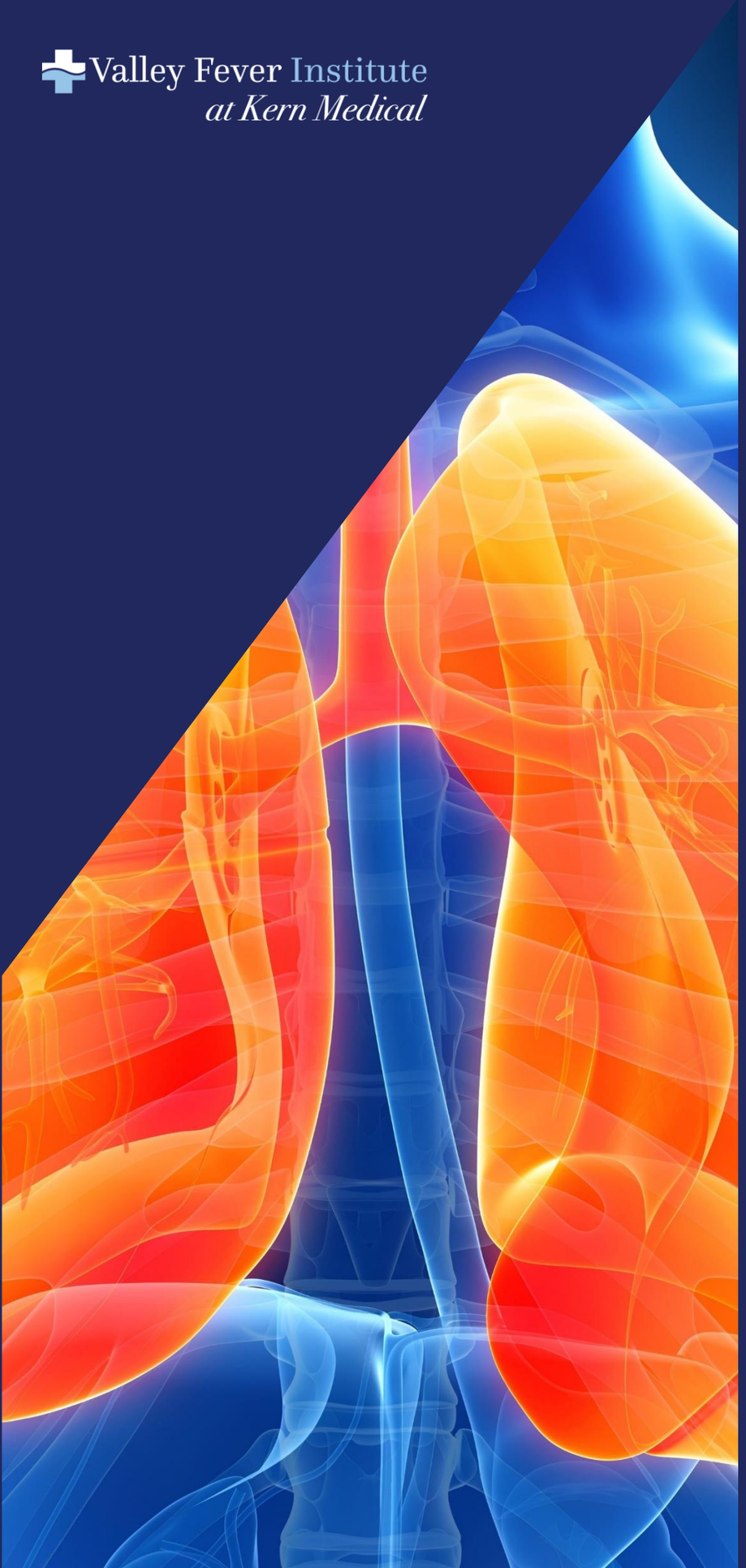
Valley Fever Institute
at Kern Medical



A Triple Threat:

Influenza, SARS-CoV-2 & Coccidioidomycosis

Moderated by

Augustine Munoz, MD

Presented by

Royce H. Johnson, MD, FACP

Arash Heidari, MD

Rasha Kuran, MD

September 25, 2020

Valley Fever Institute
at Kern Medical

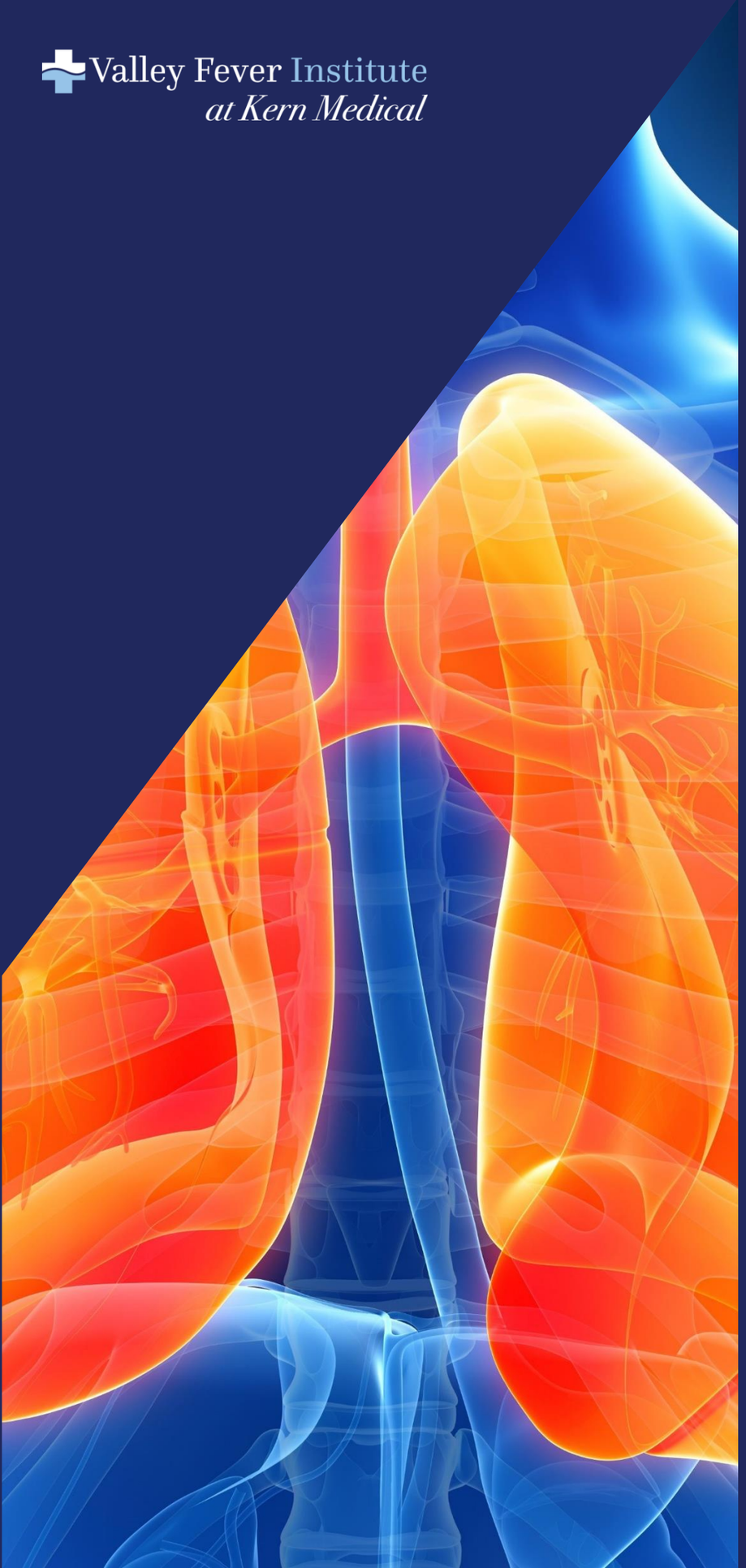
Disclosures

- Royce H. Johnson, MD, FACP has identified a financial relationship with Horizon Pharmaceuticals and received an Honoraria. This has been resolved by peer-review.
- The following speakers disclose no relevant financial relationships with commercial interests.

  Arash Heidari, MD, FACP, Rasha Kuran, MD, Augustine Munoz, MD

- All other planners, staff, and others involved with this activity have reported no revenant financial relationships with commercial interests.

Valley Fever Institute
at Kern Medical



Epidemiologic and Clinical features of Influenza, SARS-CoV-2 & Coccidioidomycosis

Royce H. Johnson, MD, FACP

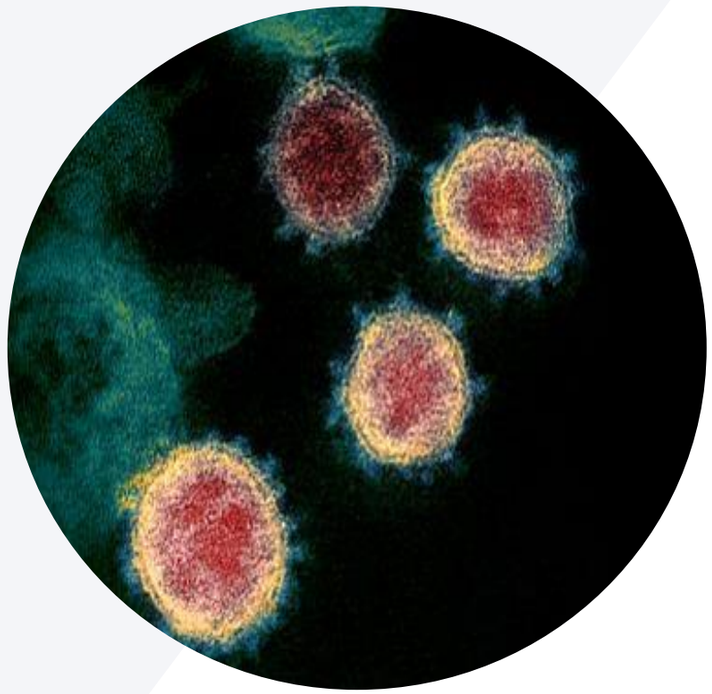
Medical Director Valley Fever Institute
Chief, Infectious Disease, Kern Medical
Professor of Medicine,
David Geffen School of Medicine UCLA

September 25, 2020

INFLUENZA

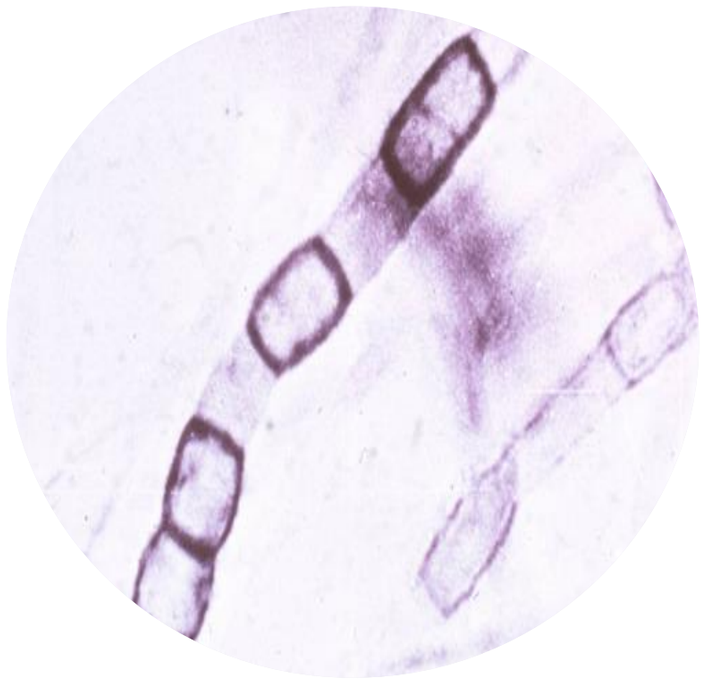
100nm

SARS-COV-2



120nm

COCCI



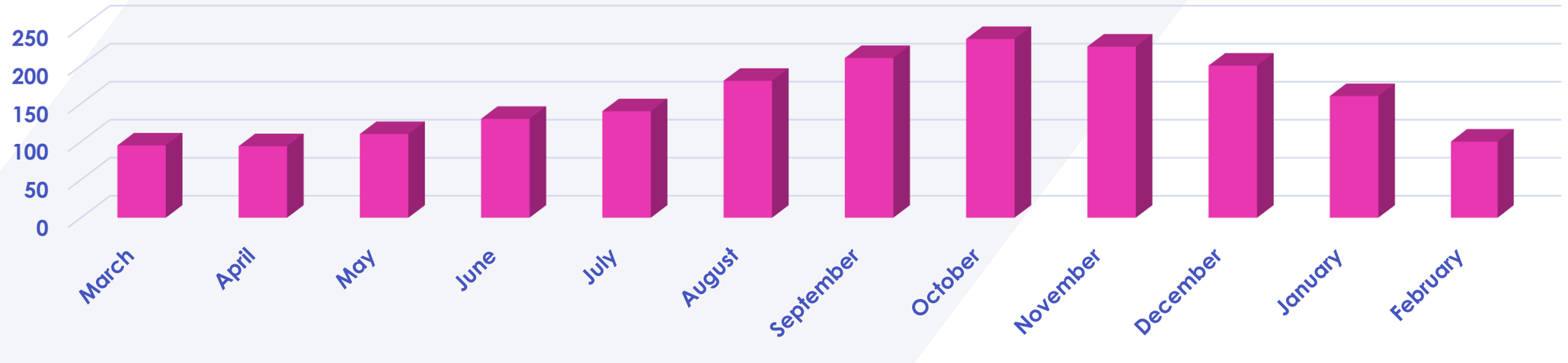
5,000nm

A Triple Threat

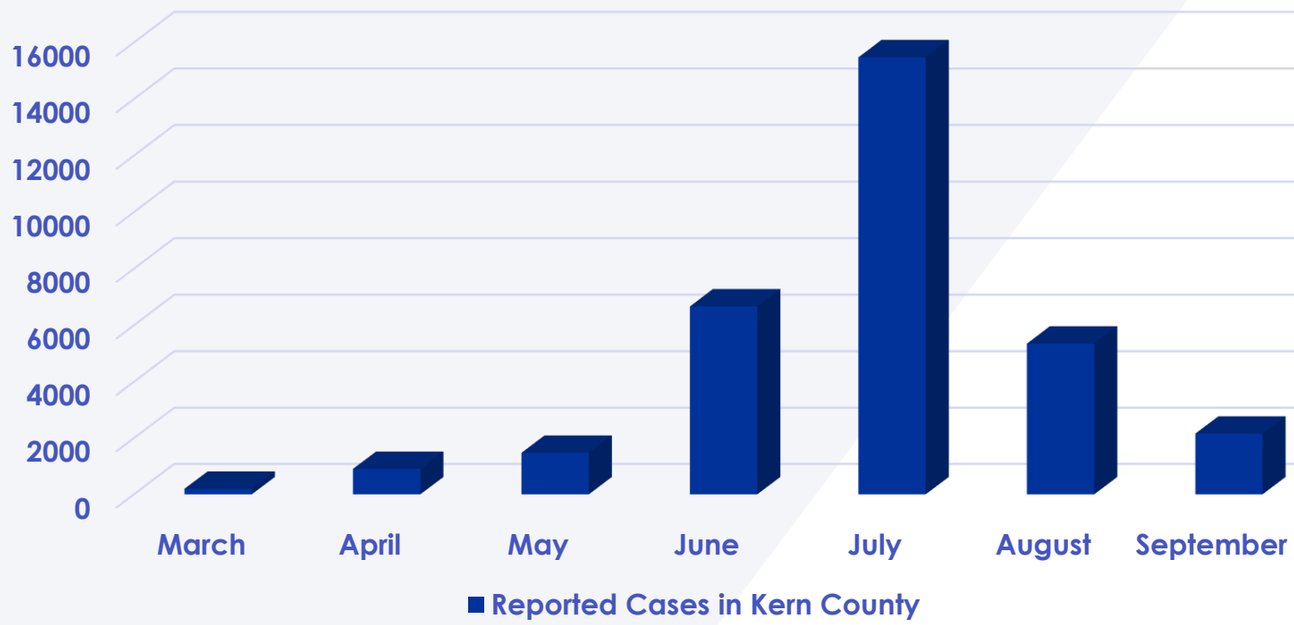
- Respiratory symptoms are among the most common reason patients seek medical attention
- The number of patients presenting with respiratory symptoms is daunting
- We are currently amid a historic SARS-CoV-2 pandemic
- We are at the threshold of an influenza season of unknown onset, duration or severity
- Primary Pulmonary Coccidioidomycosis is always a possible diagnosis

