bolus retention in the valleculae, and pyriform sinuses. The patient received dysphagia treatment in the hospital. On the sixty-fifth day he was discharged home.

This case study reported that the patient had oropharyngeal dysphagia and aspiration pneumonia following recovery from COVID-19. Researchers suggest that dysphagia as a consequence of COVID-19 is most likely due to glossopharyngeal and vagal nerve involvement. Additionally, prolonged oral tracheal intubation may have aggravated the swallowing difficulties that are seen in COVID-19 patients (Brodsky et al. 2017 as cited in Yoichiro et al., 2020).

In a recent study conducted by Dawson et al. (2020), functional swallow outcomes of patients recovery from COVID-19 were reported. This research study was a large cohort design, including 102 participants identified as having dysphagia. There were 82 patients that previously had a tracheostomy and 20 patients who previously were intubated. It was reported that the main features presented by the patients were delirium, laryngeal edema, respiratory swallow coordination challenges, burden of secretions, and constant expectoration following

the respiratory support they received. Of these patients that survived COVID-19, 20% started out with modified fluids and 76% began with an altered diet.

Investigators reported that there was a significant positive correlation between the number of days a patient was intubated and the number of days from intubation to beginning oral intake. These patients included both the endotracheal intubation group ($R^2 = 0.84$) and tracheostomy group ($R^2 = 0.31$). The participants in this cohort study demonstrated a high prevalence of dysphagia. Almost 30% of these individuals required significant interventions. Participants of this study presented with deficits in multiple phases of the swallow. However, it was noted that clinical signs of oral dysphagia were frequently identified. Many patients required an altered diet in order to manage oral phase dysphagia. Furthermore, patients received thickened liquids to support oral control due to fatigue, delirium, and poor lip closure. Researchers suggested that patients with COVID-19 that have dysphagia can be restored back to prior swallowing function with intense and targeted treatment.

In an article written by Dziewas, Warnecke, Zürcher, & Schefold (2020), researchers highlighted how different complications with COVID-19 may result in damage to central and peripheral parts of the swallowing network, leading to dysphagia in critically ill patients. Recent publications have indicated that about 5% of COVID-19 patients need ICU treatment. A high proportion of these patients required prolonged mechanical ventilation due to acute respiratory distress syndrome or vasopressor treatment for septic shock (Guan et al., 2020, as cited in Dziewas et al., 2020). According to Schefold et al. (2017), dysphagia affects more

than 10% of individuals after extubation and about half of them still have dysphagia upon discharge from the hospital (Schefold et al., 2017, as cited in Dziewas et al., 2020). Dysphagia has been recognized as a key predictor of pneumonia, extubation failure, need for tracheostomy, prolonged mechanical ventilation, increase length of stay, and overall adverse outcomes in critically ill patients (Zuercher et al., 2019, as cited in Dziewas et al., 2020).

Conditions such as acute respiratory distress syndrome and septic shock are identified as key risk factors for the development of critical illness such as polyneuropathy and myopathy (Mao et al., 2020, as cited in Dziewas et al., 2020). Swallowing is coordinated by multiple peripheral nerves and muscles. Complications of COVID-19 affect the swallowing network at different levels in critically ill patients therefore making them more prone to dysphagia. Typically, once patients are extubated or weaned off of the mechanical ventilator, signs and symptoms of dysphagia begin to arise. At this point it is critical to assess the patients efficacy and safety in their ability to swallow, in order to prevent any aspiration or aspiration pneumonia from occurring.

In a study conducted by Brodsky et al. (2018), researchers explored timing and duration differences in airway protection, as well as esophageal opening following intubation and mechanical ventilation for individuals with acute respiratory distress syndrome versus age-matched healthy volunteers. Individuals that were older than 18 who were intubated and received mechanical ventilation were evaluated for dysphagia using a videofluoroscopic swallow study (VFSS). This study excluded patients with tracheostomy, neurological impairments, and

head and neck cancer. Critically ill patients require oral tracheal intubation with mechanical ventilation. During mechanical, ventilation atrophy of muscles and weakness commonly occur as a result of limited mobility or use over time. Weakness during swallowing can lead to dysfunction and incoordination of the nerves and swallowing musculature, which may result in dysphagia with or without aspiration (Macht et al., 2013 as cited in Brodsky et al., 2018). Aspiration is a consequence of dysphagia and may lead to aspiration pneumonia, which results in longer hospital stays, increased hospital charges, and even death (Marik, 2011., as cited in Brodsky, 2018).

Up to 56% of patients with a critical illness who received oral endotracheal tube extubation from mechanical ventilation for respiratory failure presented with dysphagia (Skoretz et al., 2010., as cited in Brodsky, 2018). However, referrals to speech language pathologists were few and far between and tended to be variable in clinical practice (Brodsky et al., 2014.; Macht et al., 2012., as cited in Brodsky, 2018). Despite the importance in understanding changes in swallowing physiology following extubation and mechanical ventilation in critically ill patients there is still limited information about it.

Brodsky et al. (2018) examined airway protection and duration of esophageal opening during swallowing utilizing a 5-ml thin liquid barium during VFSS. They examined the time it took to achieve laryngeal closure and duration of the pharyngeal esophageal segment opening. The measurements recorded for pharyngeal duration of ARDS patients showed that it took longer to achieve laryngeal closure, with a median of 151 ms longer than healthy controls ($p<0.001$).

