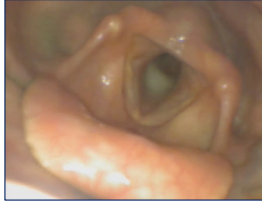


## Why Do We Fear ASPIRATION?



John R. Ashford, Ph.D., CCC-SLP

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We FEAR "Aspiration" because  
-maybe-

It's Scary!!

Or, we don't fully understand it's complexity



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## Facts: Aspiration

• Def: **Material penetrating the larynx & entering the airway below the true vocal folds.**

• Logemann, 1983

• 43% to 51% with dysphagia aspirate

• Smith et al., 1999; Garon et al., 2009

• 51.2% referred for MBS aspirate

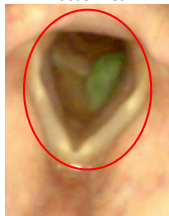
• Lundy et al., 1999

• 21.2% - NH res with dysphagia aspirate

• van der Maarel-Wierink et al., 2015

• True incidence unknown - unwitnessed

Focus Area



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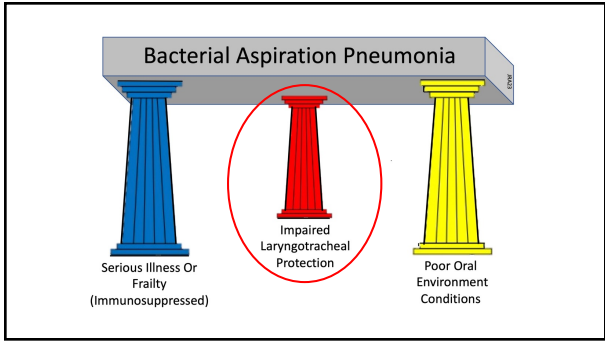
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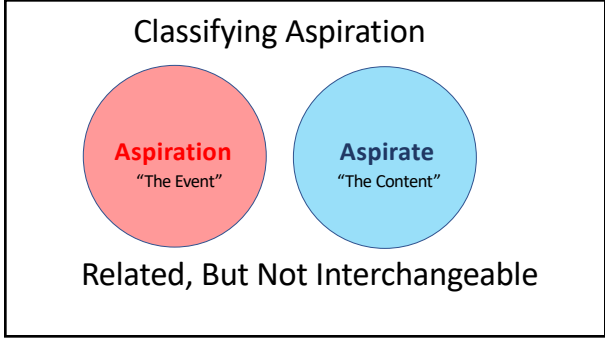
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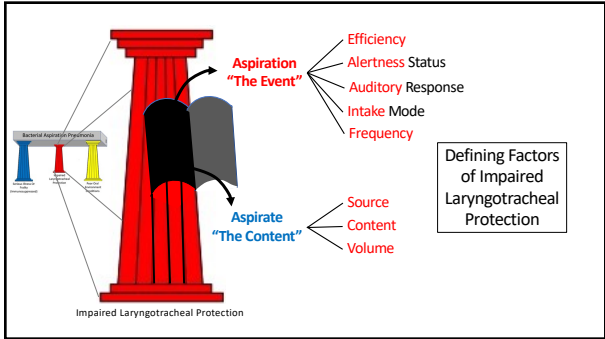
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## First Considerations

**#1 Current Health Status**

**Healthy**  
(May have self-managed medical conditions)

**Compromised Health Status**  
(Requiring Medical Intervention or Assistive Care)

**2# Primary Diagnoses**  
(Potential Immune System Compromise)

**Serious Illness**    Acute/ICU Surgery

**Debilitation**      Diseases Frailty

**Trauma**                TBI Burns Accidents

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## Classifying Aspiration

**“The Event”**

<b>Suspicion</b> < Suspected / Unsuspected	<b>Frequency</b> < Episodic / Continuous
<b>Audible</b> < Cough / Silent	<b>Mechanics</b> < Efficient / Not Efficient
<b>Witnessed</b> < Present / Not Present	
<b>Alertness</b> < Awake / Dec. Conscious / Asleep	
<b>Intake Mode</b> < Prandial / Non-Prandial	

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## Classifying Aspirate

“The Content”