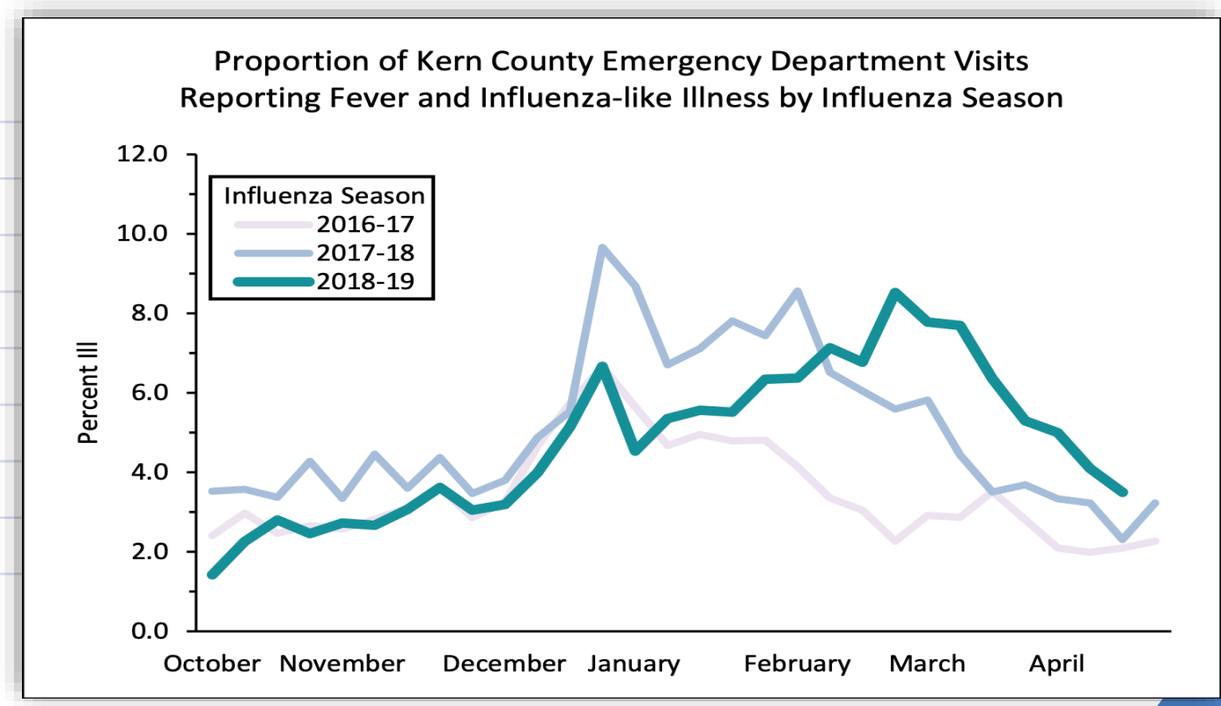
Seasonality

Coccidioidomycosis



SARS-CoV-2





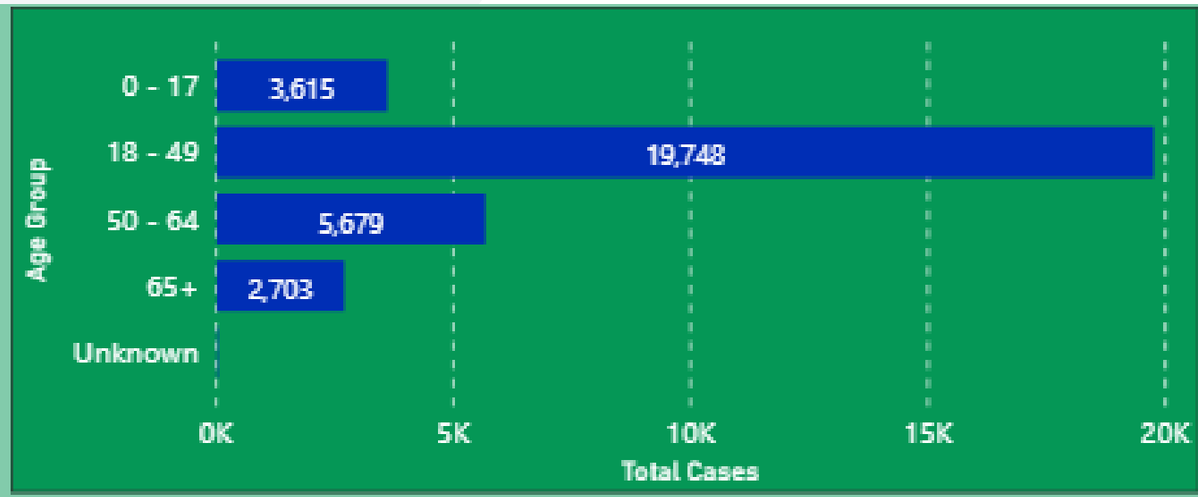
Demographics - SARS-CoV-2

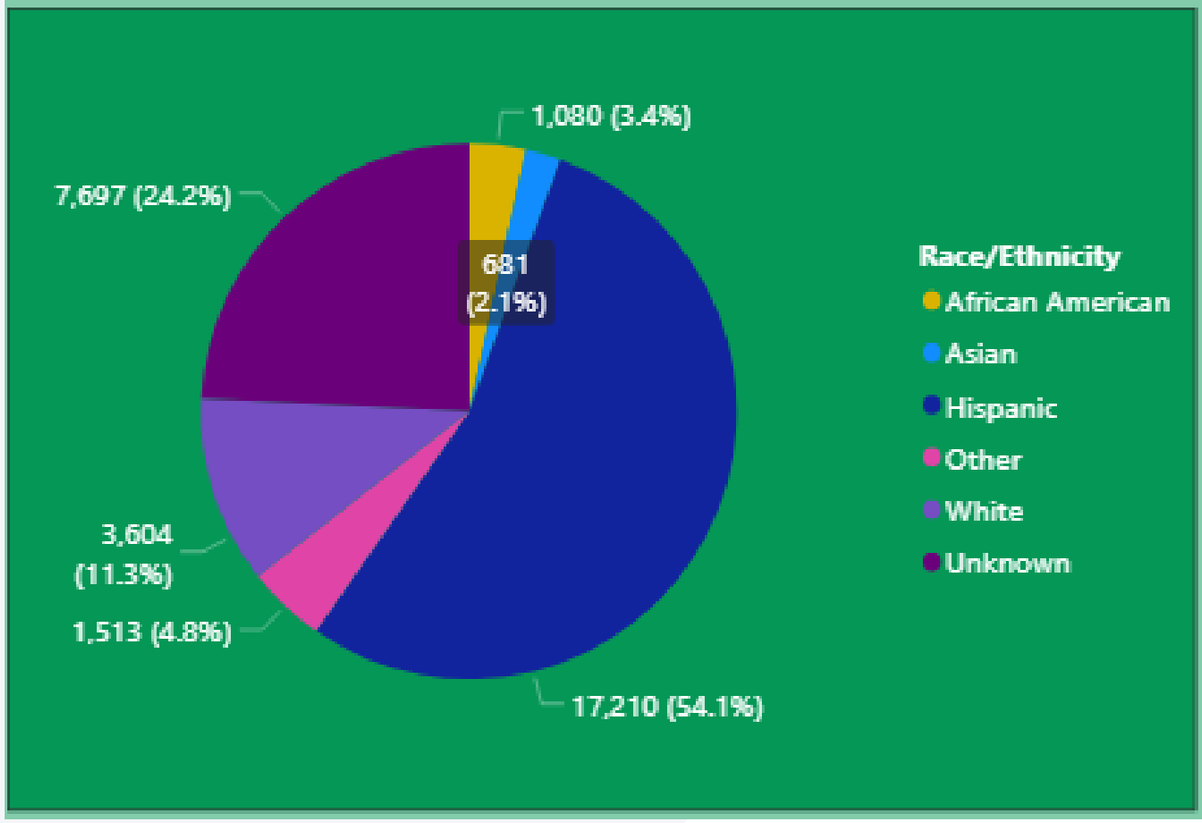
31,785 (73 New)
Total Resident Cases

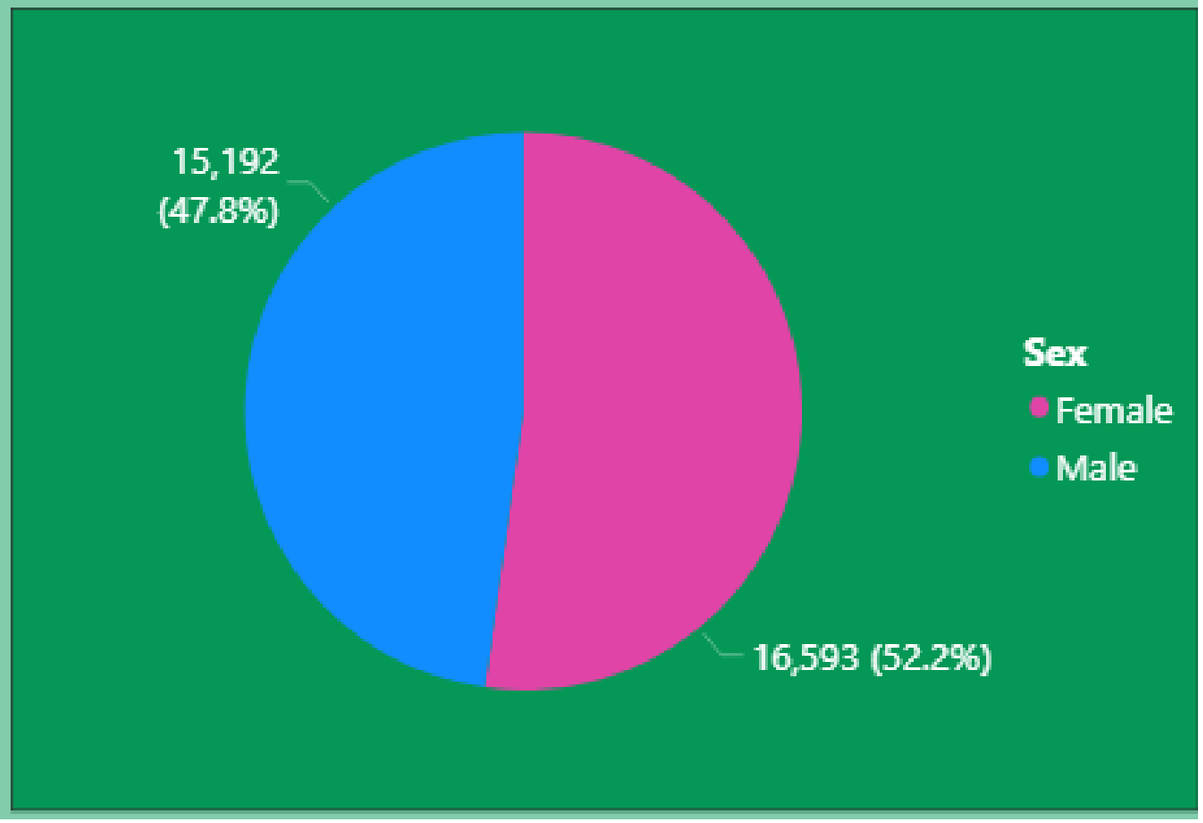
15,729
Recovered Residents

361 (1 New)
Kern Resident Deaths

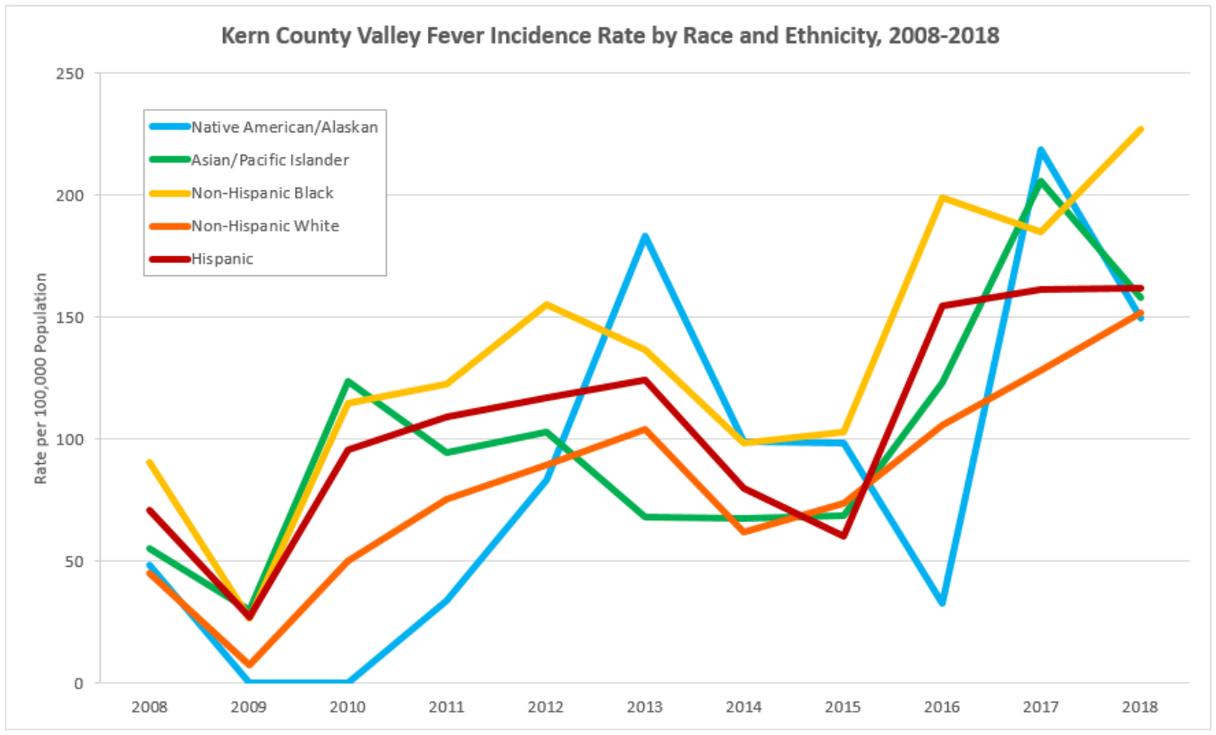
10
Non-Resident Cases

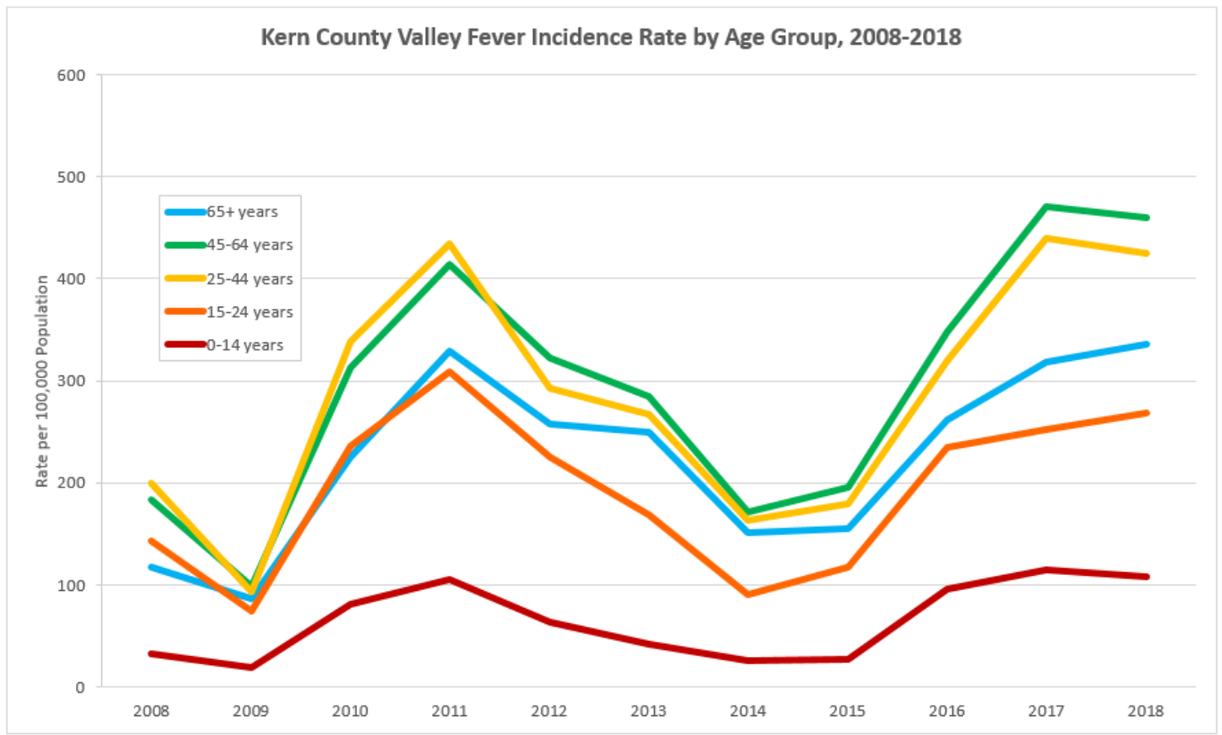


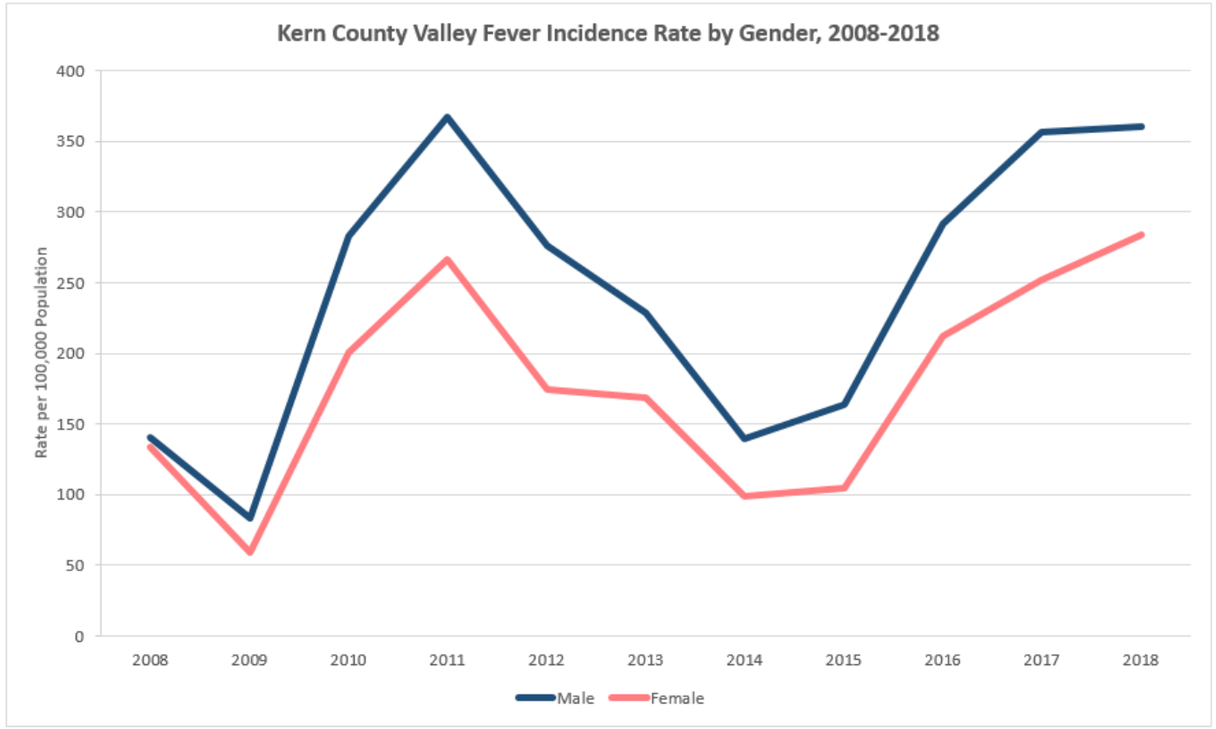




Demographics - Cocci







Infectious Disease Transmission

Influenza	**Contagious**
SARS-CoV-2	**Contagious**
Coccidioidomycosis	**Non-Contagious**

Airborne Epidemics			
	Influenza	**SARS-CoV-2**	**Coccidioidomycosis**
Seasonality	November – April	March – Present (2020)	June – December
Transmission	Droplets Aerosol Surfaces	Droplets Aerosol Surfaces	Aerosol Fomite
Incubation	3 days	5-6 days	1 – 4 weeks
Kern County Deaths/100k	0.8	40	1.3

Clinical Presentations: Triple Threat

- Asymptomatic
- Acute Bronchitis
- Pneumonic
- Non – Pneumonic

Acute Bronchitis (Non-COPD)