However, when measuring the duration of laryngeal closure there was no significant difference between the two groups ($p=0.987$). The final measurement of this study was the duration of the opening of the pharyngeal esophageal segment. This duration was a median of 116 ms shorter for ARDS patients.

The results of this study demonstrated that individuals with ARDS presented with a slow closure of the larynx while swallowing. This placed patients at risk for aspiration. Notably, only 1 of the 11 ARDS patients aspirated. This suggests that other factors, such as reduced sensation and breathe-swallow coordination may play a role in aspiration besides the timing of the swallow. Additionally, ARDS patients were delayed in reopening of their airway after swallowing. The authors suggested this potential layer of protection may be offset by the patients reduction in duration of the opening of the pharyngoesophageal segment, which may lead to greater pooling of the bolus after the swallow.

The severity and duration of dysphagia in patients with endotracheal intubation or mechanical ventilation continues to be controversial (Skoretz et al., 2010., as cited in Brodsky, 2018). However, authors of this study stated that through their observations they found that the group of patients with ARDS that were orally intubated with mechanical ventilation presented with changes in timing of pharyngeal swallowing events.

This purpose of this current study was to identify whether dysphagia is a sequela of COVID-19. The broad research question that guided this study was: "Is dysphagia a consequence of COVID-19?". This broad question was broken down into three specific questions: (1)Does dysphagia occur as a symptom or a secondary

condition to COVID-19?, (2) What is the nature of dysphagia seen in COVID-19 patients?, and (3) Does dysphagia occur as a result of COVID-19 treatment protocols?

CHAPTER II

METHODS

This qualitative study was approved by the Cleveland State University Institution Review Board. Individuals who participated in this study initially checked a statement that appeared at the top of an 18 question survey to indicate their consent to participate in the study (Appendix B). Participants received the survey sent via email.

Participants

A total of 31 participants submitted the survey. Of this number only 20 could be included in the study because 11 failed to complete the entire survey. The participants in this study were licensed medical speech language pathologists drawn from hospitals in various states. The participants had work experience ranging from 1 to 10 years in skilled nursing facilities, acute hospitals, intensive care units, or in rehabilitation centers (Table 3.1).

Table 3.1 Demographics

Participant	Years of Experience	Work Setting
1	1-4 yrs.	ICU, Acute floor
2	1-4 yrs.	Skilled Nursing Facility
3	1-4 yrs.	ICU, Acute Floor
4	1-4 yrs.	ICU, Acute Floor
5	1-4 yrs.	ICU, Acute Floor
6	1-4 yrs.	Acute Floor
7	1-4 yrs.	ICU, Acute floor, Rehabilitation, Skilled Nursing
8	1-4 yrs.	ICU, Acute Floor
9	5-10 yrs.	Rehabilitation
10	5-10 yrs.	Skilled Nursing Facility
11	5-10 yrs.	ICU, Acute Floor, Rehabilitation
12	over 10 yrs.	Rehabilitation
13	over 10 yrs.	ICU, Acute floor
14	over 10 yrs.	ICU
15	over 10 yrs.	Skilled Nursing Facility
16	over 10 yrs.	ICU, Acute Floor
17	over 10 yrs.	ICU, Acute Floor
18	over 10 yrs.	ICU, Acute Floor
19	over 10 yrs.	ICU, Acute Floor, Rehabilitation
20	over 10 yrs.	Acute Floor

Recruitment

In order to recruit participants for the study, the researcher gathered phone numbers for the Speech and Hearing Departments of hospitals across various states. Once the phone numbers were obtained, the researcher contacted the director of the department and asked for their willingness to participate in the study. The directors who agreed to take part in the study were sent an email link to the survey in

Qualtrics. The directors were then asked to forward the survey to other speech language pathologists throughout their department.

Procedure

Each participant had access to the survey through Qualtrics, which is a web-based survey software. The survey consisted of 18 questions (Appendix A). The first two questions of the survey were related to participants and their patients' demographics. Additionally, participants were asked to select pre-comorbidities seen in their patients. The remaining 14 questions of the survey were yes/no questions about various conditions seen in their COVID-19 patients. Once the survey was completed the data were recorded in Qualtrics. Access to the survey closed at the end of an eight week period.

CHAPTER III

RESULTS

Participant Demographics

A total of 20 participants completed the survey for this study. Table 3.1 depicts the demographics of the participants. Of these participants a total of eight had 1-4 years of experience, three had 5-10 years of experience, and a total of nine participants had over 10 years of experience. For each category of years of experience at least one participant worked in all four settings: intensive care unit (ICU), acute floor, rehabilitation, or a skilled nursing facility. For example, participant #7 in table 3.1 worked in all four of the settings.