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Source

Volume

Content

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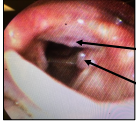
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## Aspirate Content Classification: **Source**

**"If my patient is aspirating, where is the aspirate coming from?"**

### **Oropharynx**

- Secretions - Saliva & mucous
- Food Material/debris
- Microorganism communities in dental plaque/dental disease
- Sloughed epithelial cells



GERD  
Interarytenoid Hypertrophy  
Granuloma

### **Esophageal/Stomach**

- Common in healthy people
- Most serious complication of tube feeding
- Micro- or macroaspiration of gastric juices
- Secondary to LES/hiatal hernia impairment
- Significant issue with ventilator pt.

Methney et al., 2002  
Ficke et al., 2022

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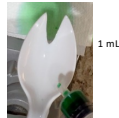
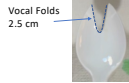
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## Aspirate Content Classification: **Volume**

**"How much is my patient aspirating?"**

### **Microaspiration**

- Trace, drops - "little stuff"
- Drinka 2010
- As small as 0.01 to 0.2mL
- Gleeson et al, 1997



### **Macroaspiration**

- Larger amounts  $\sim$  > 1 mL ; "big stuff"
- Langmore et al., 1998
- Drinka 2010
- Most common cause of AP
- Vedamurthy et al., 2020

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## Aspirate Content Classification: **Content**

**"So, if we know the source of the aspirate, what is the content of the aspirate?"**

Source: Oral Cavity

### **Secretions Only**

- Saliva
- Mucus
- Microbes (Pathogens)

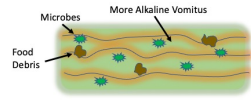
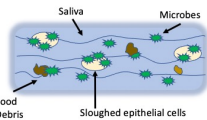
### **Secretions/Food**

- Saliva
- Mucus
- Food/Liquids
- Microbes (Pathogens)

Source: Stomach

### **Stomach Acid/Contents**

- Hydrochloric Acid
- Partially digested food
- Microbes (PPI)



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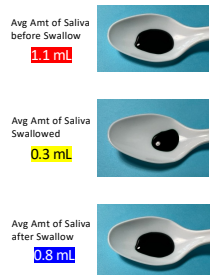
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**Content: Saliva**

- 99% water
  - Bicarbonate
  - Enzymes
  - Immune properties
- Flow rate: ~ 0.3 mL/min
- Amount per day: ~600 mL
  - 1.27 pints or 0.6 liter
  - Highest afternoon
  - Least during sleep
    - ~0.06 tsp



Avg Amt of Saliva before Swallow: **1.1 mL**

Avg Amt of Saliva Swallowed: **0.3 mL**

Avg Amt of Saliva after Swallow: **0.8 mL**

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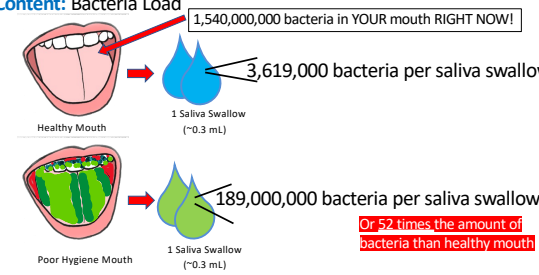
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**Content: Bacteria Load**

1,540,000,000 bacteria in YOUR mouth RIGHT NOW!



Healthy Mouth: 1 Saliva Swallow (~0.3 mL) → 3,619,000 bacteria per saliva swallow

Poor Hygiene Mouth: 1 Saliva Swallow (~0.3 mL) → 189,000,000 bacteria per saliva swallow

**Or 52 times the amount of bacteria than healthy mouth**

It varies, but we swallow about 600 to 3,000 times per 24 hours.