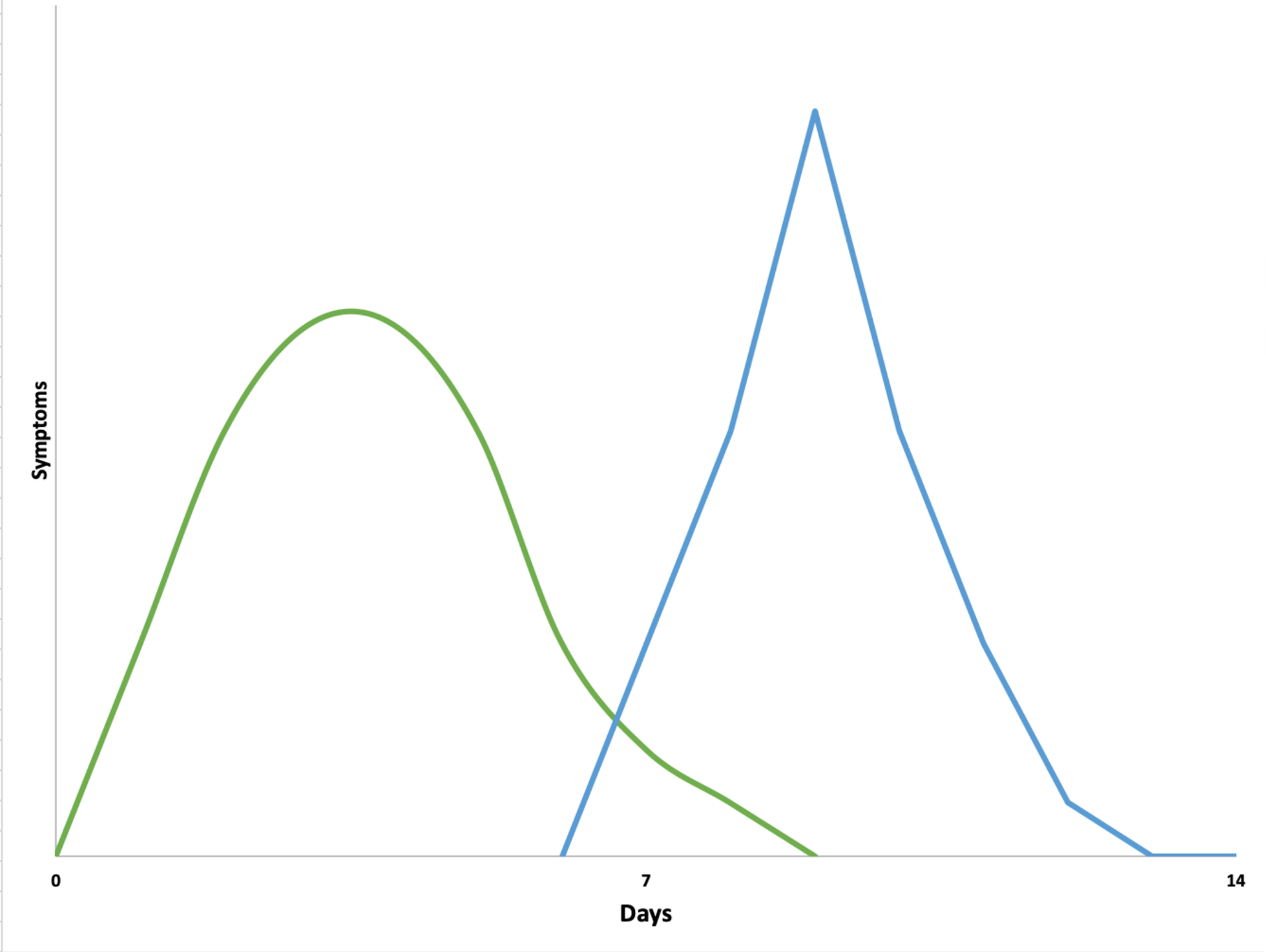
~ 90%	< 10%
Rhinovirus	Mycoplasma
Influenza	Chlamydophila
RSV	Bordetella Pertussis
Metapneumovirus	
Coronavirus non-CoV-2	
Adenovirus	

Bacterial Superinfection	
Influenza	Relatively Common
SARS-CoV-2	Uncommon
Coccidioidomycosis	Very Rare

Community Acquired Pneumonia

Common	Uncommon
Staphylococcus Pneumoniae	MSSA
Haemophilus Influenzae	MRSA
Moraxella Catarrhalis	Streptococcus Pyogenes
Legionella Pneumophila	Gram negatives
Mycoplasma Pneumoniae	Anaerobes
Chlamydophila Pneumoniae	

Bimodal Symptom Distribution



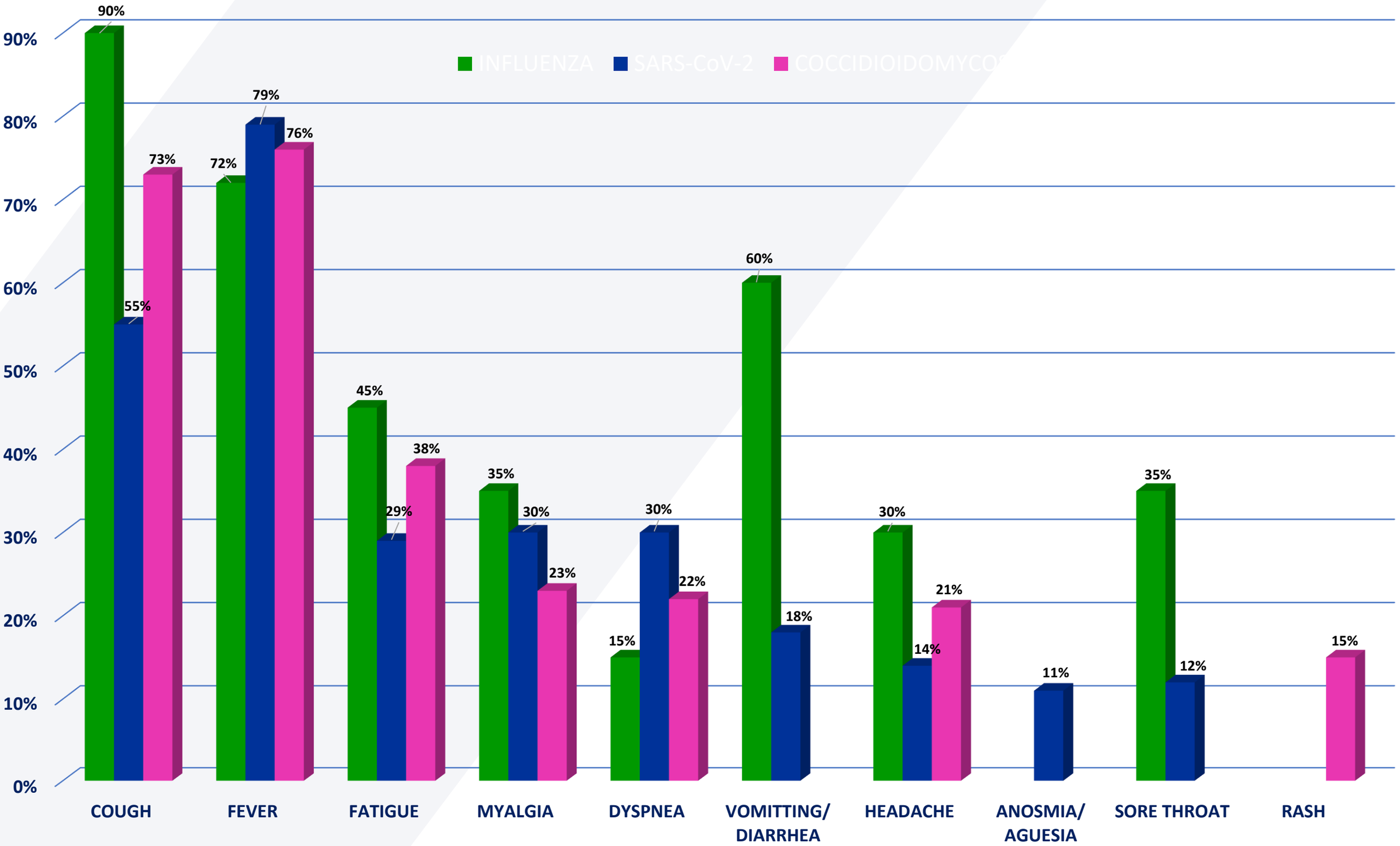
Influenza

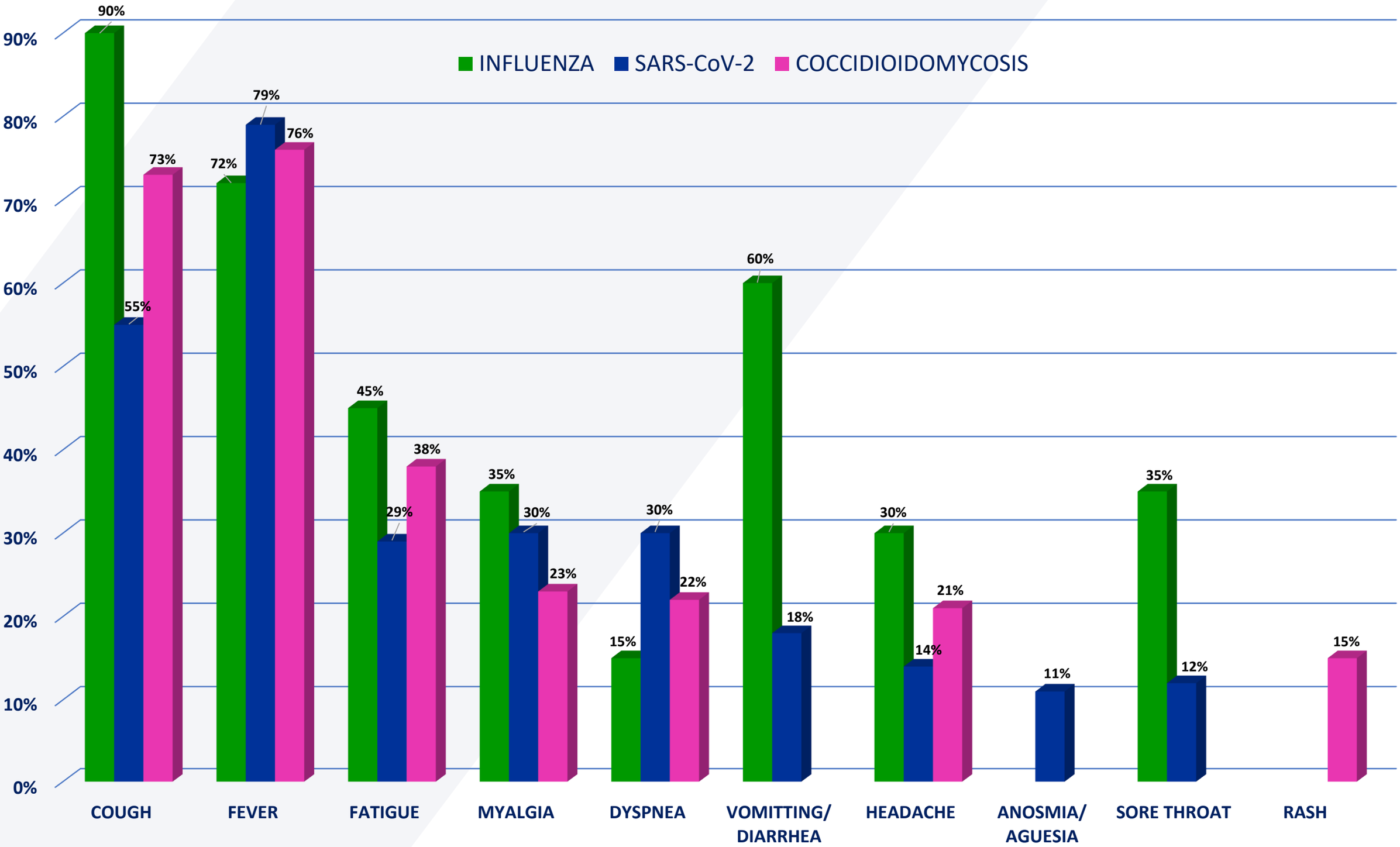
Bacterial Superinfection

- S. Pneumoniae
- MSSA
- MRSA
- Others

Acuity

SARS-CoV-2 and Influenza negative patients who have been symptomatic for 10 days should be considered for Coccidioidomycosis

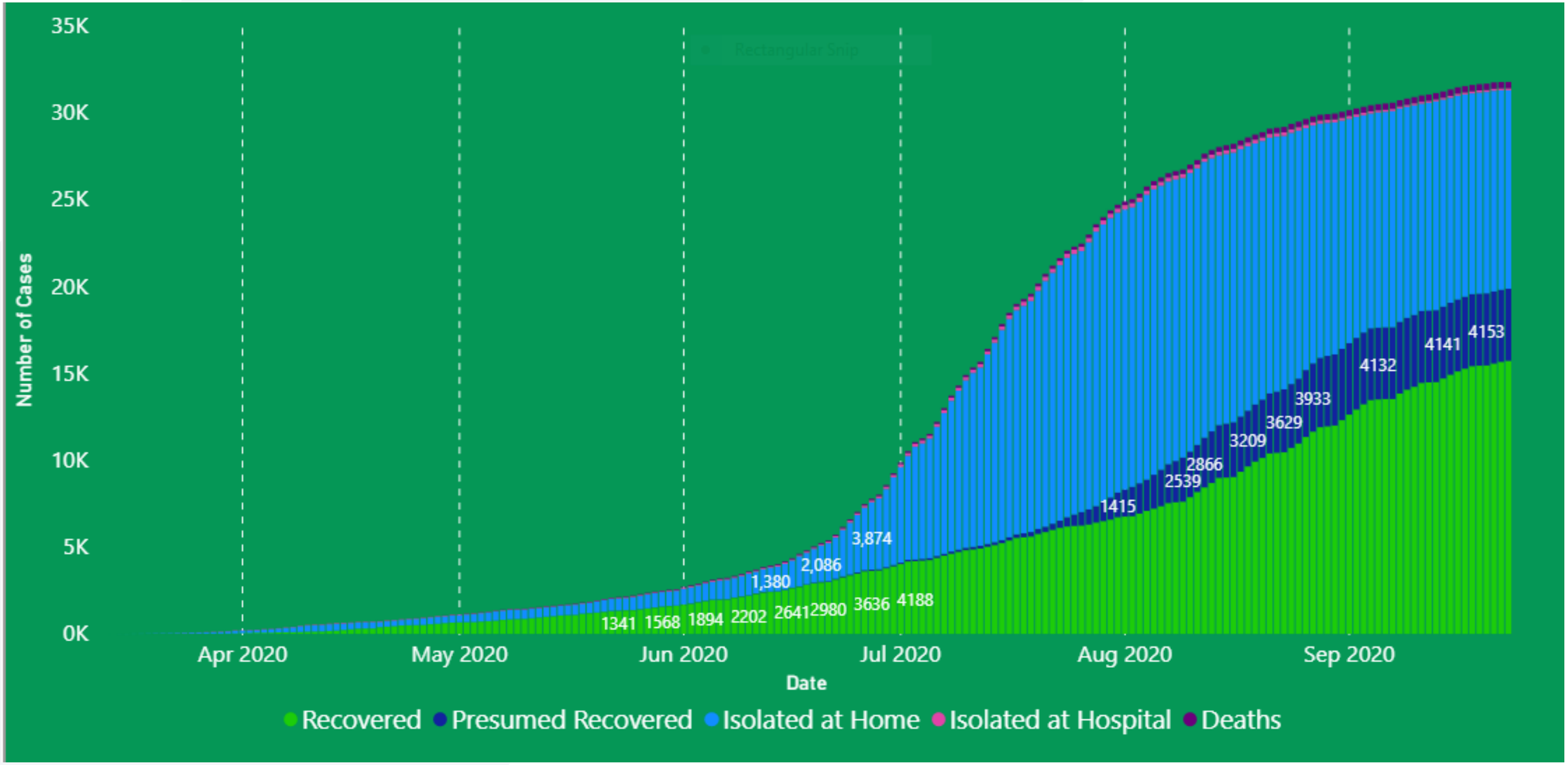

INFLUENZA
SARS-CoV-2
COCCIDIOIDOMYCOS
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
90%
55%
73%
72%
79%
76%
45%
29%
38%
35%
30%
23%
15%
30%
22%
60%
18%
30%
14%
21%
11%
35%
12%
15%
COUGH
FEVER
FATIGUE
MYALGIA
DYSPNEA
VOMITTING/ DIARRHEA
HEADACHE
ANOSMIA/ AGUESIA
SORE THROAT
RASH


INFLUENZA
SARS-CoV-2
COCCIDIOIDOMYCOSIS
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
90%
55%
73%
72%
79%
76%
45%
29%
38%
35%
30%
23%
15%
30%
22%
60%
18%
30%
14%
21%
11%
35%
12%
15%
COUGH
FEVER
FATIGUE
MYALGIA
DYSPNEA
VOMITTING/ DIARRHEA
HEADACHE
ANOSMIA/ AGUESIA
SORE THROAT
RASH

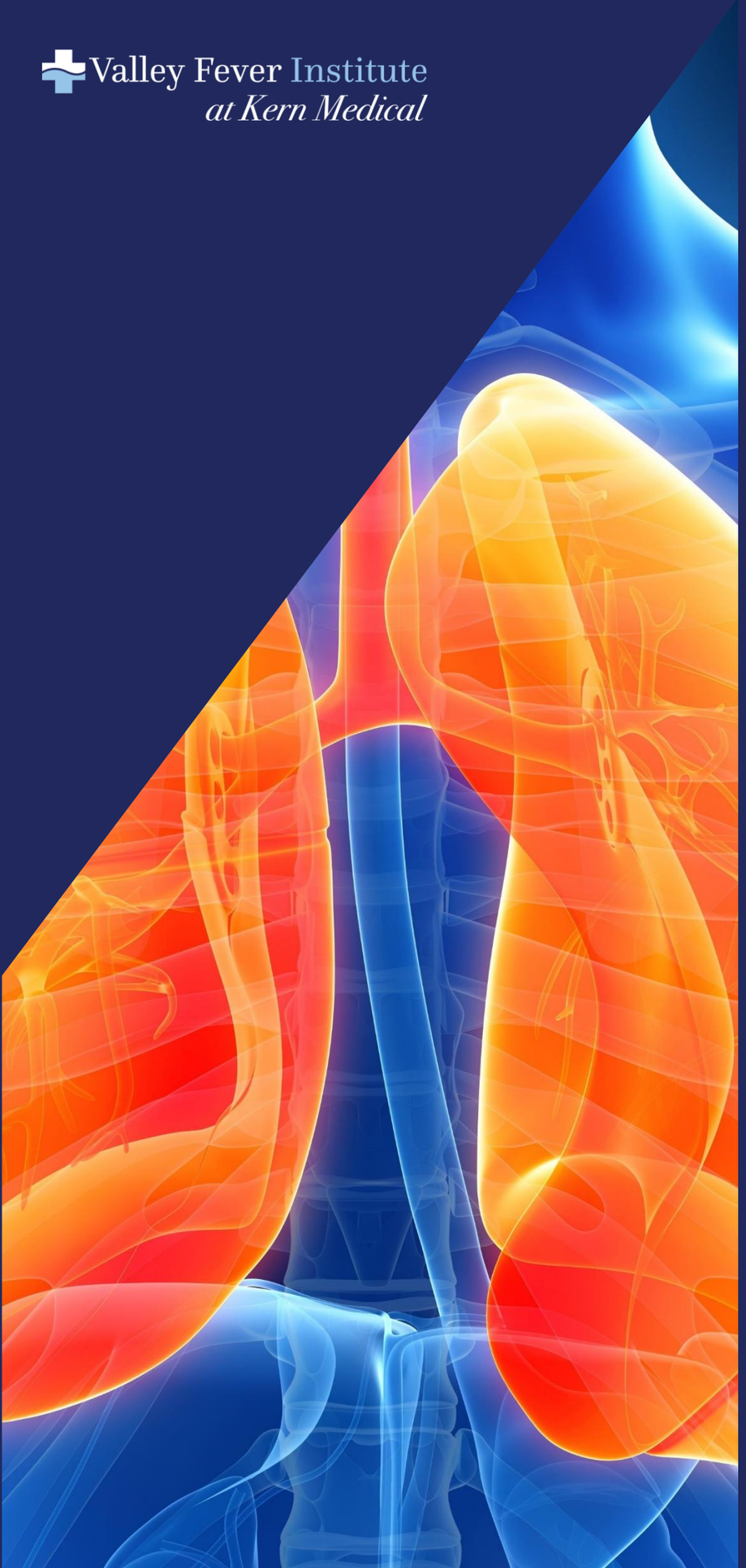
How to Lower Your Risk

Influenza	SARS-CoV-2	Coccidioidomycosis
Face Mask	Face Mask	Face Mask
Maintain Physical Distancing (6 feet)	Maintain Physical Distancing (6 feet)	Wet down dusty areas before working/playing in them
Hand washing	Hand washing	Stay indoors with windows and doors closed (during dust storms) and use recirculating air-conditioning
Annual Flu Immunization	Immunization *(we hope)*	Immunization *(we hope)*