Table 3.1 Demographics

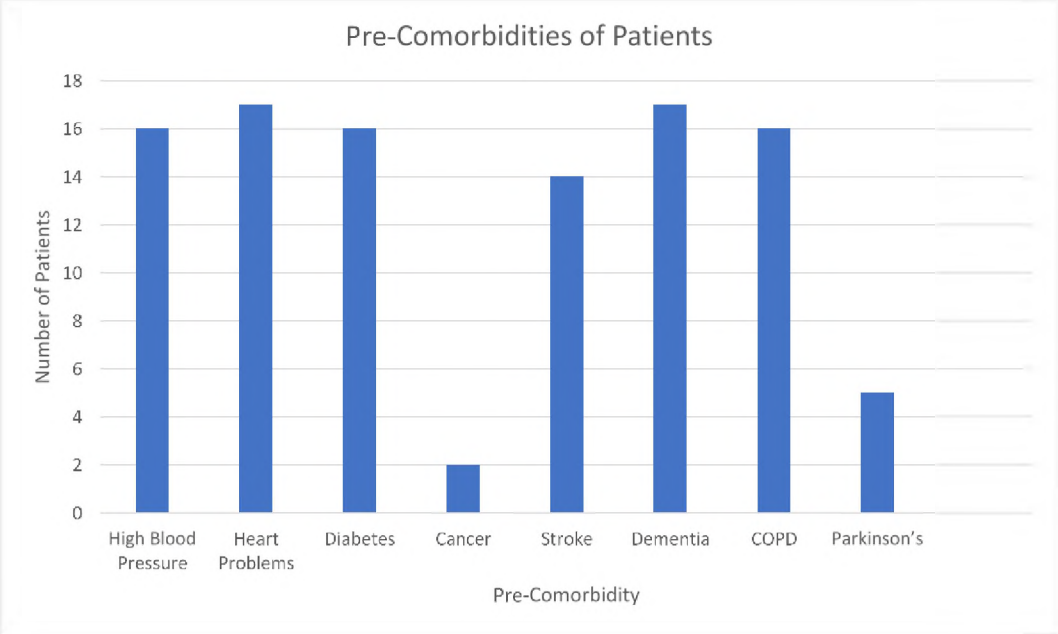
Participant	Years of Experience	Work Setting
1	1-4 yrs.	ICU, Acute floor
2	1-4 yrs.	Skilled Nursing Facility
3	1-4 yrs.	ICU, Acute Floor
4	1-4 yrs.	ICU, Acute Floor
5	1-4 yrs.	ICU, Acute Floor
6	1-4 yrs.	Acute Floor
7	1-4 yrs.	ICU, Acute floor, Rehabilitation, Skilled Nursing
8	1-4 yrs.	ICU, Acute Floor
9	5-10 yrs.	Rehabilitation
10	5-10 yrs.	Skilled Nursing Facility
11	5-10 yrs.	ICU, Acute Floor, Rehabilitation
12	over 10 yrs.	Rehabilitation
13	over 10 yrs.	ICU, Acute floor
14	over 10 yrs.	ICU
15	over 10 yrs.	Skilled Nursing Facility
16	over 10 yrs.	ICU, Acute Floor
17	over 10 yrs.	ICU, Acute Floor
18	over 10 yrs.	ICU, Acute Floor
19	over 10 yrs.	ICU, Acute Floor, Rehabilitation
20	over 10 yrs.	Acute Floor

Age and ethnicity. Table 3.2 provides a breakdown of the typical age-range and ethnicities of the COVID-19 patients who were seen by the speech language pathologists (SLP). Of the total SLPs participating in this study, sixteen stated that they worked with African American individuals, four reported that they worked with Asian individuals, nineteen reported to have worked with Caucasian individuals, and seven reported that they worked with Hispanic individuals. The participants reported that the COVID-19 patients seen were between the ages of 18-55.

Table 3.2 Patient Demographics by Age and Ethnicity

	Number of Patients
18-55 years	11
above 55 years	16
African American	16
Asian	4
Caucasian	19
Hispanic	7

Figure 3.1



Pre-comorbidities of patients. Figure 3.1 describes the pre-comorbidities of the patients seen by the SLPs. These included high blood pressure, heart problems, diabetes, cancer, stroke, dementia, chronic obstructive pulmonary disease (COPD), and Parkinson's. Sixteen SLPs reported that the majority of their patients presented with high blood pressure, seventeen heart problems, sixteen

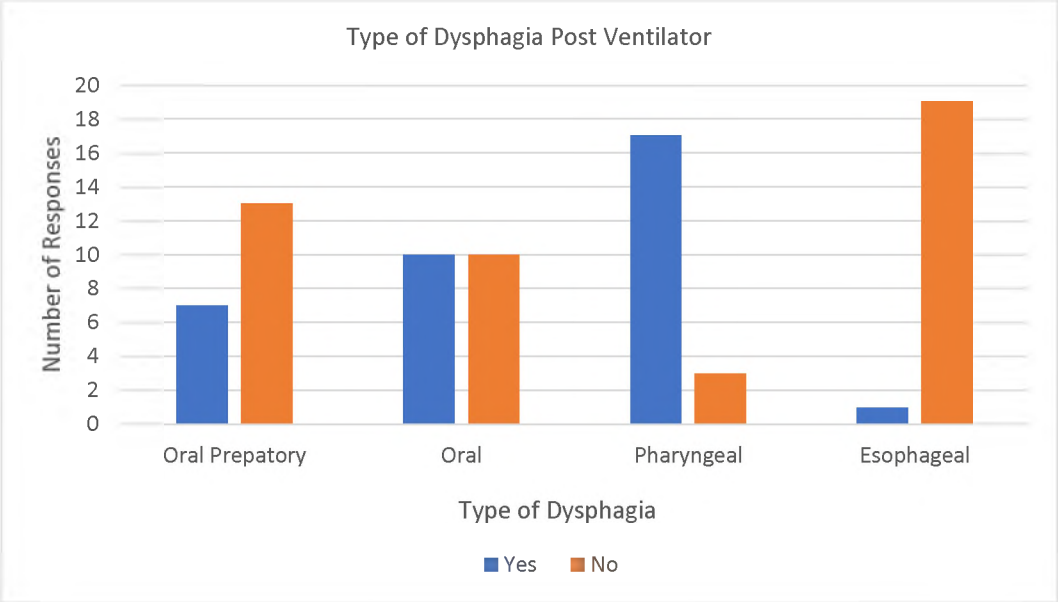
diabetes, two cancer, fourteen stroke, seventeen dementia, sixteen COPD, and five Parkinson's. However, the two most reported comorbidities in COVID-19 patients were heart problems and dementia. Participants reported high blood pressure, diabetes, and COPD to be the second most common pre-comorbidities.