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**Question:**  
**What Happens to the Aspirate**  
**after it is Aspirated?**

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## Lower Respiratory System Defenses

**Cough:** - 1st to activate  
- 2nd in importance

**Mucociliary Elevator:** - 1st in importance  
- Most effective

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## 3 Types of Cough

- **Type I: Reflex Cough** ☆
  - Presence of food and fluid in airway
  - Not under conscious control - unable to suppress
  - Reflexive - Brainstem-mediated without cortical control

- **Type II: Voluntary Cough**
  - Under conscious control
  - Cortical-mediated control
- **Type III: Evoked Cough**
  - Urge to cough initiates a voluntary cough
  - Only in conscious patients
  - Unique-rostral & caudal medulla

☆ = FEES Focus

Eckles, 2009, Handbook Exp Phon  
Hegland et al., 2012, J Appl Physiol

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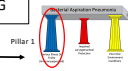
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## How Efficient & Effective is the COUGH?

Underlying determinant factor : OPERATIONAL VOLUME OF THE LUNG

What is the patient's OVERALL Health Condition?



**Key 1: Strength & coordination of respiratory and laryngeal muscles**

**Key 2: Lung mechanics**

Frail & Debilitated

Lung Disease (COPD, asthma, bronchiectasis etc.)

↓  
Respiratory Muscle weakness & incoordination  
decrease driving pressure applied to alveoli & bronchial airways.

↓  
Decreased operational lung volume  
results in expiratory flow limits  
& lung hyperinflation

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## Coughing & Aging

- Chronic lower respiratory tract disease is 3rd leading cause of death aged 65 and older
  - asthma, emphysema, chronic bronchitis, bronchiectasis, and COPD
- Changes in thoracic cavity impact normal lung function
  - Kyphosis, muscle function & strength
- Decreased ability to clear mucus from lungs
  - Reduced cough strength
  - Alterations in ability to clear particles from airway.

Lowery et al., 2013

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## Neurological Conditions with INCREASED Reflex Cough Sensitivity

- **Cerebral Disorders**
  - Somatic or "tic" cough, Tourette's syndrome
  - Rare Autoimmune Disease- Neuromyelitis Optica Spectrum Disorder (NMOSD)
- **Cerebellar Disorders**
  - Cerebellar neurodegenerative disorders
- **Vagal Neuropathy** - neuroinflammation as underlying reason.
  - Viral infections
  - Larynx sensory neuropathy
  - Irritant exposure (irritable larynx)
  - Chronic conditions, such as asthma
  - Rare - Vitamin B12 Deficiencies (myelin sheath & axonal degeneration)

Al-Bilragi et al., 2022, World J Crit Care Med

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## Neurological Conditions with DIMINSHED Reflex Cough Sensitivity

- **Cerebral Disorders**
  - Brain hypoxia, CVA, Dementia, Parkinson's Disease, Drugs (antipsychotic, anesthetics)
- **Neurodegenerative Diseases**
  - ALS & MS
- **Neuromuscular Diseases**
  - myasthenia gravis
- **Peripheral Neuropathy**
  - Hereditary sensory autonomic neuropathies, Phrenic nerve palsy or injury, Diabetic autonomic neuropathy, Vitamin B12 & folate deficiency

Al-Bilragi et al., 2022, World J Crit Care Med

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## Reflex Cough in Patients with Recurrent Pneumonia- Is it an Important factor?

- Study: 7 pts. - 6 males & 1 female - age 43-83 (M=63) & controls
  - Followed 5 yrs.
  - All well & active except when having pneumonia, immune labs normal ranges, pulmonary functions normal
  - All had history of recurrent pneumonia (2 events in 1 year or 3+ at any time)
  - Cough sensitivity examined 10-21 days after pneumonia event using capsaicin solution
  - Reexamined 12 weeks later
  - **Recurrent pneumonia group cough sensitivity was reduced with subsequent pneumonia events increasing odds of pneumonia redevelopment**

Nishi et al., 2003 Thorax

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## Coughing: Bolus Volumes & Viscosities

- 180 consecutive patients referred for FEES
  - Thin Liquid Aspiration Incidence = 32%
  - Mildly Thick Fluid Aspiration Incidence = 18%
- Significant association between cough to aspiration & volumes & viscosities
  - Silent aspiration more prevalent with **thick fluids** than with thin fluids
  - Variable cough responses to aspiration across different volumes & viscosities
    - 5mL—some patients coughed when aspirating thin fluids but silently aspirated **thick fluids**
    - 50mL—few incidences, coughed on aspirated thin fluids but silently aspirated **thick fluids**
- **Conclusion:** Cough response varies across volumes & viscosities in some patients. Strongly encourage instrumental in making decisions

Miles et al., 2018, Int J Lang Commun Disord

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Our Lower Respiratory Passages ARE NOT PVC Pipes!!!