Kern County Case Status



Valley Fever Institute
at Kern Medical



Diagnostically Differentiating Influenza, SARS-CoV-2 & Coccidioidomycosis

Rasha Kuran, MD

Associate Medical Director, Valley Fever Institute

Clinical Instructor of Medicine,

David Geffen School of Medicine at UCLA

September 25, 2020

Diagnostic Availability			
	Influenza	**SARS-CoV-2**	**Cocci**
Molecular			Uncommon
Antigen			
Antibody			
Culture			Uncommon

Diagnostic Turn Around Time

	Influenza	SARS-CoV-2	Cocci
Molecular		15-30 minutes 1-8 hours	N/A
Antigen	<15 minutes	<15 Minutes	3-5 Days
Antibody		1-4 hours	
Culture		Rapid: 1-3 days Conventional: 3-10 days	

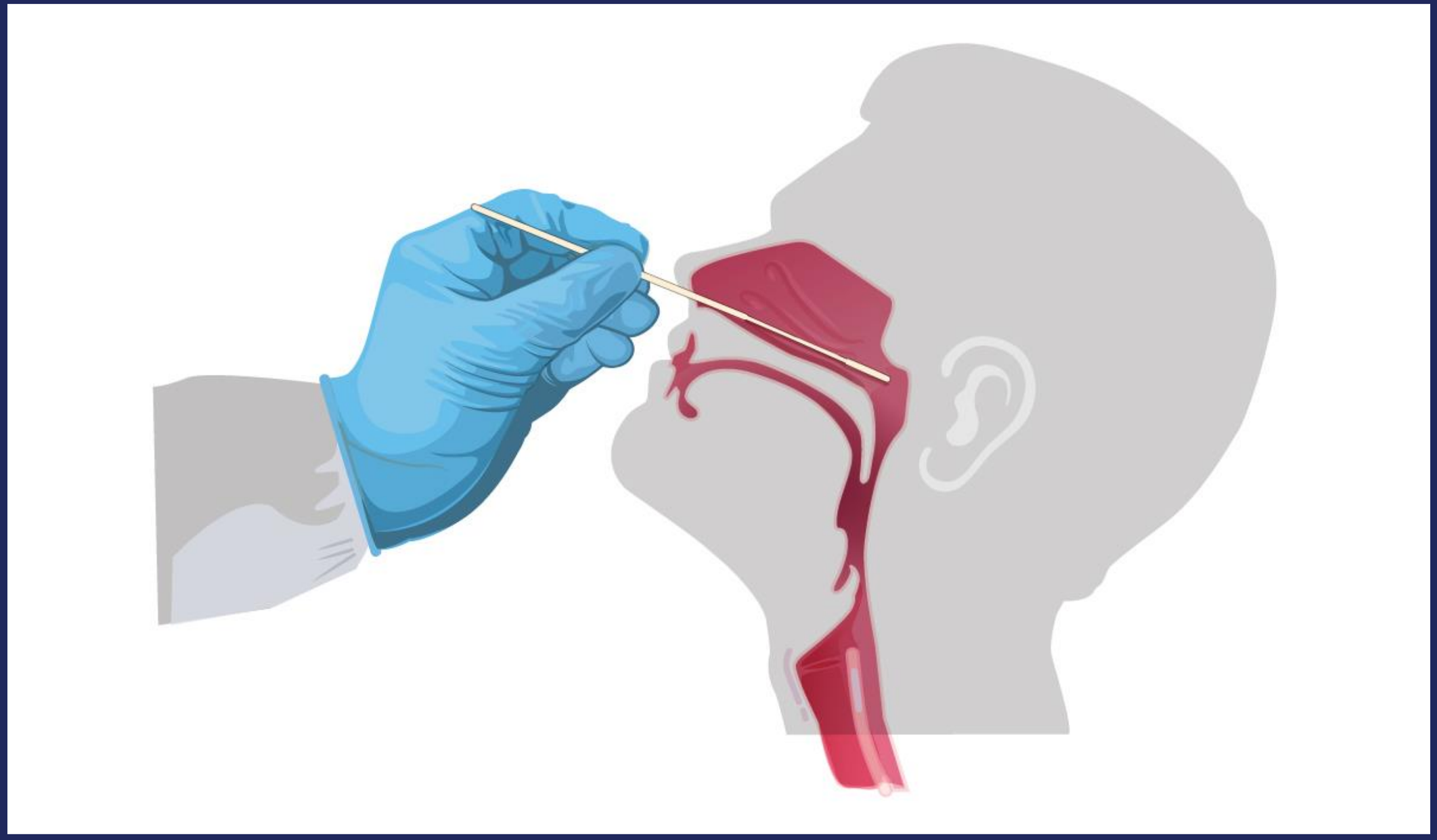
Diagnostic Limitations			
	Influenza	**SARS-CoV-2**	**Cocci**
Molecular			
Antigen			
Antibody			
Culture			

Diagnostic Sensitivity			
	Influenza	**SARS-CoV-2**	**Cocci**
Molecular			
Antigen			
Antibody			
Culture			

Diagnostic Specificity			
	Influenza	SARS-CoV-2	Cocci
Molecular			
Antigen			
Antibody			
Culture			

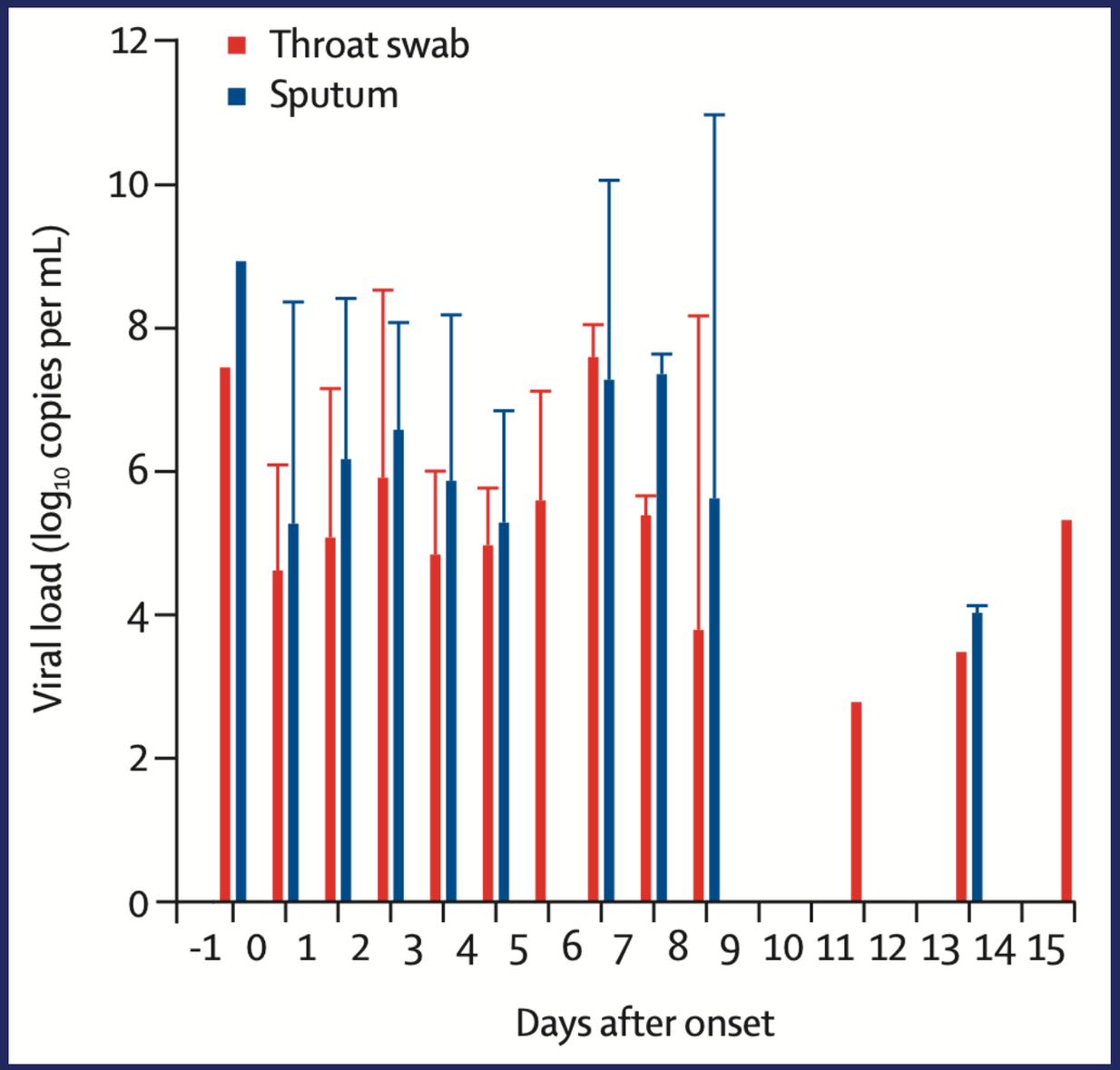
Acquisition-symptomatic			
	Influenza	**SARS-CoV-2**	**Cocci**
Molecular			
Antigen			
Antibody		Convalescent	
Culture			

Nasopharyngeal Swab



SARS-CoV-2 Viral Load Median in throat and sputum samples

Collected from 80 patients at different stages after disease onset



Valley Fever Institute

Basis for Establishing a Diagnosis of Coccidioidomycosis

Skin Tests
Serologic Test (tube precipitins, complement fixation, etc.
Wet mounts of sputum, pus and body fluids
Histologic studies of biopsy specimens from skin, lung, etc.
Cultures of sputum, pus and body fluids

Laboratory Findings

Most routine laboratory findings are unremarkable
Serum procalcitonin: normal
ESR often 1-2x above the upper limits of normal
WBC count usually normal or only slightly elevated
Eosinophilia in approximately one-quarter of patients
Symptoms and routine laboratory abnormalities associated with coccidioidomycosis.
Yozwiak ML, Lundergan LL, Kerrick SS, Galgiani JN
West J Med. 1988;149(4):419.

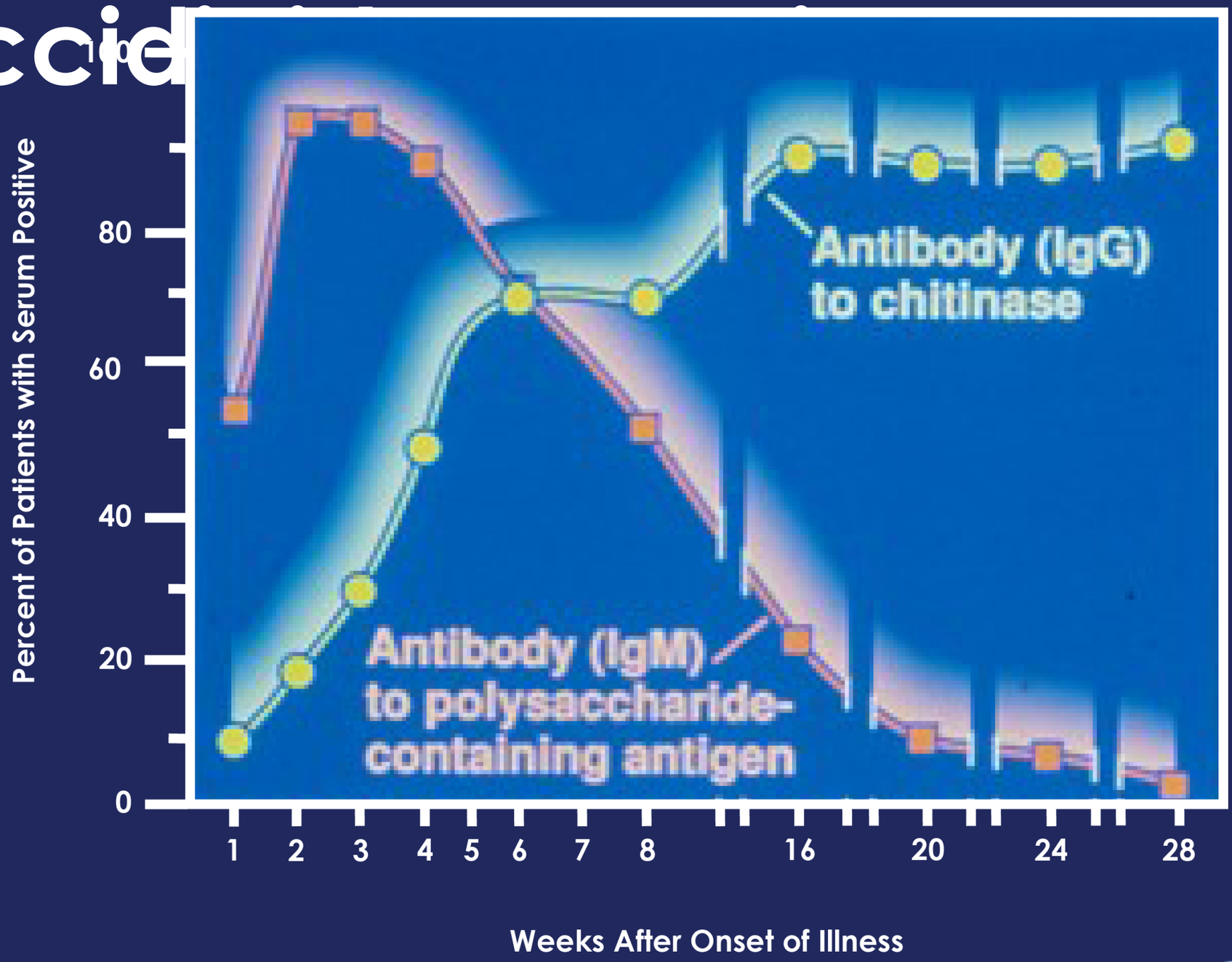
EIA : A very sensitive and commonly used method for diagnosing coccidioidomycosis, detects IgM and IgG antibodies.

ID: detects IgM, positive early in disease course.

CF: detects IgG, assessment of disease severity.

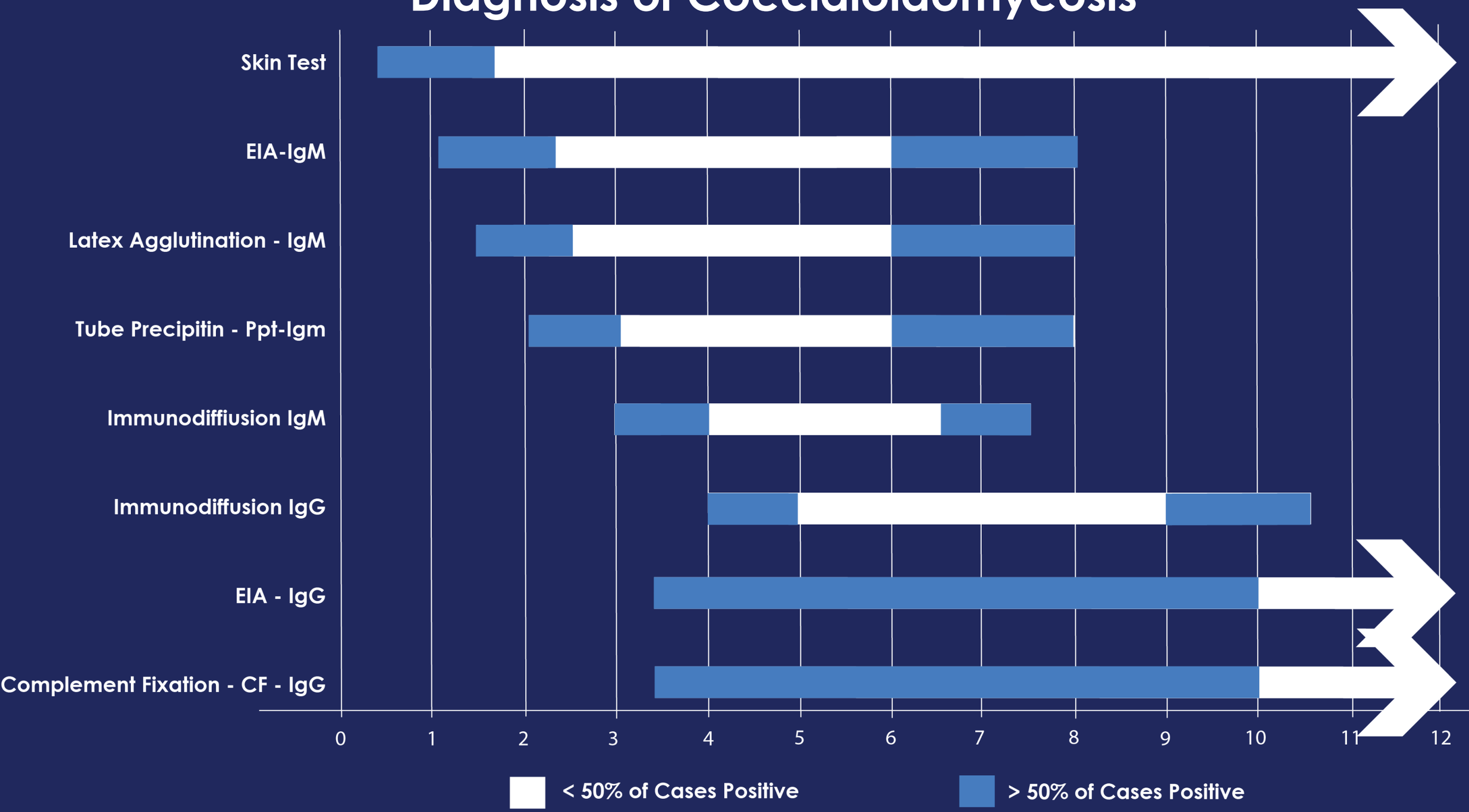
LFA: is a rapid test (~30 minutes) to detect the presence of total antibodies against *Coccidioides* spp (IgM or IgG).

Coccid



Valley Fever Institute

Course of Serum Reactivity to Serological Methods for the Diagnosis of Coccidioidomycosis



Valley Fever Institute

Urinary antigen detection:

Not widely used, but may have some utility in diagnosing coccidioidomycosis in immunocompromised patients with severe forms of the disease.

Valley Fever Institute

Polymerase Chain Reaction (PCR):

For detection of *Coccidioides* directly from lower respiratory specimens.