COVID-19 symptoms. In the survey the participants were asked to list the COVID-19 symptoms that were seen in the majority of their patients. Seven participants reported that the majority of their patients presented with difficulty smelling whereas eight stated their patients had difficulty tasting (Table 3.3). Of the 20 SLPs that participated, thirteen reported that their patients did not experience difficulty smelling and twelve stated that their patients did not experience difficulty tasting (Table 3.3).

Table 3.3 COVID-19 Symptoms

	Yes	No
In general, the patients reported difficulty smelling.	7	13
In general, the patients reported difficulty tasting.	8	12

Figure 3.2



Type of dysphagia post ventilator. Figure 3.2 shows the four different phases of the swallow affected after the patients were removed from the ventilator. The four phases are oral preparatory, oral, pharyngeal, and esophageal.

Oral preparatory phase dysphagia. At this stage of the swallow food is masticated into a cohesive bolus. Patients who have dental problems or reduced sensation in the oral cavity or even tongue weakness may have difficulty manipulating the bolus. According to figure 3.2, seven participants reported the majority of the patients presented with oral preparatory phase difficulties after being taken off the ventilator.

Oral phase dysphagia. The oral phase of the swallow is the propulsion phase. This is when the bolus is propelled posteriorly to the back of the pharynx. Any decrease in oral sensation or tongue weakness can interfere with this short phase of the swallow. Based on figure 3.2, ten participants stated that most of their patients presented with oral phase dysphagia after being taken off the ventilator.

Pharyngeal phase dysphagia. The pharyngeal phase is a critical phase in the swallow. This is when contraction of the pharyngeal muscles in conjunction with pressure in the pharynx further propels the bolus into the esophagus. At this stage, the larynx rises, the velopharyngeal port closes, the laryngeal valves close to prevent the material from entering into the airway while the epiglottis directs the food into the now relaxed upper esophageal sphincter (UES). Any weakness in the pharyngeal contraction can result in the food adhering to the pharyngeal sinuses, such as the valleculae and the pyriform sinuses. In addition, failure of the laryngeal valves to close can result in material being aspirated into the airway. On the other hand, if the velopharyngeal port does not close then material can enter into the nasal cavity. In the case of these COVID-19 patients, seventeen SLPs reported that the majority of their patients presented with pharyngeal phase dysphagia after being taken of a ventilator (Figure 3.2).

Esophageal phase dysphagia. At this stage of the swallow the UES relaxes, so that the bolus can enter the esophagus on its way to the stomach. Failure of the UES to relax can result in the material pooling on top of the UES as well as in the pyriform sinuses. This can place the patient at risk for aspiration. In this study, one participant reported that their patients typically exhibited esophageal phase dysphagia after being taken off a ventilator (Figure 3.2)

Table 3.4 Occurrence of Pneumonia Due to COVID-19

	Yes	No
Patients with pneumonia before intubation	17	3
Patients with pneumonia after intubation	8	12

Occurrence of pneumonia. Survey question #8 probed the occurrence of pneumonia before and after intubation. According to Table 3.4, seventeen SLPs reported the majority of their patients presented with pneumonia before intubation while three did not. Eight SLPs stated that most of their patients presented with pneumonia after intubation, however, twelve did not.

Table 3.5 Dysphagia Risk Factors

	Yes	No
Patient had tongue weakness after extubation	9	11
Patient had abnormal breathe-swallow coordination	19	1
Patient had stroke after diagnosis of COVID-19	3	17
Patient had one or more pre-existing conditions	19	1

Dysphagia risk factors. Table 3.5 gives a breakdown of the number of patients that had (1) tongue weakness after extubation, (2) abnormal breath swallow coordination, (3) stroke after diagnosis of COVID-19, and (4) patients that had one or more pre-existing conditions. Of these patients 19 (95%) presented with abnormal breathe-swallow coordination and had one or more pre-existing condition. A total of 9 (45%) participants reported their patients had tongue weakness after extubation. Additionally, 3 (15%) participants stated that most of their patients had a stroke after their diagnosis of COVID-19 (Figure 3.5).