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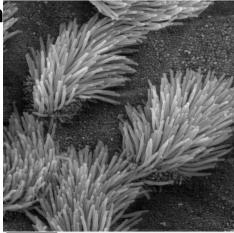
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## Respiratory Epithelium

**Pseudostratified ciliated Columnar Epithelium**  
or  
Mucociliary Transport System  
or  
Mucociliary Elevator



**THE Primary Respiratory Defense Mechanism!!**

Aldrich, 2019; Public Domain; Nat. Inst. Gen. Med. Sciences  
Eiselle & Anderson, 2011 / Pathogens

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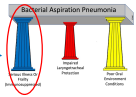
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## Function: Mucociliary Transport System (MTS)

- **Upper airway MTS** (nose & pharynx) traps & remove large particles (air debris & pathogens) before they reach the lower airway
- **Lower airway MTS** (trachea & bronchi) trap, absorb, & remover finer particles & pathogens over time.
- Mucins from goblet cells use antimicrobial compounds from the **immune system**
  - Recognize & destroy debris & pathogens



Lowery et al., 2013

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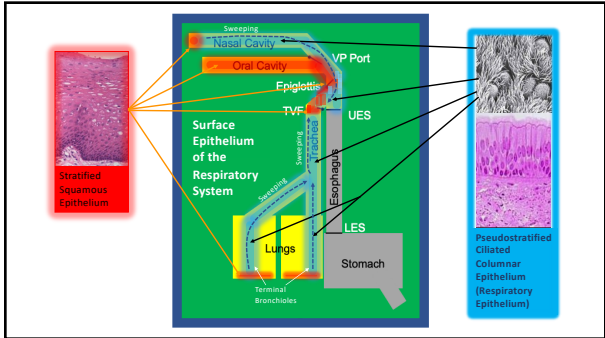
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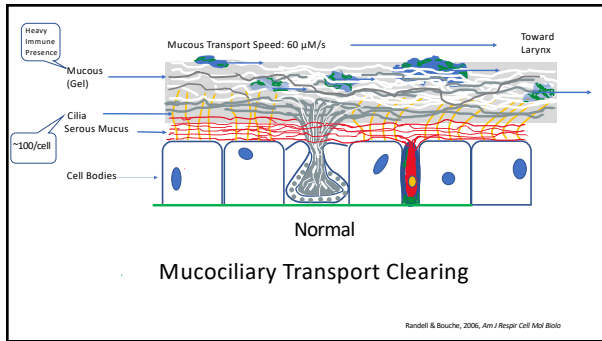
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### MTS and Diseases

- **Cystic Fibrosis**
  - Thick mucous that cannot be cleared easily
  - Results: Repeated infections, bronchiectasis, eventual respiratory failure
- **Ciliary Dyskinesia**
  - Genetic disorder with defective cilia
  - Results: Repeated infections & bronchiectasis
- **COPD & Asthma**
  - Hypersecretion of mucus resulting in airway inflammation
  - Results: worsening airway resistance, impaired airflow, increased work of breathing, dyspnea, & exercise intolerance

Bhowmik et al., 2009

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### MTS and Dehydration

- With dehydration
  - **Serous mucous layer collapses** & replaced with more viscous & adhesive layer
    - Results: mucous adhesion & reduced mucus clearing with formation of plaque & mucous plugs
  - reduced water in mucus allows bacteria to thrive & grow in dry, anaerobic environment.
- **"Withholding water or thickening liquids in an already hydration-compromised older adult may further compromise the primary protection mechanism (MTS) increasing probability of development or exacerbating infection & disease."**