Valley Fever Institute

C-F Titer in Primary and Disseminated Coccidioidomycosis

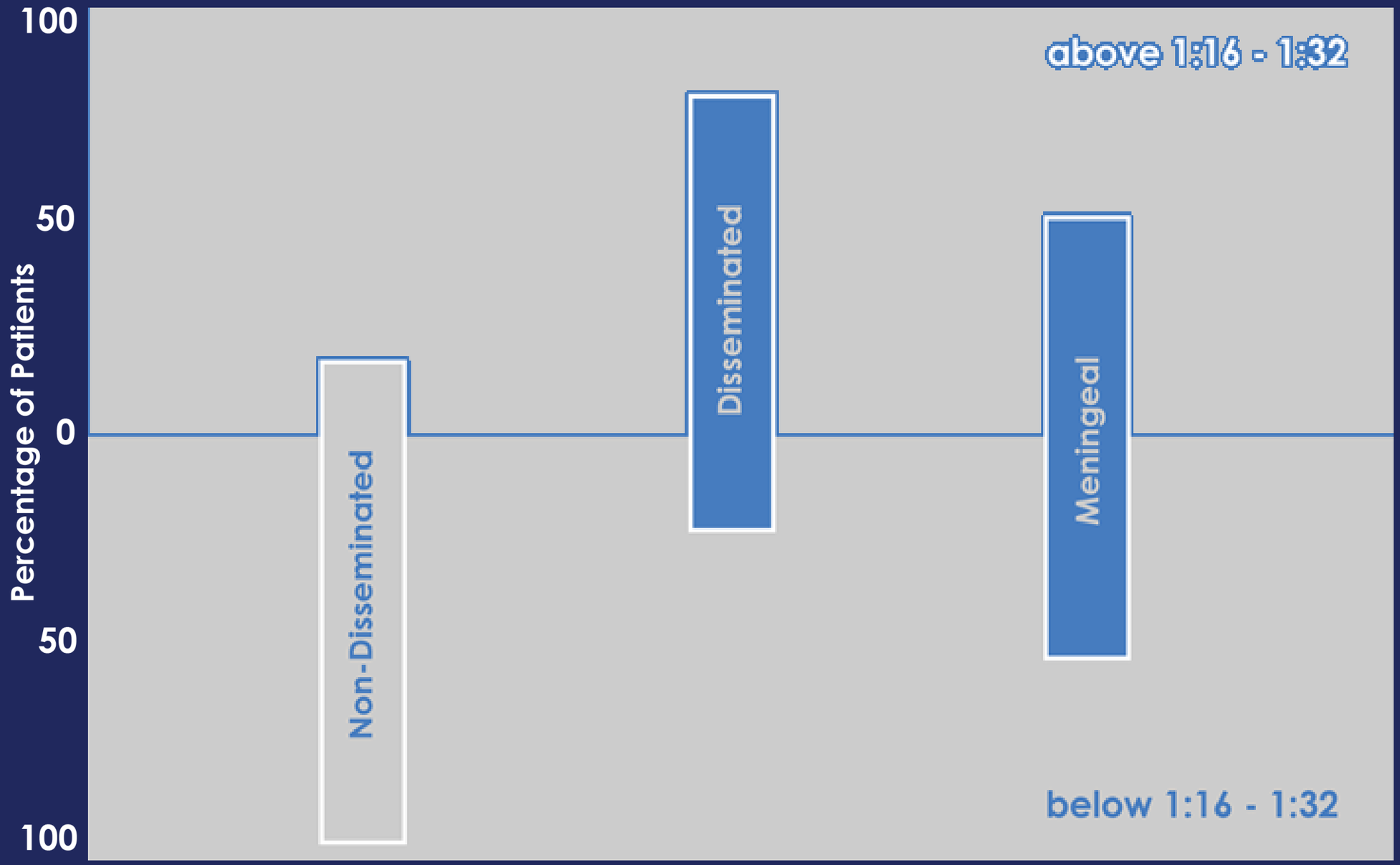


Fig. 4 - Range and significance of complement fixation titers in Coccidioidomycosis

Coccidioides Culture:

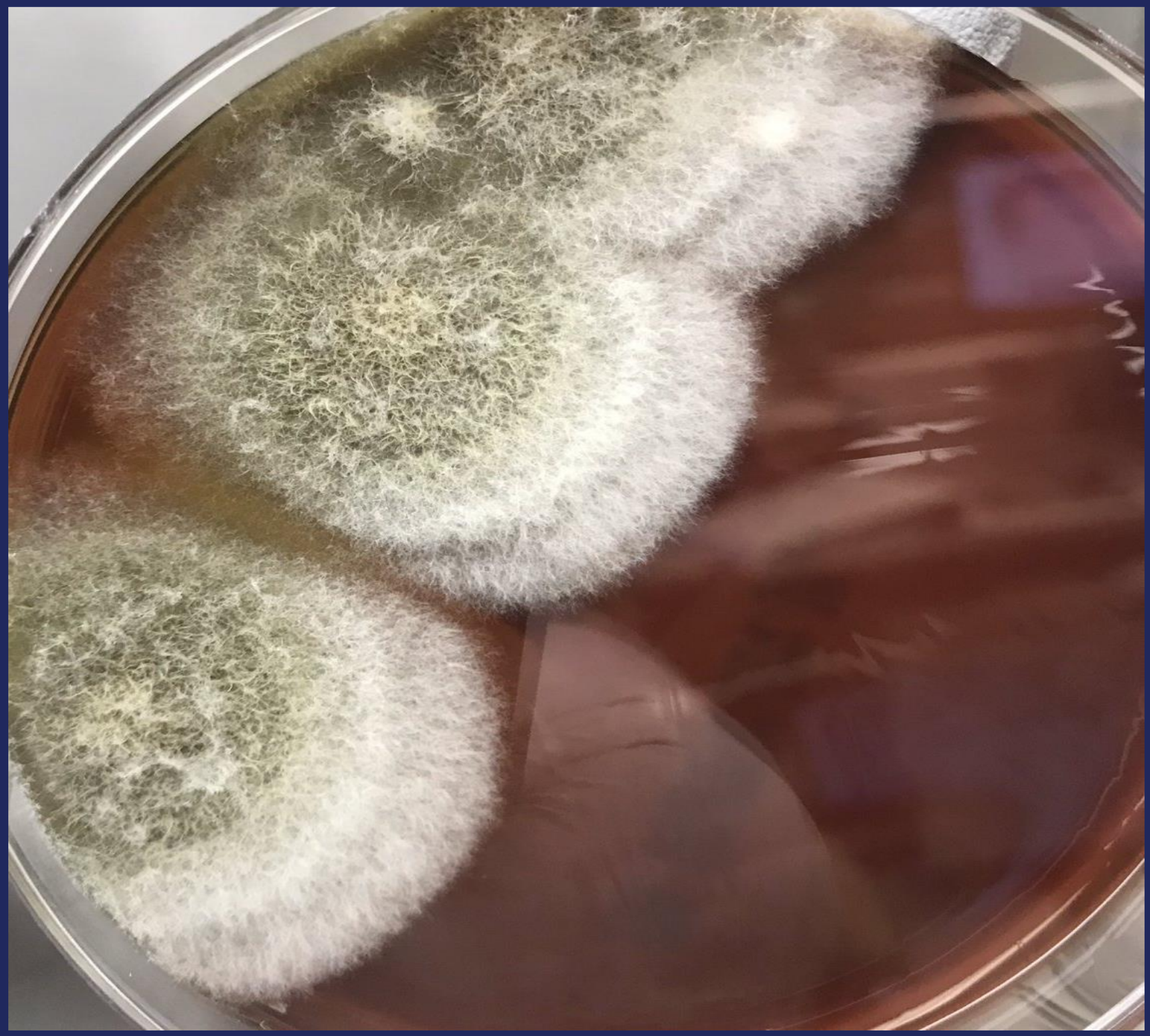
Can be performed on tissue or respiratory specimens.

It is not routinely used to diagnose valley fever.

Collecting specimens may need invasive procedure (BAL, biopsy).

Cocci grows readily on a variety of culture media at 35°C and is usually visually apparent in 2-7 days.

Valley Fever Institute



Valley Fever Institute

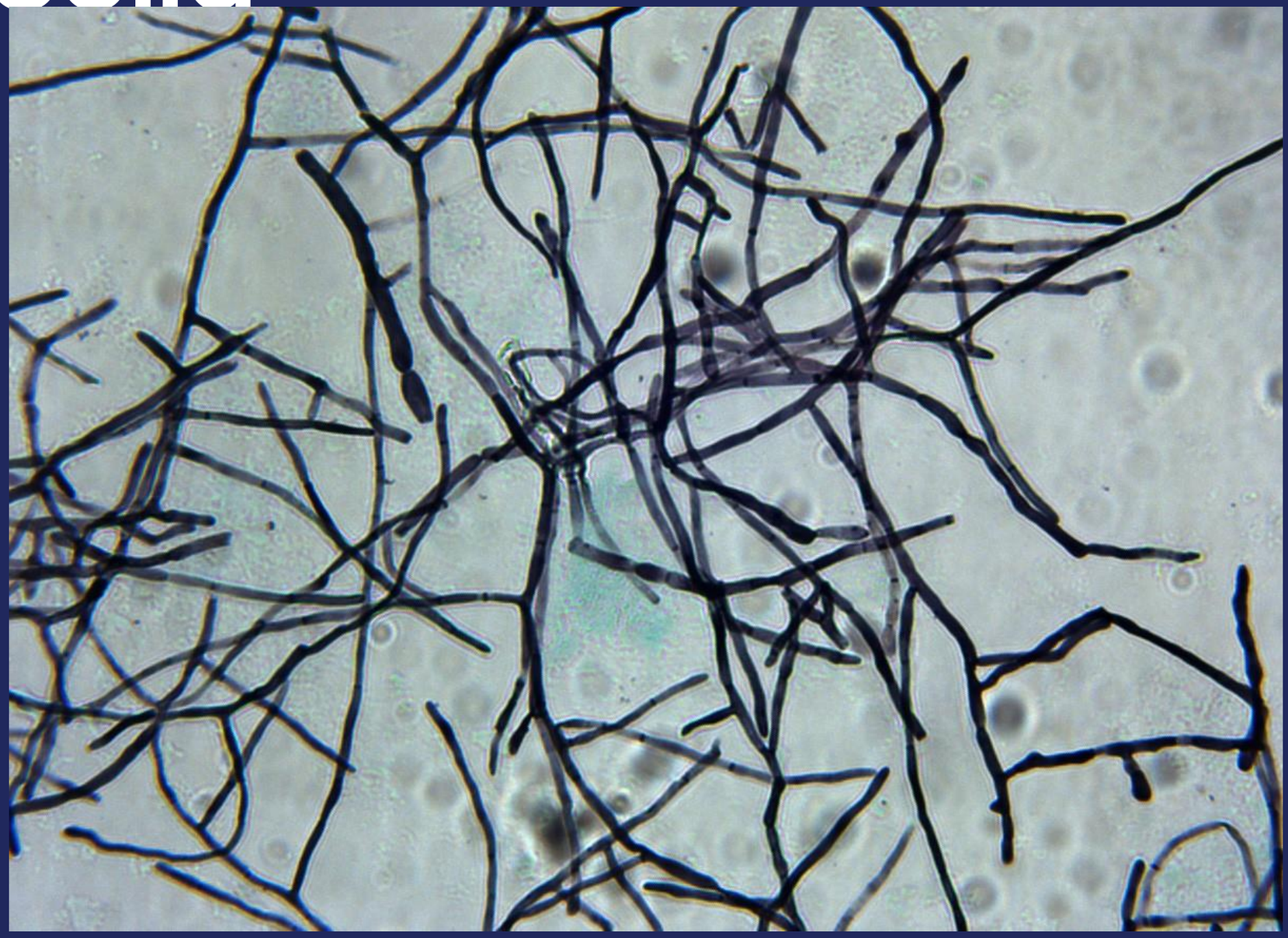
Microscopy:

Pathognomonic structure is the spherule.

The diagnosis can be established in fixed tissue using a variety of stains, including hematoxylin-eosin and Gomori methenamine-silver.

Low sensitivity.

Mycelia



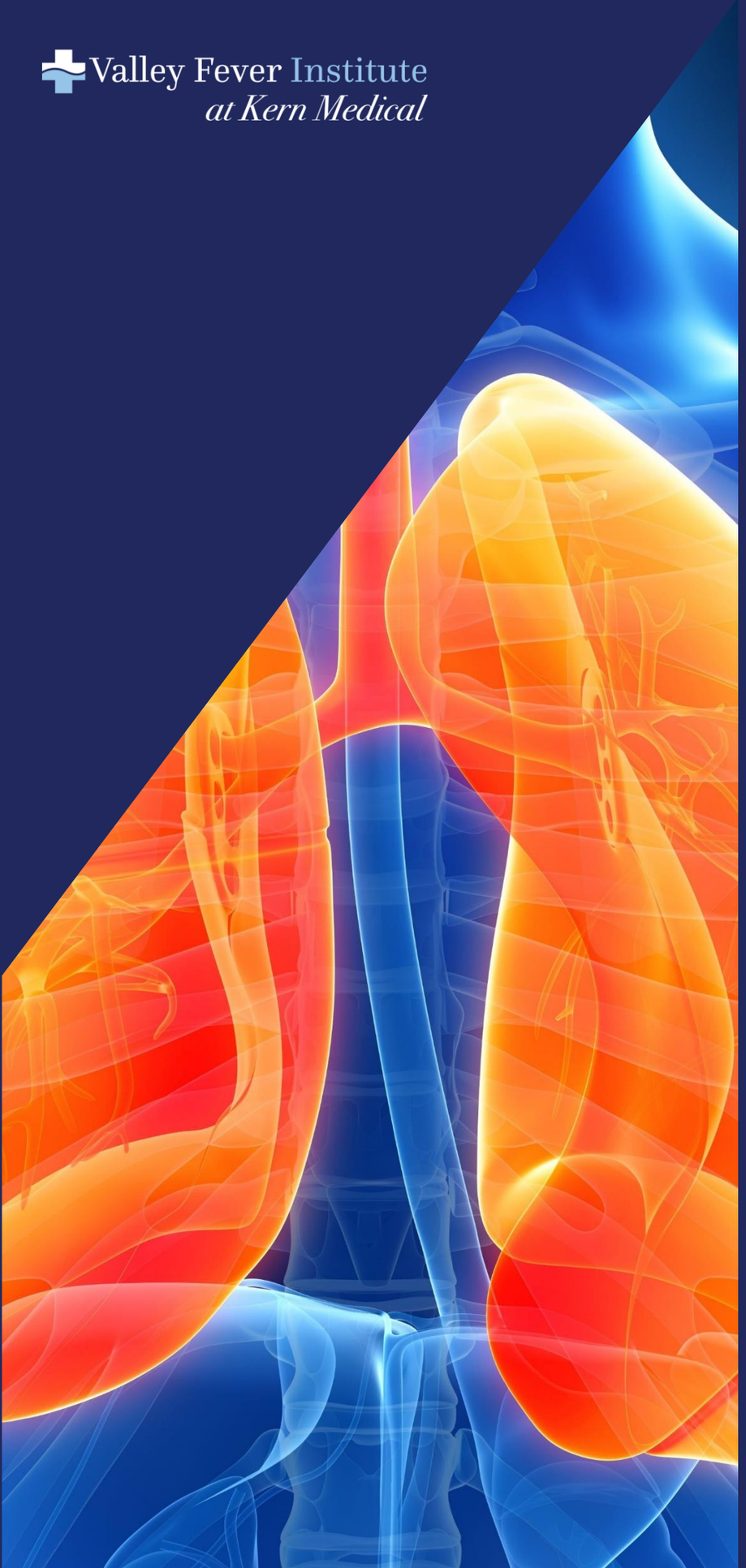
Valley Fever Institute

Arthroconidia

Valley Fever Institute

Spherules & Endospores

Valley Fever Institute
at Kern Medical



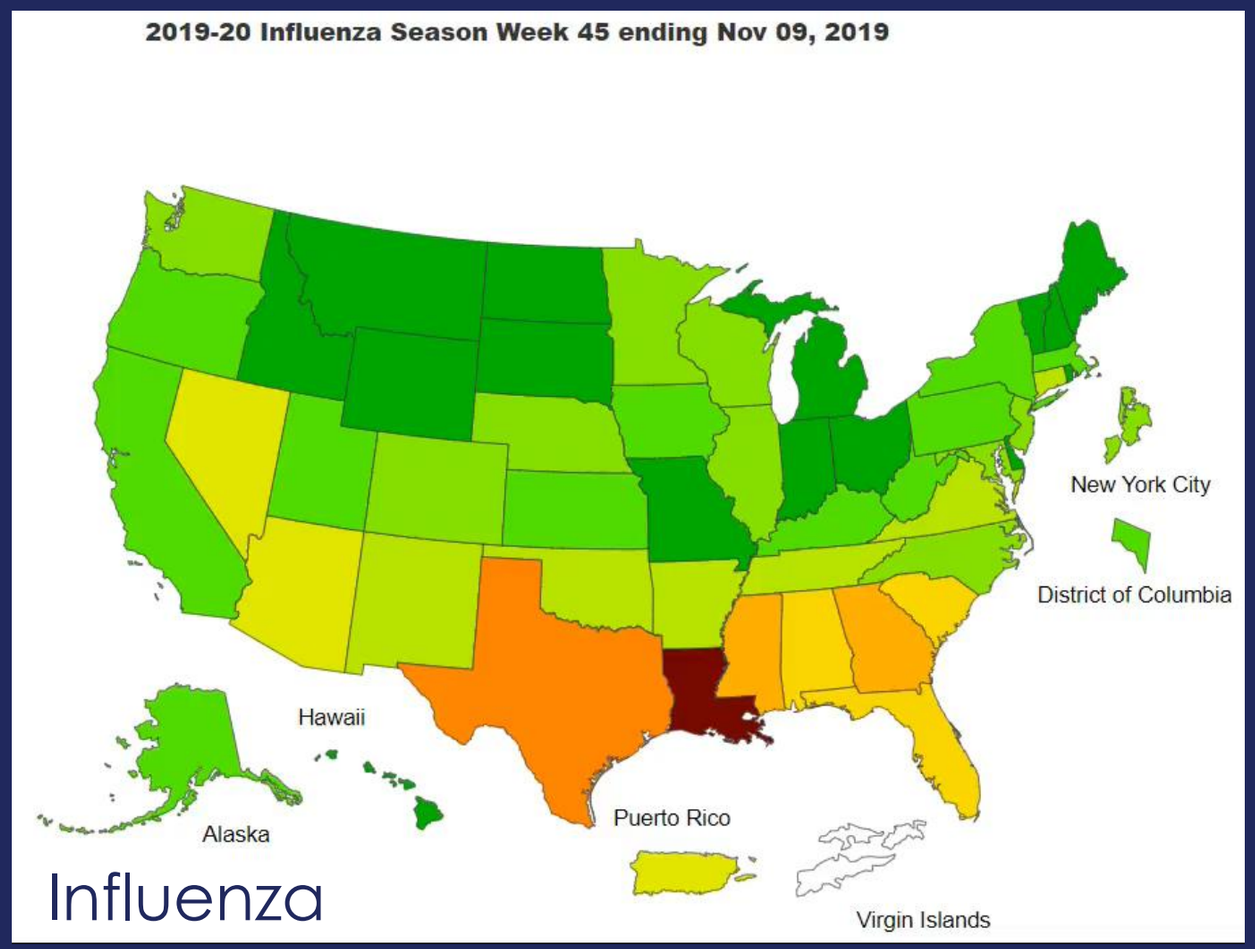
Radiologically Distinguishing Influenza, SARS-CoV-2 & Coccidioidomycosis