Figure 3.3

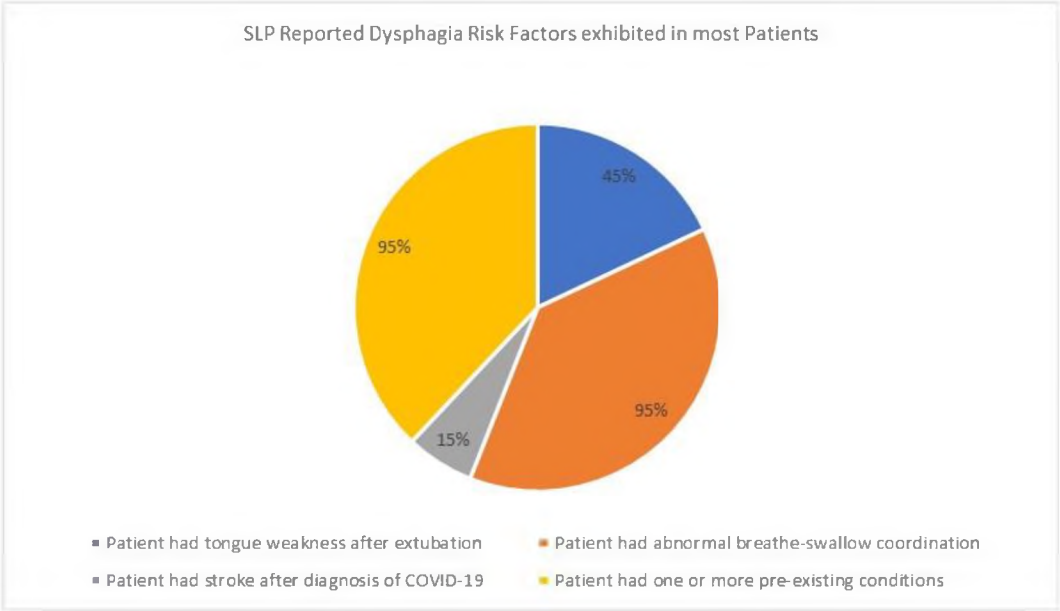


Table 3.6 Ventilator Usage due to COVID-19

	Yes	No
Patients were on a ventilator for at least 48 hours, as a result of COVID-19	17	3
Patients were not on a ventilator, but presented with dysphagia as a result of COVID-19	14	6

Ventilator dependent patients secondary to COVID-19. Based on the results above, seventeen (85%) SLPs reported that the majority of their patients seen were placed on a ventilator for at least 48 hours as a result of COVID-19. A total of three (15%) SLPs stated that in general their patients were not placed on a ventilator for at least 48 hours due to COVID-19. Furthermore, fourteen SLPs reported that the majority of their patients were not on a ventilator but presented with dysphagia. Six participants reported that most of their patients were not on a ventilator but did exhibit dysphagia as a result of COVID-19.

Figure 3.4

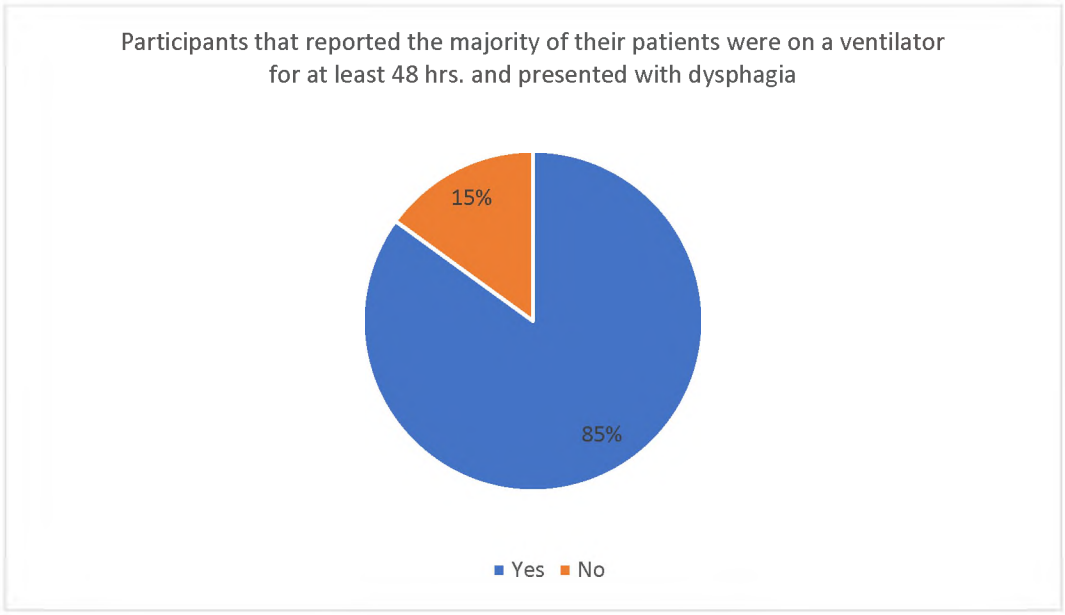
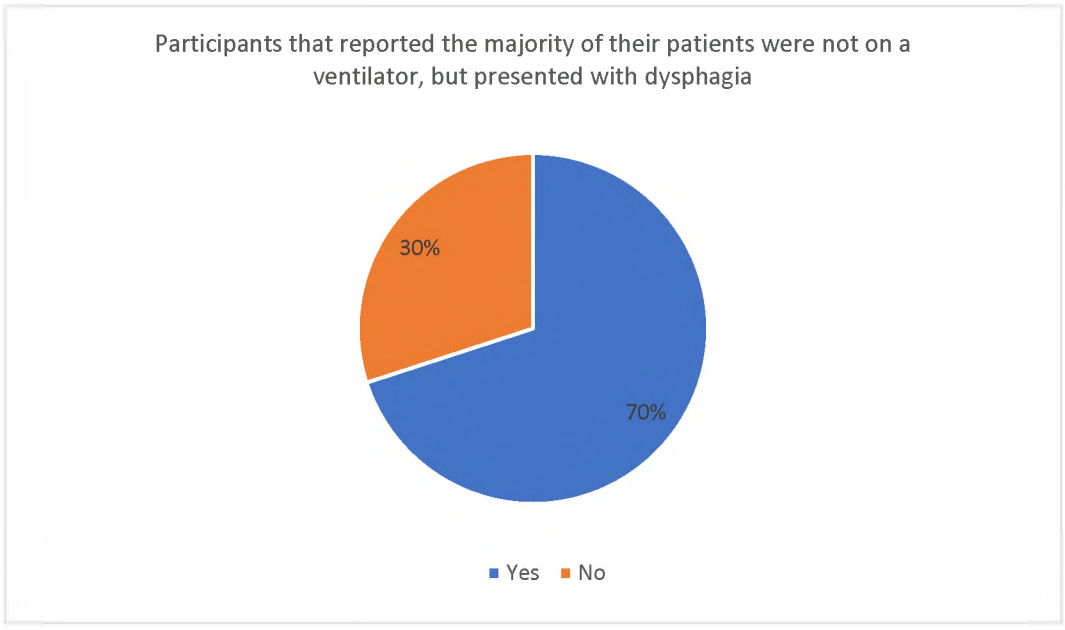