Randell & Bouche, 2006

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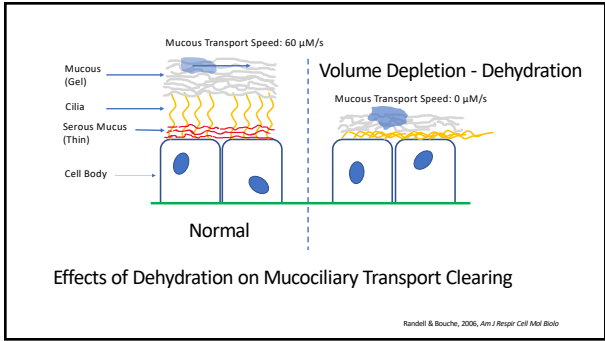
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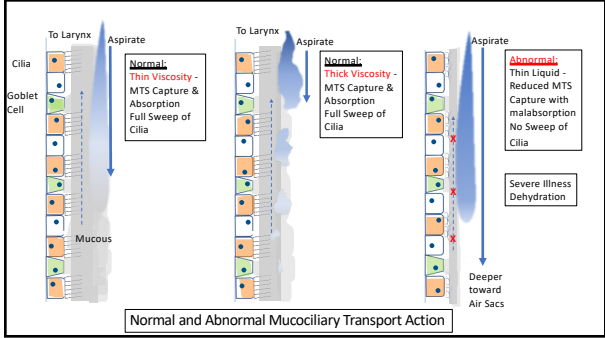
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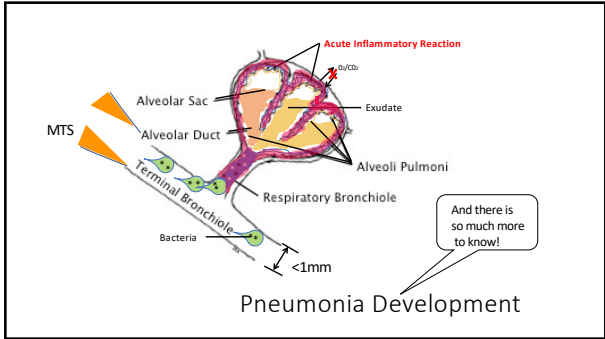
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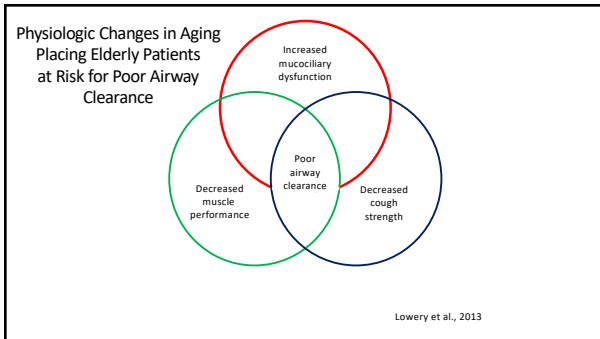
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Lastly--Old, But Interesting Study

- Randomized 20 CVA pts in hospital (10 study group; 10 control group)
  - Control group - received thickened liquids only
  - Study group - received thickened liquids + free access to water for thirst
- Results:
  - No pneumonia, dehydration, or complications developed in either group.
- RX:
  - Water (Ice chips) be given with pt refusal to take thickened liquids, OR when hydration issues cause medical concern.

Garon, Engle, Ormiston, 1997

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Final Notes

- Aspiration is a biomechanical/sensory event & the consequence of muscle weakness.
- **One-half or more normal adults aspirate nocturnally & silently.**
- Silent, non-prandial microaspiration is more the cause pneumonia than macroaspiration prandial aspiration.
- **Meal-time aspiration is a greater concern for choking than aspiration.**
- Source of aspirate for pneumonia development is the oral cavity.
- Aspirate content bacteria concentration is 52 times greater for the sick patient.
- **Nocturnal microaspiration of oral secretions is a greater risk for pneumonia development among older patients.**
- **Coughing & mucociliary transport system are the primary protectors of the lungs from aspiration effects.**

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The presence of aspiration alone is not the single determinant of whether a patient should be orally fed or not.

Knowledge of & understanding of the patient's illness diagnoses & their current severity, and the health of the oral environment are paramount to . . .

- . . . determining the importance of potential aspiration,
- . . . it's potential contribution to pneumonia development,
- . . . appropriate intervention.

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See? No More Fear!

A Lot More Confident!

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Questions?

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