Arash Heidari, MD, FACP

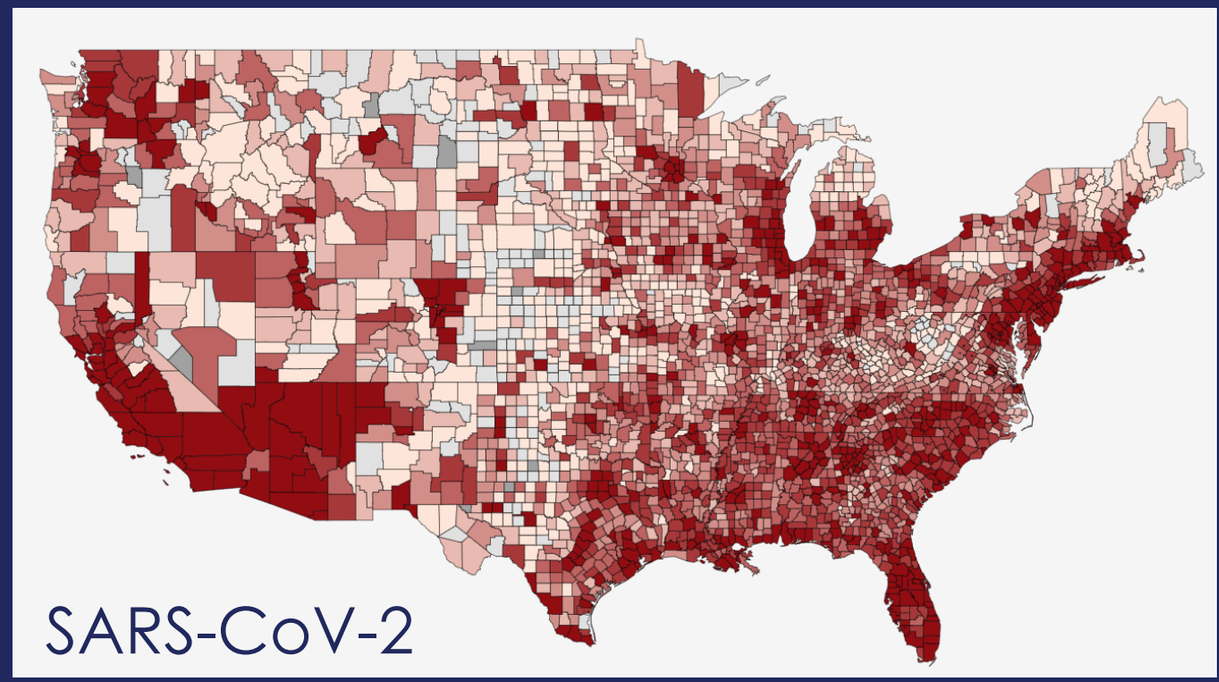
Associate Medical Director, Valley Fever Institute
Fellowship Director, Infectious Disease, Kern Medical
Associate Clinical Professor of Medicine,
David Geffen School of Medicine UCLA

September 25, 2020

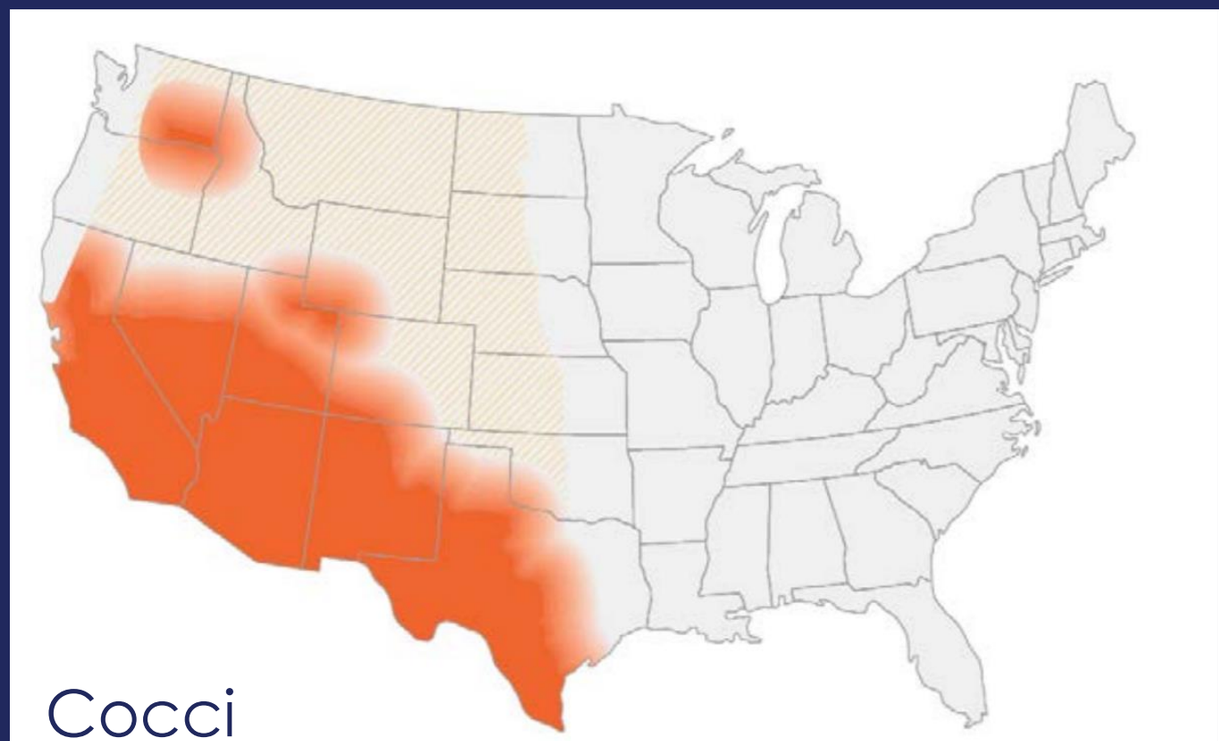
US Map



Influenza



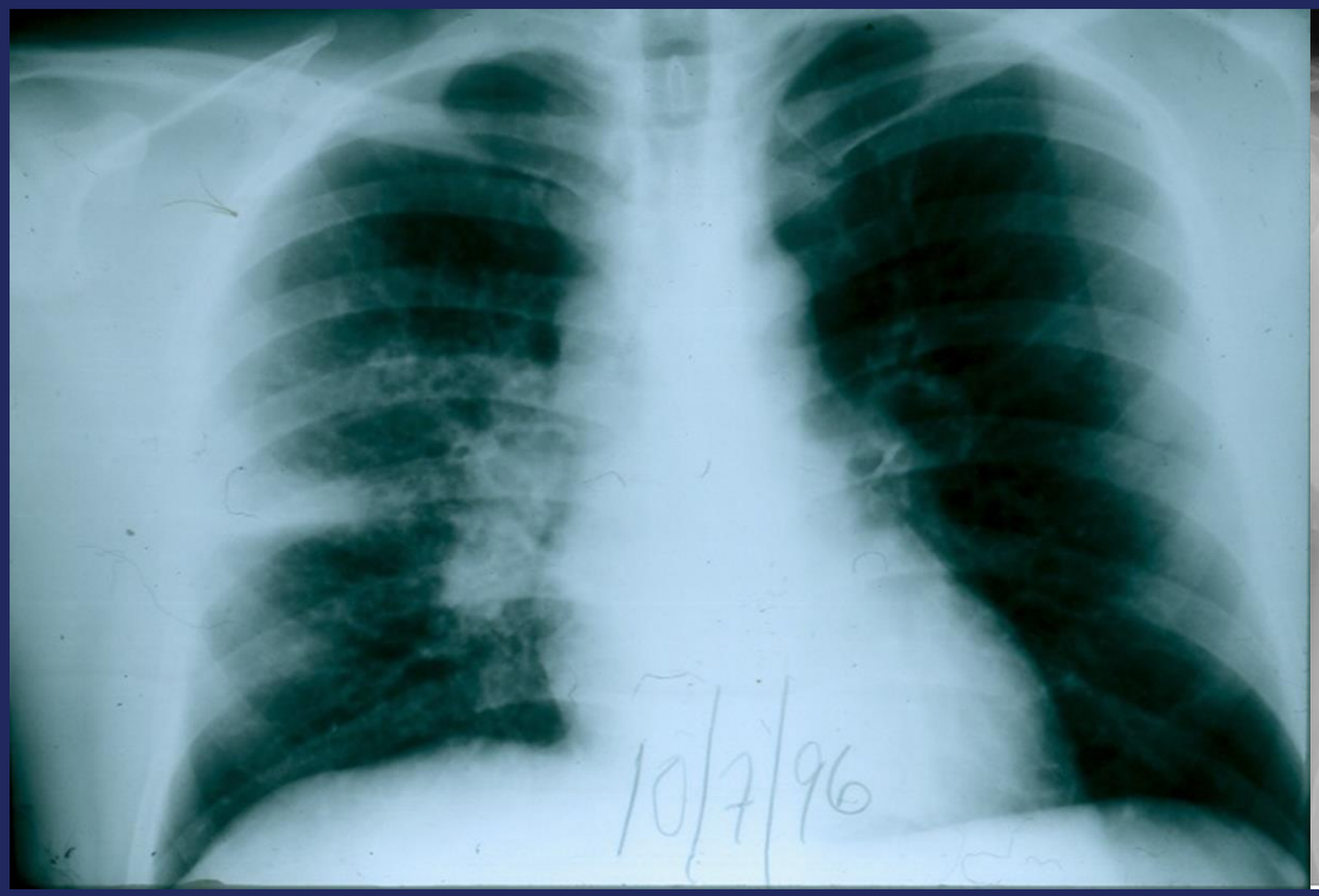
SARS-CoV-2



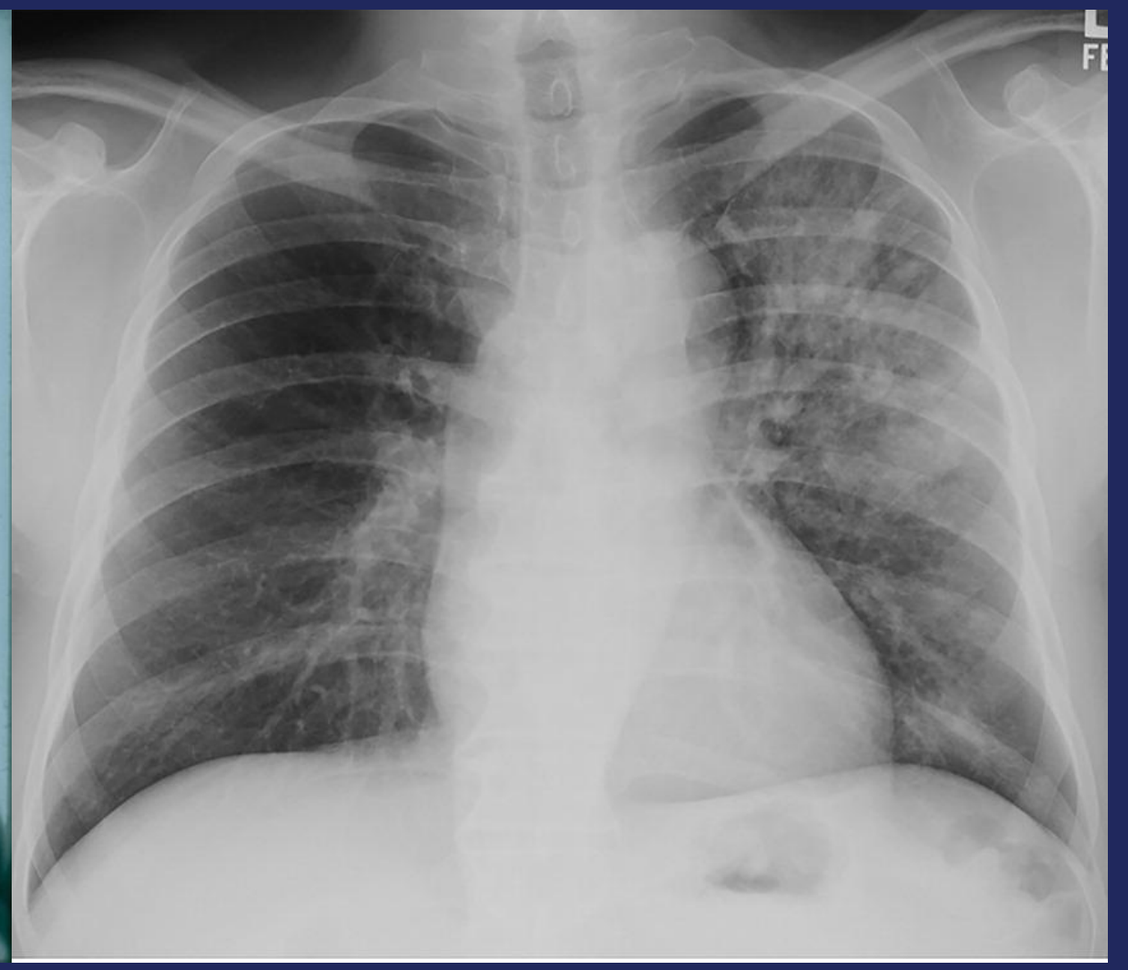
Cocci

Valley Fever Institute

Pulmonary Cocci (40%)



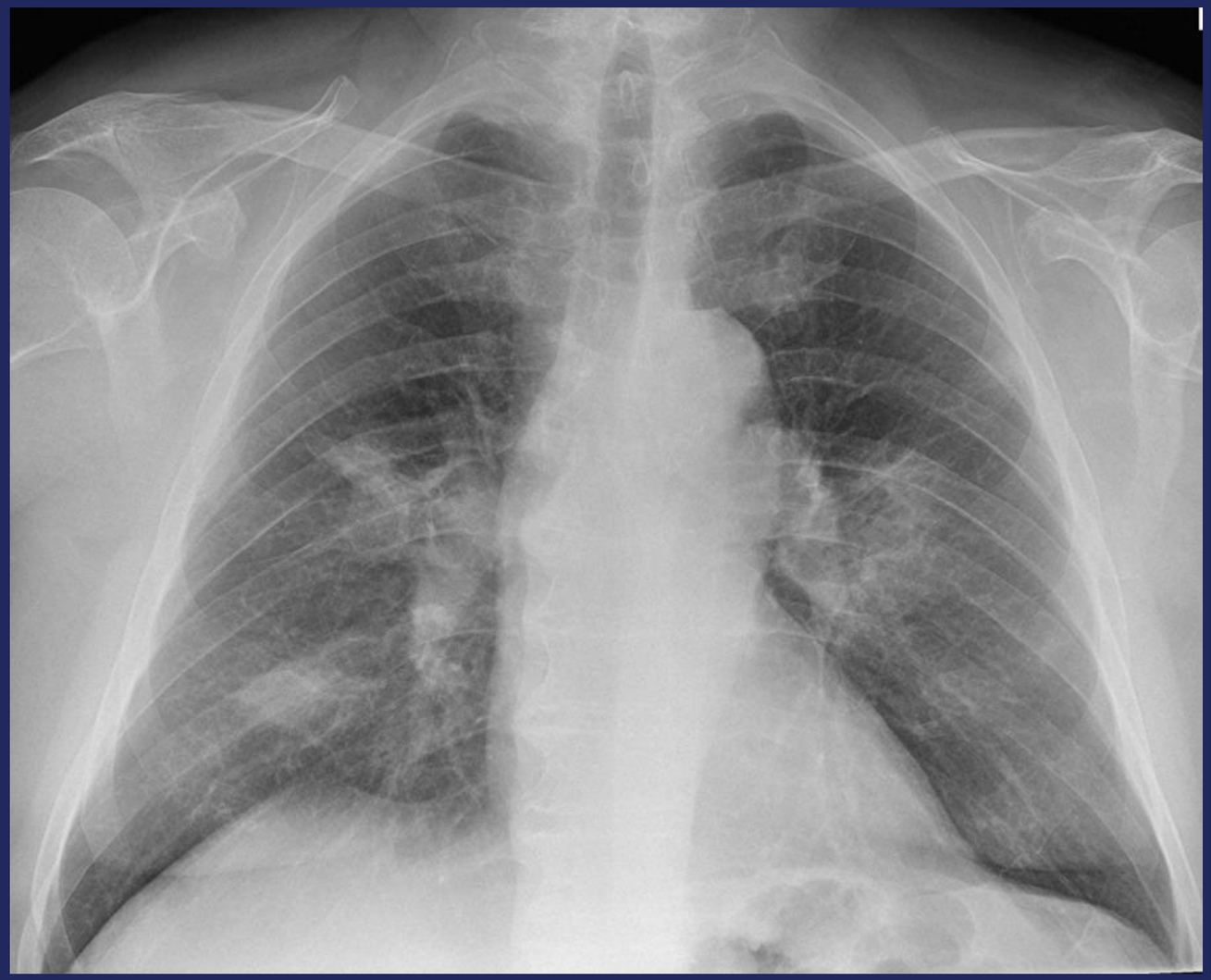
RUL sitting on the fissure with hilar adenopathy