Figure 3.5



CHAPTER IV

ANALYSIS

Since this is a qualitative study, quantitative statistical analysis was not applied, instead, descriptive statistics were more appropriate for data interpretation. Consequently, the data were analyzed in terms of the number and percentage of responses to the survey questions. The aim of this study was to gather information regarding the incidence of dysphagia in COVID-19 patients from the perspective of speech language pathologists. There were three specific research questions that guided this study. Each research question will be discussed below in terms of the results obtained.

Research question # 1: Does dysphagia occur as a symptom or a secondary condition to COVID-19? As previously stated, breathe-swallow coordination plays a large role in the onset of dysphagia in a patient. Breathe swallow coordination is defined as the pattern in which we breathe and swallow when consuming food or liquids. These two systems are exceedingly coordinated, with both sharing neurological, structural, and functional dependence (Matsuo & Palmer, 2009). Swallowing occurs in an expiration-swallow-expiration pattern in order to keep materials away from the trachea (Mohan & Mohapatra, 2020). When

an individual's breathe-swallow coordination is negatively affected it can lead to aspiration pneumonia, malnutrition, dehydration, and compromise the prognosis of the individual (Mohan & Mohapatra, 2020) People with pre-existing conditions such as chronic obstructive pulmonary disease, heart problems, high blood pressure, diabetes, Parkinson's, or strokes are more likely to develop severe cases of COVID-19. In severe cases, ARDS can result in reduced breathe-swallow coordination, which may lead to reduced lung function. Reduction in breathe-swallow coordination and lung functionality can cause dysphagia, which may lead to aspiration. Seventeen SLPs reported the majority of their patients had pneumonia before being intubated (Table 3.4). The presence of pneumonia could be caused by the virus itself, as well as aspiration pneumonia which could result from inadequate breathe swallow coordination.

Based on the results of the survey, it is not conclusive whether dysphagia occurs as an initial symptom, or a secondary condition of COVID-19. This is due to the fact that we do not know from the survey results, whether dysphagia is a result from a pre-existing condition or COVID-19's effects on the body. It appears that dysphagia may be a secondary condition to COVID-19 because the coronavirus pathogen does not directly affect or damage the tissue in the swallowing musculature as far as is currently known. However, the results of this study in some way indicate that dysphagia may be secondary to COVID-19 in critically ill patients.

Research question # 2: What is the nature of dysphagia seen in COVID-19 patients? As previously discussed, most hospitalized COVID-19 patients are

placed on a ventilator for varying amounts of time. A ventilator is a respiratory support device that helps individuals maintain oxygen saturation levels. Individuals with severe cases of COVID-19 often have acute respiratory distress syndrome (ARDS), which can result in reduced lung function and requires respiratory support of a ventilator. A ventilator passes through the oral cavity, oropharynx, larynx, and down into the trachea (Frajkova et al., 2020). As indicated in Table 3.6 , seventeen SLPs reported that the majority of their patients were on a ventilator for at least 48 hrs. It has already been established in the literature that prolonged use of a ventilator poses a risk for dysphagia because it can cause injury or trauma to the structures that are involved in the swallowing. The reports of the majority of SLPs in this study, as cited above, appeared to corroborate previous studies.

The oral prepatory phase of the swallow was not commonly reported by SLPs as being affected by the ventilator. This could very well be related to the fact that the placement of the ventilator does not impact the musculature involved in the oral preparatory phase of the swallow. Thirteen SLPs reported that the oral preparatory phase was not affected (Figure 3.2). However, six SLPs reported that the majority of their patients presented with oral preparatory dysphagia after being taken off of a ventilator (Figure 3.2). In this study it was not clearly established how long these patients were on the ventilator. There are some studies that have reported prolonged use of the ventilator may cause dental damage and temporary drying of the salivary glands (Komasawa et al., 2017; Vogel et al., 2009., as cited in Frajkova et al., 2020). Individuals with dental damage would most likely have difficulty in the mastication of the food as well as creating a cohesive bolus if their saliva is

dried out. Additionally, prolonged use of a ventilator can cause the mucosal lining of the lips to become cracked and dried. This may result in reduced lip sensitivity as well as closure; thus, causing liquids and the bolus to drip or spill out of the mouth during mastication following removal of the ventilator.

Oral phase dysphagia was reported as more pervasive in COVID-19 patients following the removal of the ventilator. A total of ten of the twenty SLPs in this study reported that the majority of their patients experienced oral phase dysphagia post ventilation (Figure 3.2). The oral phase of the swallow may also be affected by the placement of the ventilator in the oral cavity. Prolonged use of a ventilator may result in decreased oral sensation and or tongue weakness (Linden & Siebens, 1983., as cited in Frajkova et al., 2020). Weakness of the tongue can cause food to spread throughout the oral cavity or residue on the palatal area. This residue may result in premature spillage of the material into the laryngeal area leading to aspiration which can cause pneumonia.

Of the four phases, the pharyngeal phase of the swallow was most commonly reported by SLPs as being affected in COVID-19 patients after being taken off a ventilator. Seventeen SLPs stated that the majority of their patients presented with pharyngeal phase dysphagia after being removed from the ventilator (Figure 3.2). Prolonged use of the ventilator may cause atrophy of the pharyngeal structures. The glottis in particular, the space between the vocal folds, remains open while the patient is receiving respiratory support through either mechanical ventilation or endotracheal intubation. Hinderance of the natural movements of the

muscles leads to discoordination or weakness, which can result in reduced protection of the trachea when swallowing (Brodsky, 2018)

Reduced sensitivity may also contribute to pharyngeal phase dysphagia. At this phase of the swallow the pharyngeal constrictor muscles contract and move the bolus through the pharynx into the esophagus. Insufficient sensitivity of the bolus in the pharynx can interfere with the protective reflexes of the swallow (Linden & Siebens, 1983, as cited in Frajkova et al., 2020). The vocal folds within the larynx may have decreased sensitivity or become weak, leading to reduced protection of the airway. Additionally, the larynx may also fail to maximally elevate post removal of the ventilator. This reduction in the elevation of the larynx may result in failure of the upper esophageal sphincter (UES) to maximally relax. This chain of events can result in the accumulation of the bolus in the hypo-pharynx, which can also contribute to aspiration.

Disorders of the esophageal phase of the swallow were least reported by SLPs to be present in COVID-19 patients after being taken off a ventilator. One SLP reported that the majority of the patients had esophageal phase dysphagia after being removed from a ventilator (Figure 3.2). These results are similar to current reports in the literature. During this phase, the UES relaxes, and the food enters the esophagus and moves into the stomach. It is proposed that gastroesophageal reflux may affect the upper and lower esophageal sphincter, therefore increasing the risk of aspiration (Mendell & Logemann., 2002, as cited in Frajkova et al., 2020). However, placement of the mechanical ventilator does not involve the structures of

this phase of the swallow, so it is unlikely that the structures in this phase may become injured or weakened due to ventilator placement.

Based on these results it appears that most of the COVID-19 patient in this study presented with oral or pharyngeal phase dysphagia. This makes sense because the placement of the mechanical ventilator creates more hinderance to the structures in these two phases of the swallow.

Research question # 3: Does dysphagia occur as a result of the protocols used to treat COVID-19? Results from this survey support the theory that dysphagia occurs as a result from COVID-19 treatment protocols in severe cases. Treatment protocols for individuals with severe cases of COVID-19 include respiratory support devices such as endotracheal intubation, mechanical ventilation, or enteral nutrition through a nasogastric tube. These devices can result in abnormal breathe-swallow coordination. Respiration and swallowing are highly coordinated systems, with both sharing neurological, structural, and functional dependence. Swallowing occurs in an expiration-swallow-expiration pattern in order to keep materials away from the trachea (Mohan & Mohapatra, 2020). Nineteen SLPs reported that the majority of their patients experienced difficulties in breathe-swallow coordination (Table 3.5). These findings are concurrent with other reports in the literature. According to Frajkova, Z., et al., 2020, since swallowing and respiration are highly coordinated functions, impaired synchronization of these actions could most likely lead to dysphagia. Patients with severe cases of COVID-19 resulting in ARDS typically require prolonged respiratory support. The damage that is caused by these support devices can have long-term effects on the patients'

swallowing abilities (Mohan & Mohapatra, 2020). In fact, it is reported that many patients who recover from ARDS have persistent dysphagia six months after discharge (Brodsky et al., 2017., as cited in Mohan & Mohapatra, 2020).

A serendipitous finding that occurred from this study is one of iatrogenic dysphagia. Iatrogenic dysphagia is a swallowing disorder that results from medical treatment for another illness. In the case of the participants of this study, those who received mechanical ventilation for the treatment of COVID-19 were found to have oral and pharyngeal phase dysphagia due to the placement of the ventilator. Most of the COVID-19 patients reported by the SLPs suffered with dysphagia secondary to the respiratory treatment protocols such as mechanical ventilation, endotracheal intubation, or enteral nutrition through a nasogastric tube. This would suggest that the treatment protocols for the COVID-19 may be directly related to the dysphagia. However, this may not be conclusive because of the small number of participants in the study.

Based on these results, it appears that dysphagia may occur from COVID-19 treatment protocols, or from COVID-19 itself. In severe cases COVID-19 may result in ARDS, which could interfere with the breathe-swallow coordination as discussed above. Patients with ARDS require respiratory support treatment, which in turn can cause further complications in the structures involved in swallowing.

CHAPTER V

DISCUSSION

Currently, there is limited research on how COVID-19 affects dysphagia. COVID-19 is still an ongoing pandemic and at the time of this current study new discoveries are being made. The aim of this study was to gather information about dysphagia in COVID-19 patients, from the perspective of the speech language pathologists. This study examined whether dysphagia is a sequela of COVID-19. Data collected from this study and other current findings in academic literature suggest that dysphagia in severe cases of COVID-19 is prevalent.