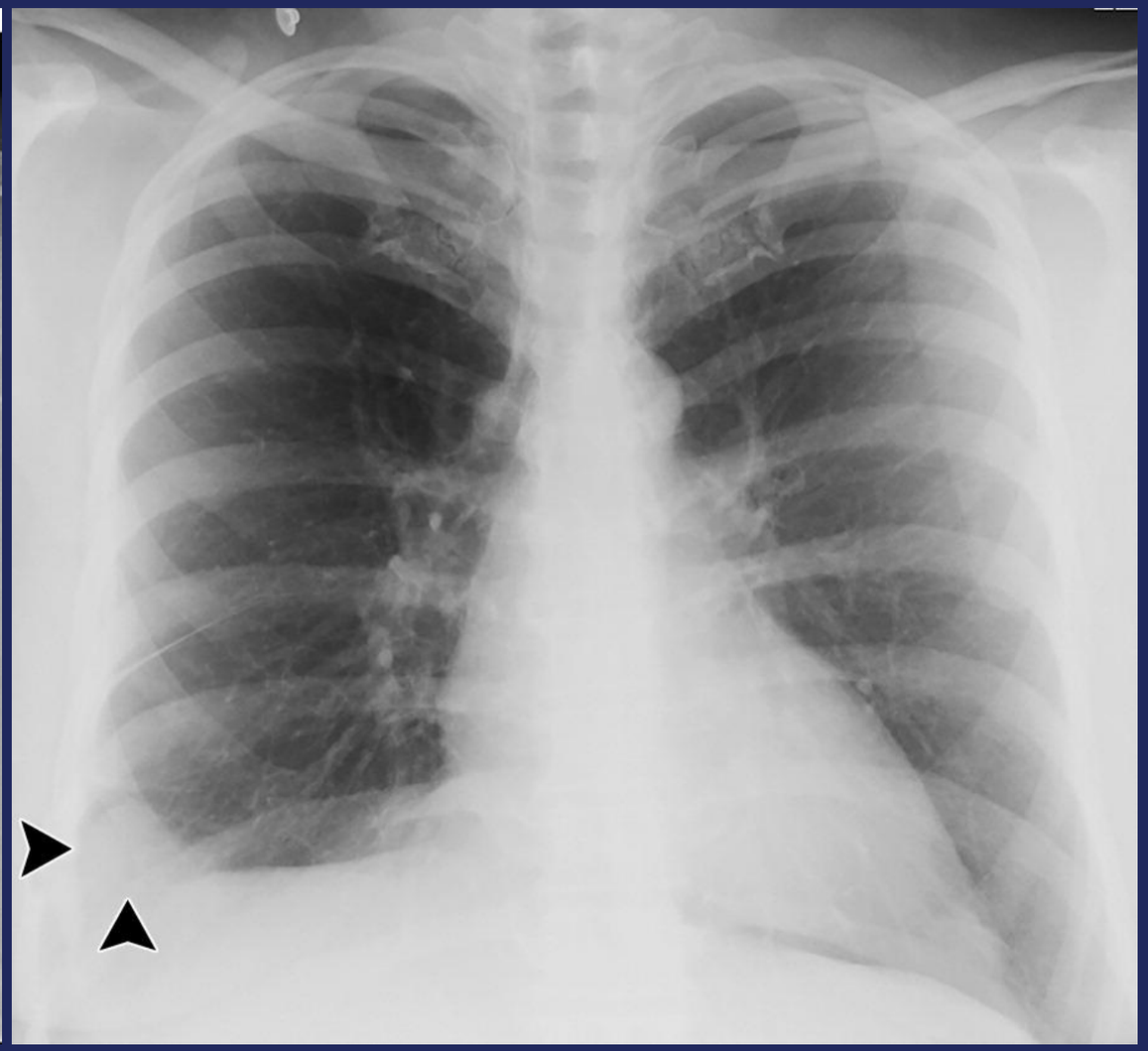
LUL

Valley Fever Institute

Pulmonary Cocci



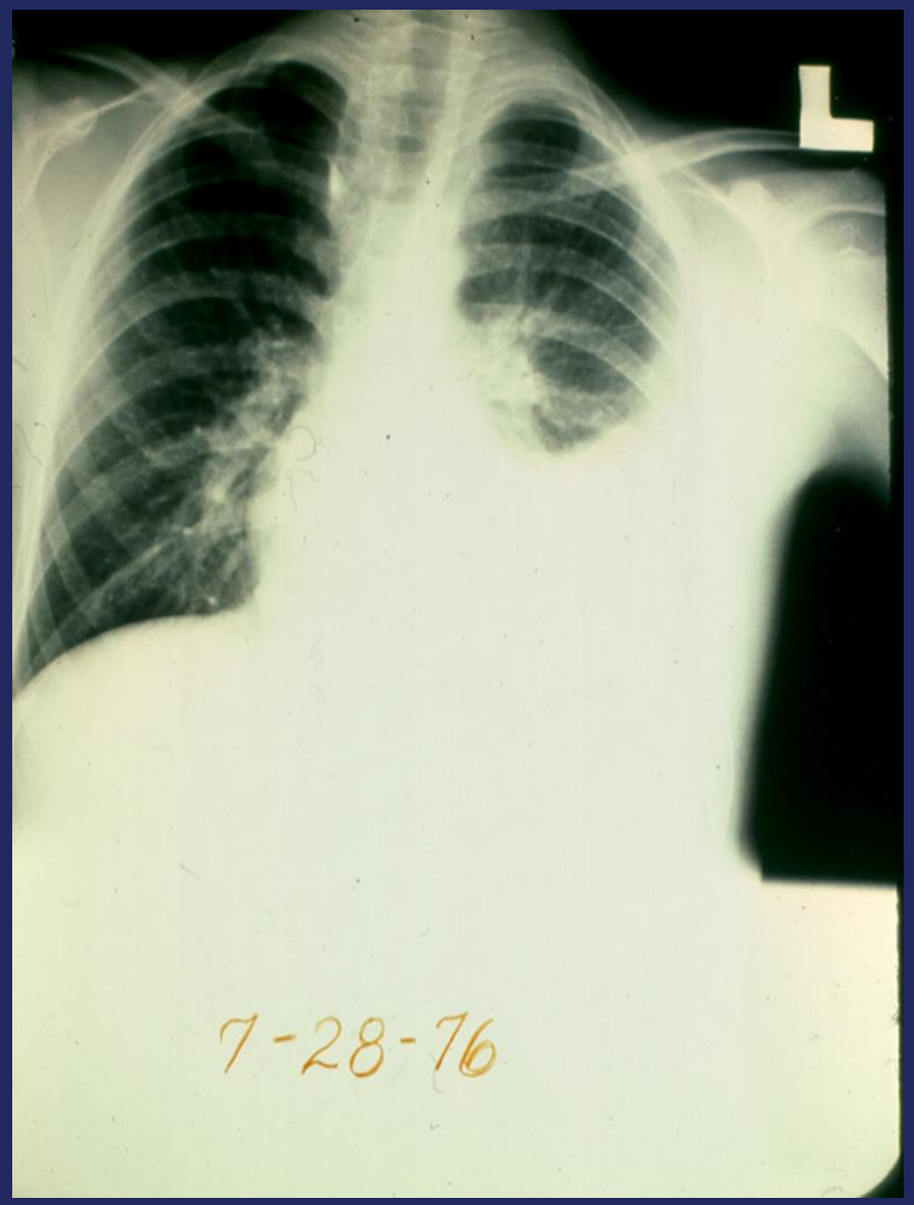
Bilateral Multifocal Consolidations



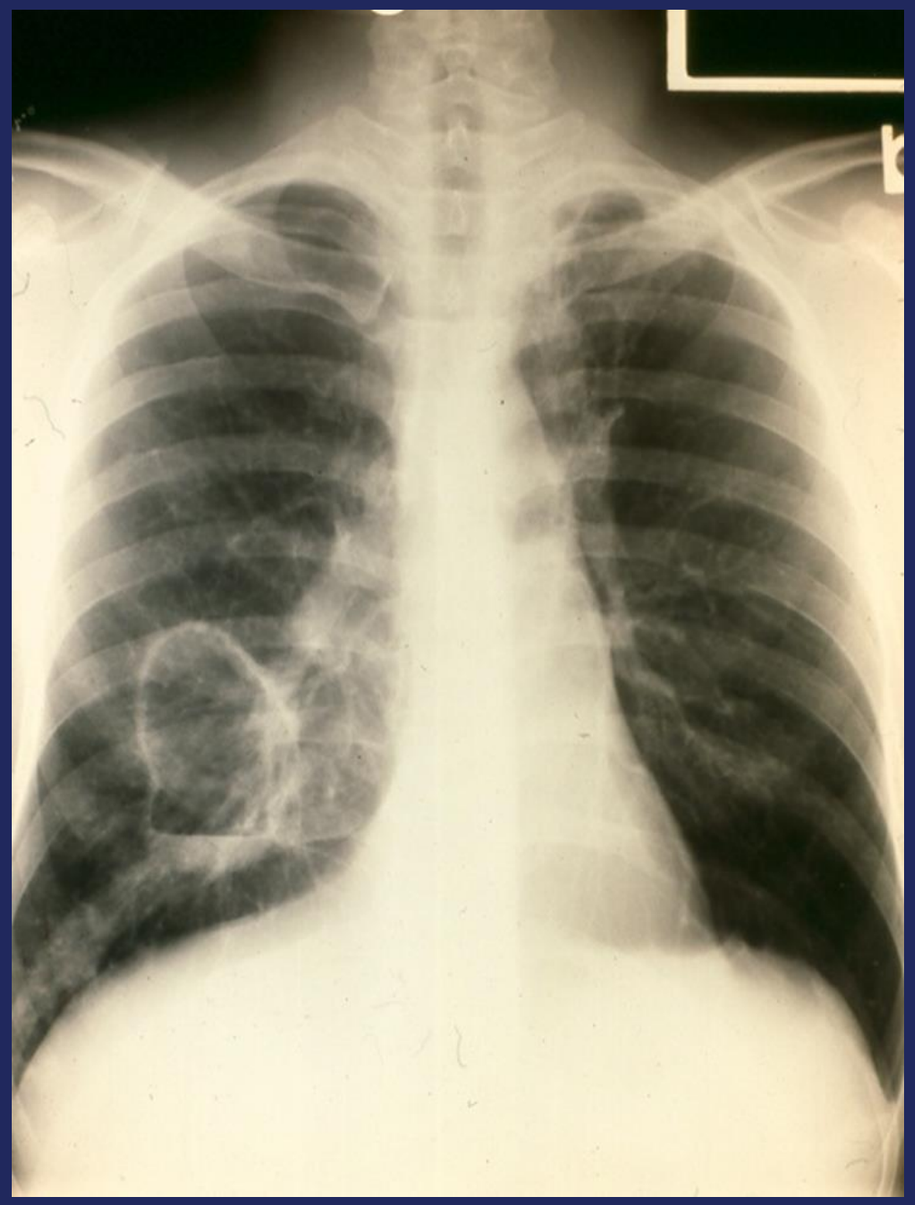
Nodular Opacity

Valley Fever Institute

Pulmonary Cocci



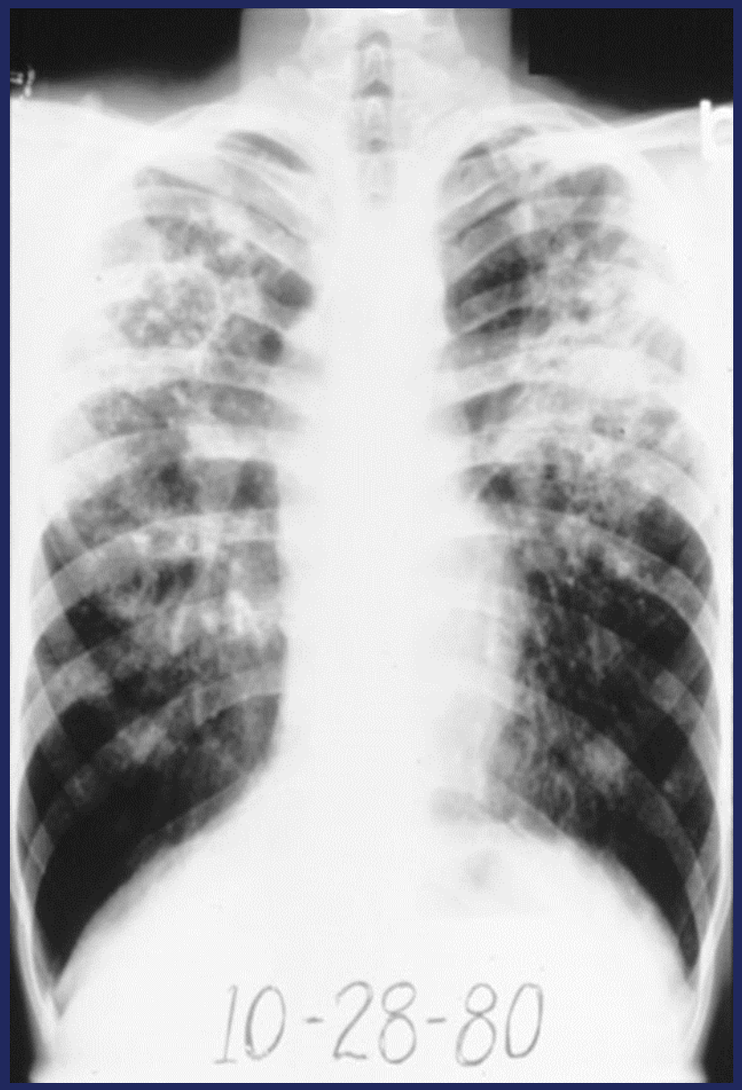
Pleural Effusion



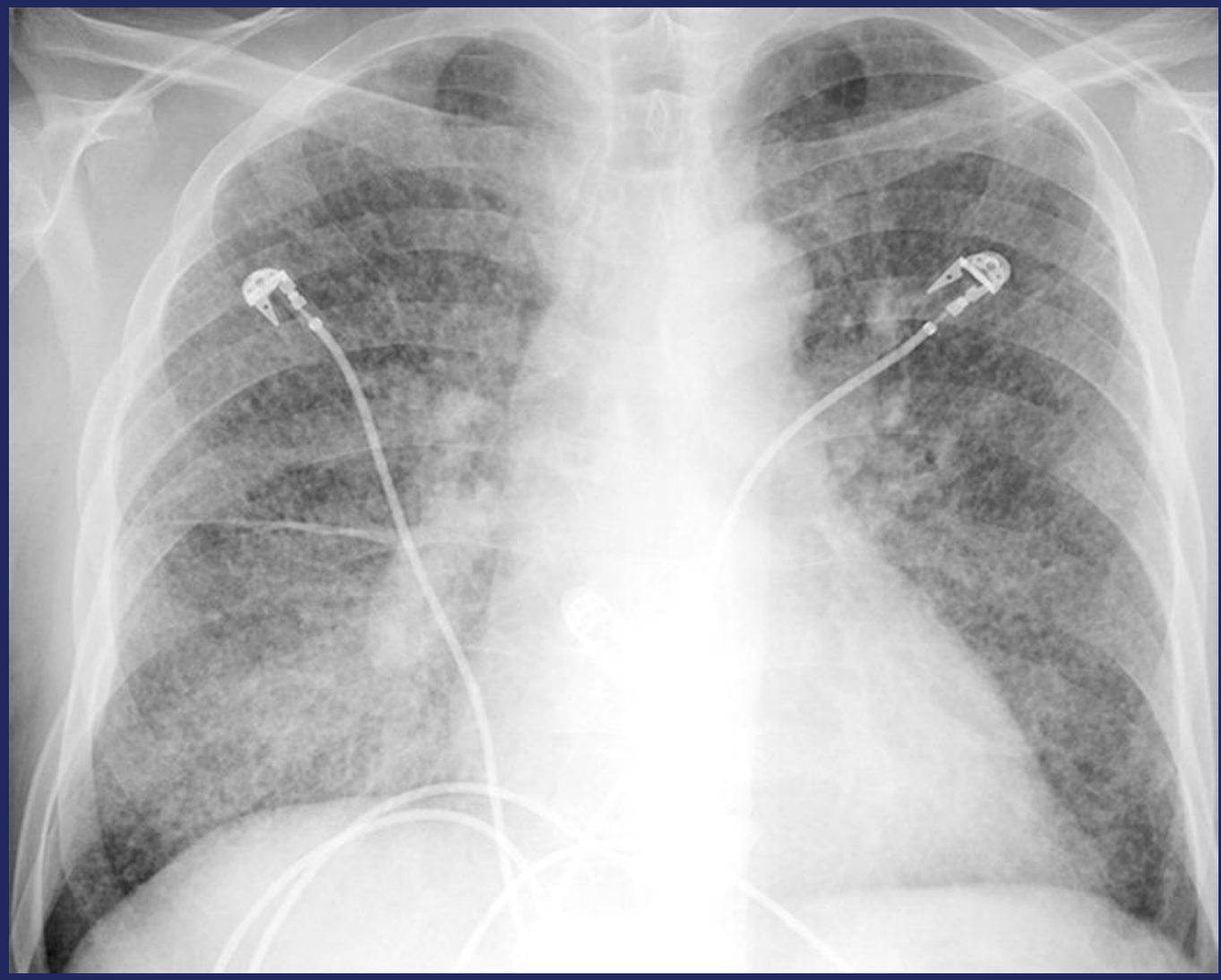
Cavity with Air Fluid Level

Valley Fever Institute

Pulmonary Cocci



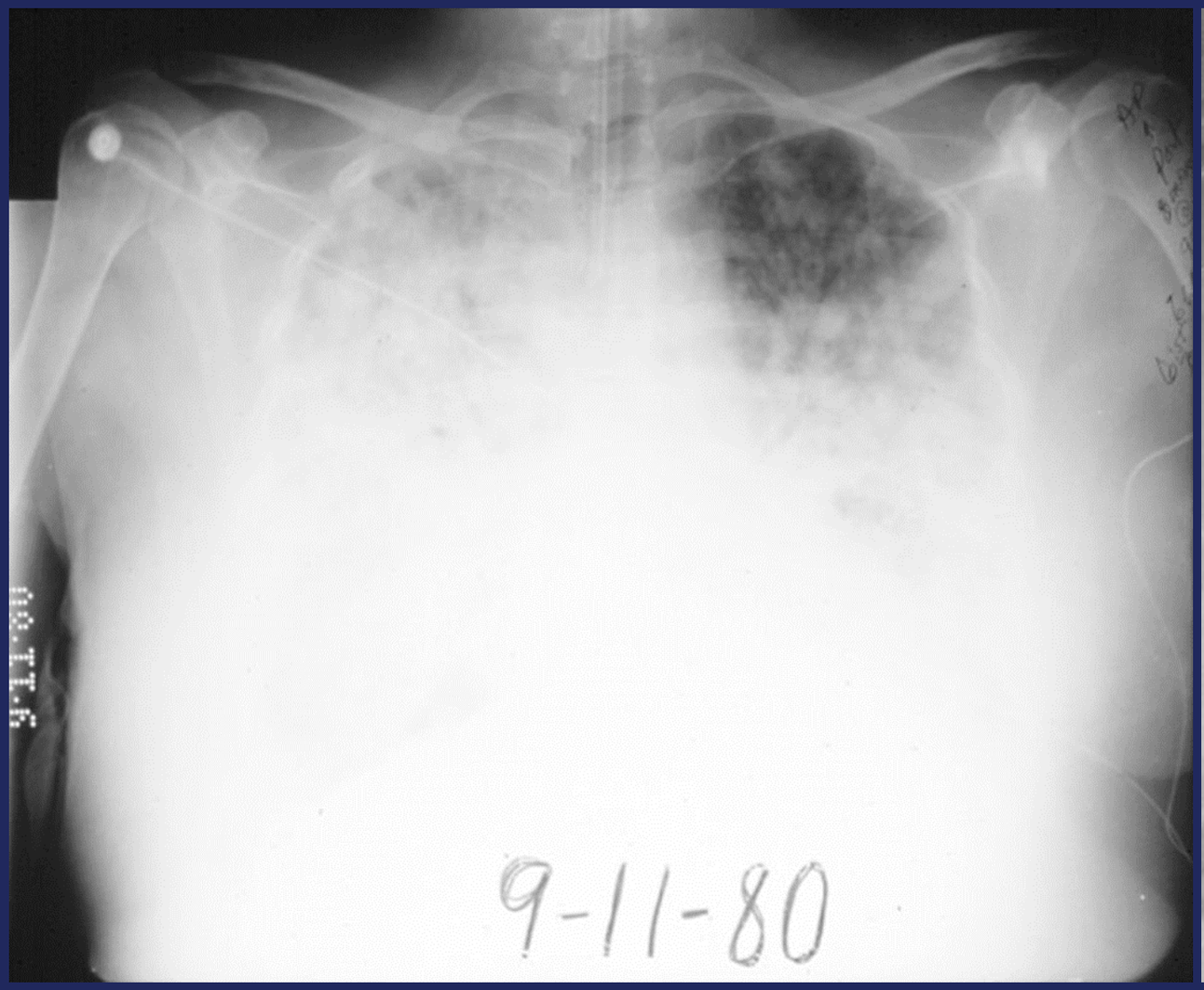
Fibro cavitary

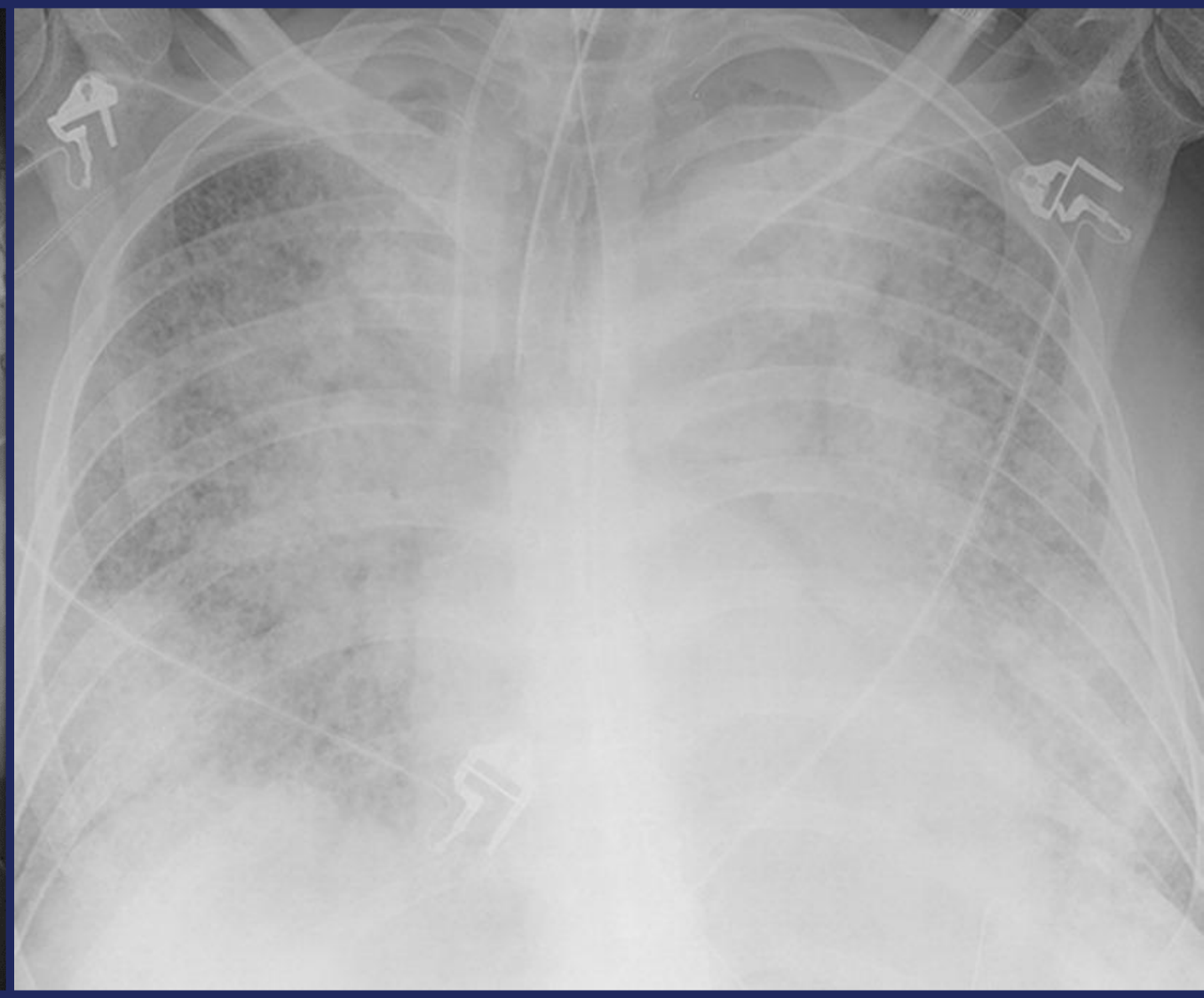


Miliary

Valley Fever Institute

Pulmonary Cocci



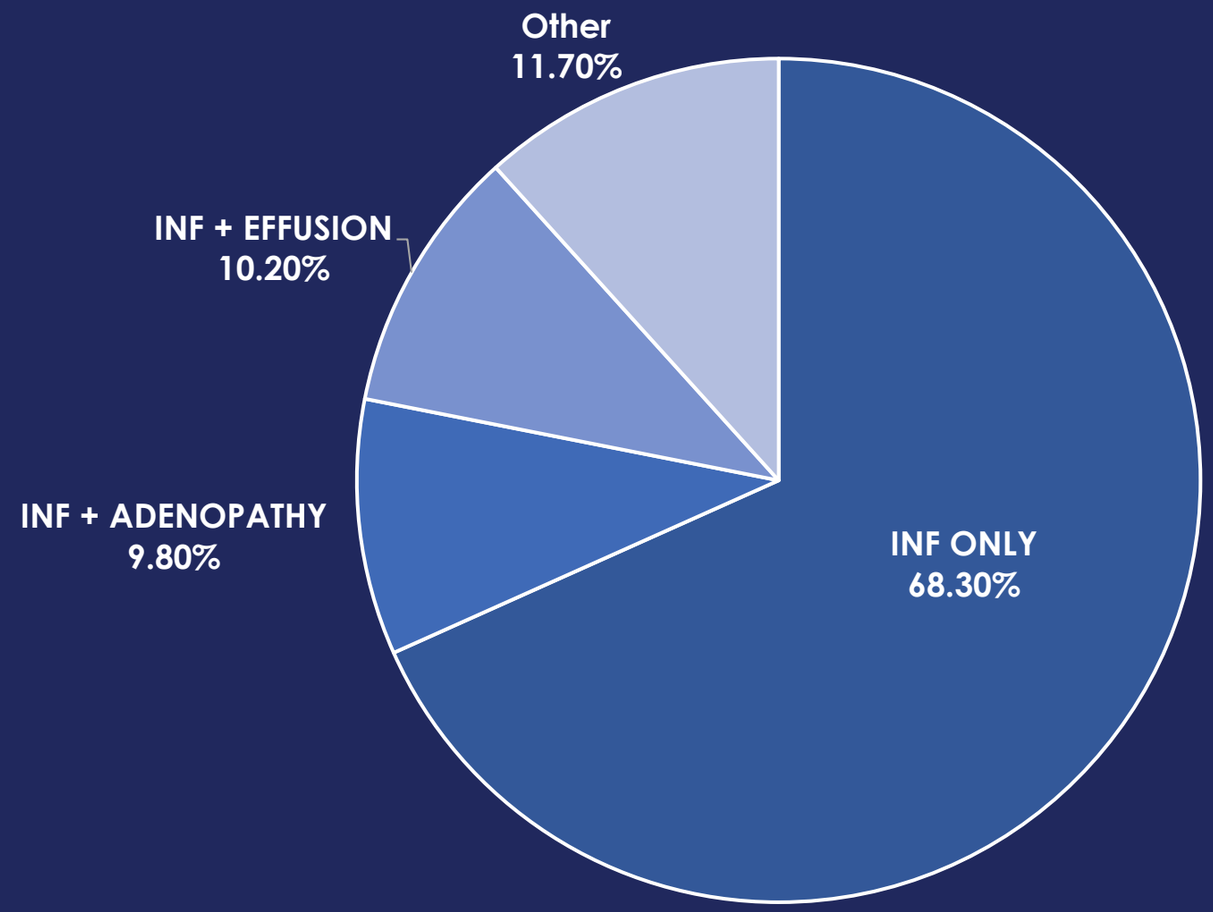


ARDS

Valley Fever Institute

Pulmonary Cocci

Radiographic Abnormalities



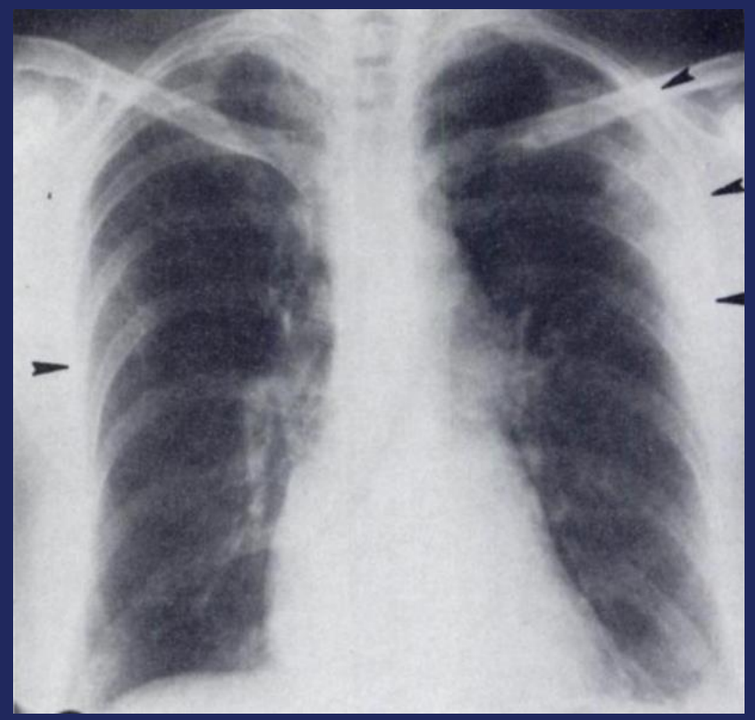
Note: Normal CXR	74/436	13.8%
CXR Not Done	52/536	9.7%

Valley Fever Institute

Ground Glass History