One important finding in this study is that breathe-swallow coordination plays a major role in the onset of dysphagia in COVID-19 patients, following the removal of a respiratory support device. Furthermore, patients commonly presented with pneumonia before being intubated. Another key finding from this study is that oral or pharyngeal phase dysphagia tend to be the most prevalent in COVID-19 patients. This is likely due to the prolonged use of respiratory support devices, which may cause atrophy, decreased sensation, and hinderance of the natural movements of the structures involved in these phases. Additionally, reduced lung

function prior to being intubated may exacerbate the problem of dysphagia particularly in patients with breathe swallow incoordination as already discussed.

Limitations

One major limitation of this study was the small number of participants that completed the survey. The survey was sent to various medical facilities in several states. However, the response to the survey was extremely disappointing. Perhaps the reason why many speech language pathologists did not participate in this study, may be related to the timing of the distribution of the survey. At the time of the circulation of the survey the country was experiencing the highest reported cases of COVID-19 with accompanying high mortality rates. In addition, speech language pathologists were not the immediate responders to COVID-19 cases, consequently many of them did not have this patient population on their caseload. Respiratory therapists along with nurses and physicians were the most essential healthcare workers for individuals with COVID-19. As COVID-19 improved within the more recent months, more speech language pathologists are able now to see the effects of COVID-19 on patients ability to swallow safely.

Future Studies

Future studies should include a larger number of participants. This will provide information of how COVID-19 plays a role in the onset of dysphagia. Future studies can now take advantage of the fact that more SLPs will be included in serving COVID-19 patients, as their appears to be an association between COVID-19 and the incidence of dysphagia.

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APPENDIX A : Survey

Demographics

Check the box that represents your years of experience as an SLP

[ ] 1- 4 yrs. [ ] 5-10 yrs. [ ] over 10 yrs.

Check the box that describe your work location

[ ] ICU [ ] Acute floor [ ] Rehabilitation [ ] Skilled Nursing Facility

Check the box to indicate the typical age of the patients.

[ ]18-30 [ ] 31-50 [ ]51-65 [ ] over 65 yrs.

Check the box to indicate the gender of the patients.

[ ]male [ ]female

Check the box to indicate ethnicity of patient.

[ ] African American [ ] Caucasian [ ] Hispanic [ ] Asian [ ] Native American

Check as many of the following pre-morbid disorders in your COVID-19 patients

[ ] High blood pressure

[ ] Diabetes

[ ] Cancer

[ ] Heart problems

[ ] Stroke

[ ] Dementia

[ ] Head Injury

[ ] Parkinson Disease

[ ] Multiple sclerosis

[ ] Chronic Obstructive Pulmonary Disease

[ ] None of the above

For the following Yes/No questions check the box that describes the situation.

1.) In general, COVID-19 patients had one or more pre-existing conditions.

[ ] yes [ ] no

2.) In general, patients were on a ventilator for at least 48 hours as a result of COVID-19.

[ ] yes [ ] no

3.) In general, patients were not on a ventilator but presented with dysphagia as a result of COVID-19.

[ ] yes [ ] no

4.) In general, patients presented with oral preparatory dysphagia after being taken off ventilator.

[ ] yes [ ] no

5.) In general, patients presented with oral dysphagia after being taken off a ventilator.

[ ] yes [ ] no

6.) In general, patients presented with pharyngeal dysphagia after being taken off a ventilator.

[ ] yes [ ] no

7.) In general, patients presented with esophageal dysphagia after being taken off a ventilator.

[ ] yes [ ] no

8.) In general, patients presented with pneumonia after intubation.

[ ] yes [ ] no

9.) In general, patients presented with pneumonia before intubation.

[ ] yes [ ] no

10.) In general, patients had a stroke after the diagnosis of COVID-19.

[ ] yes [ ] no

11.) In general, patients had tongue weakness after extubation.

[ ] yes [ ] no

12.) In general, patients had abnormal breath-swallow coordination.

[ ] yes [ ] no

APPENDIX B: Informed Consent

Dear Participant,

We are Dr. Cox, faculty member, and Ashley Cochran graduate student, in the Speech and Hearing Program at Cleveland State University. We are asking you to complete a survey about how swallowing is effected in patients with COVID-19.Your participation is voluntary. You may withdraw at any time. We agree to protect your privacy. We will not share your information with anyone outside of this study. You do not have to sign your name to this document. Your participation in this study will count as your consent. Your responses will in no way identify you. There is no reward for participating in this study. There are no consequences for not participating in this study. Any risks associated with this study do not exceed those of the time constraints of daily living. The survey should take about 10-15 minutes to complete.

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.

For further information regarding this research, please contact Dr. Cox at (216)687-6909, email: v.cox@csuohio.edu, or the co-investigator, Ashley Cochran at (614)824-0959, email: a.cochran30@vikes.csuohio.edu

By checking this box, you acknowledge that you are 18 years of age or older. [ ]

By checking this box at the end of this statement will constitute my consent to participate in this study. [ ]

Thank you in advance for your cooperation and support.

APPENDIX C: Research Flyer

College of Sciences & Health Professions

Exciting Research Information for Speech-Language Pathologists!

Here is an opportunity to collect information regarding how COVID-19 effects swallowing.

If you are interested, please complete the accompanying twelve question electronic survey. For more information

Contact Ashley Cochran

Cleveland State University

(216) 687-6909

a.cochran30@vikes.csuohio.edu