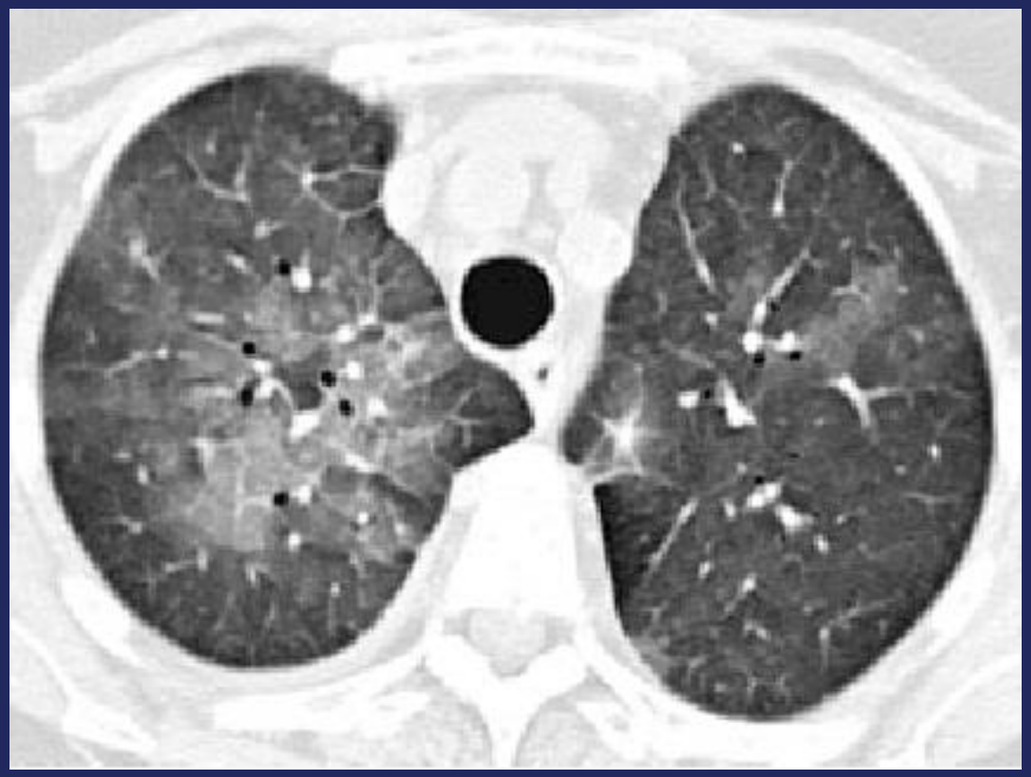
- 1976: A case of psittacosis from Japan…"Fun-shaped ground glass-like shadow"

- 1977: Chronic eosinophilic pneumonia
  "We added a category called:
  "ground glass"
  others have described as
  "amorphous airlessness"
  "Cloudy densities"
  "texture of haze or cloud"



Valley Fever Institute

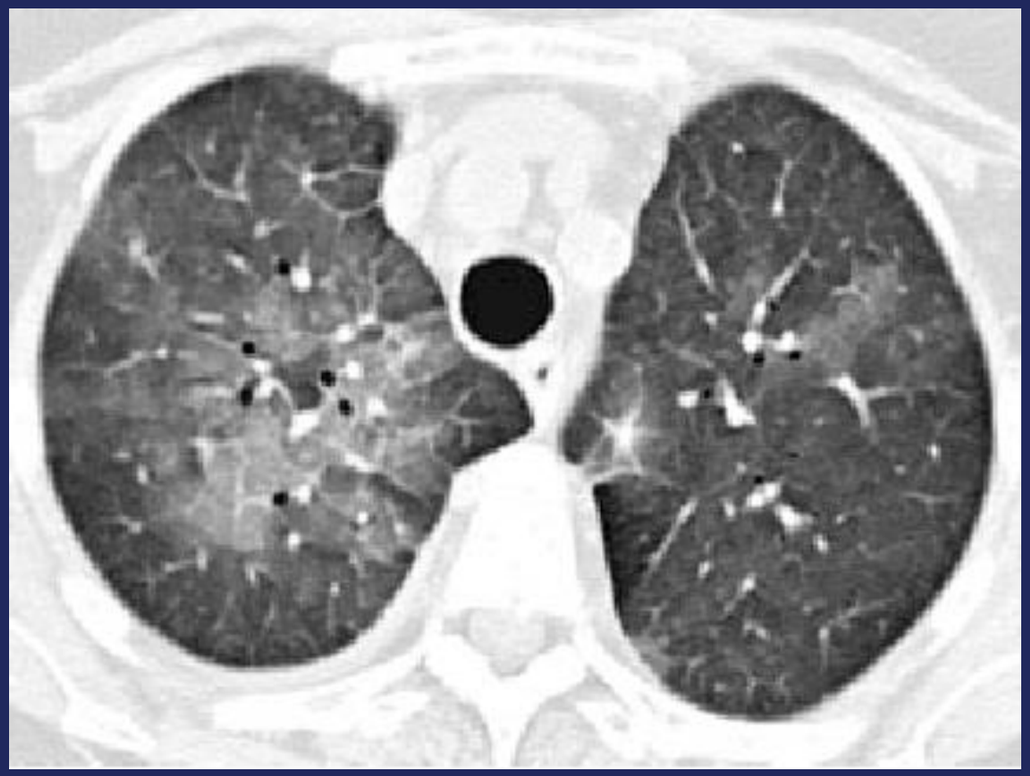
GGO Fleischner Society: 1984



Ground glass, adj.
Any extended, finely granular patten of pulmonary opacity within which normal anatomic details are partly obscured; from a fancied resemblance to etched or abraded glass

Valley Fever Institute

GGO Fleischner Society: 2008

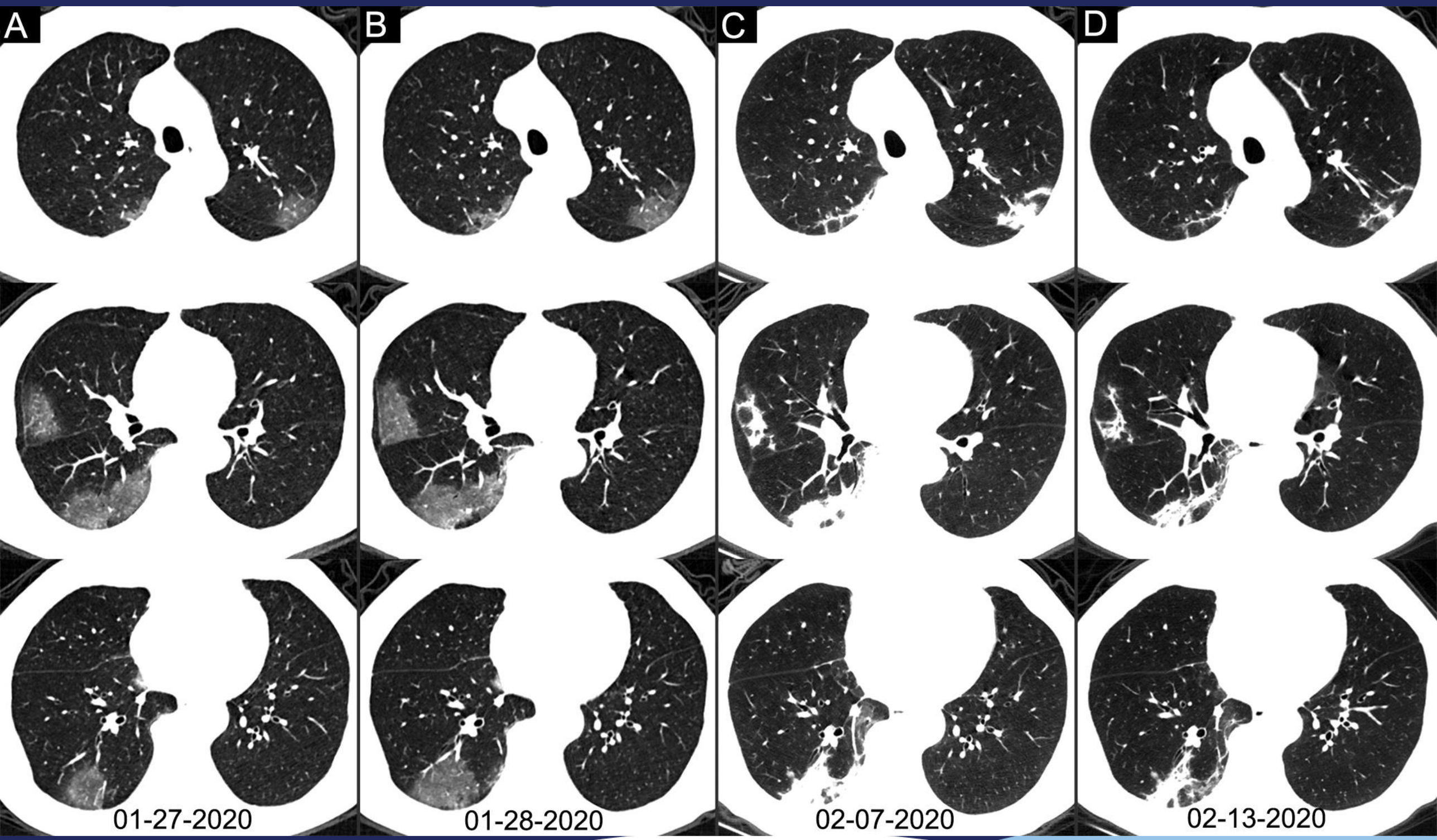


Chest x-ray: An area of hazy increased lung opacity margins of pulmonary vessels may be indistinct

CT Scan: hazy increased opacity of lung, with preservation of bronchial & vascular margins

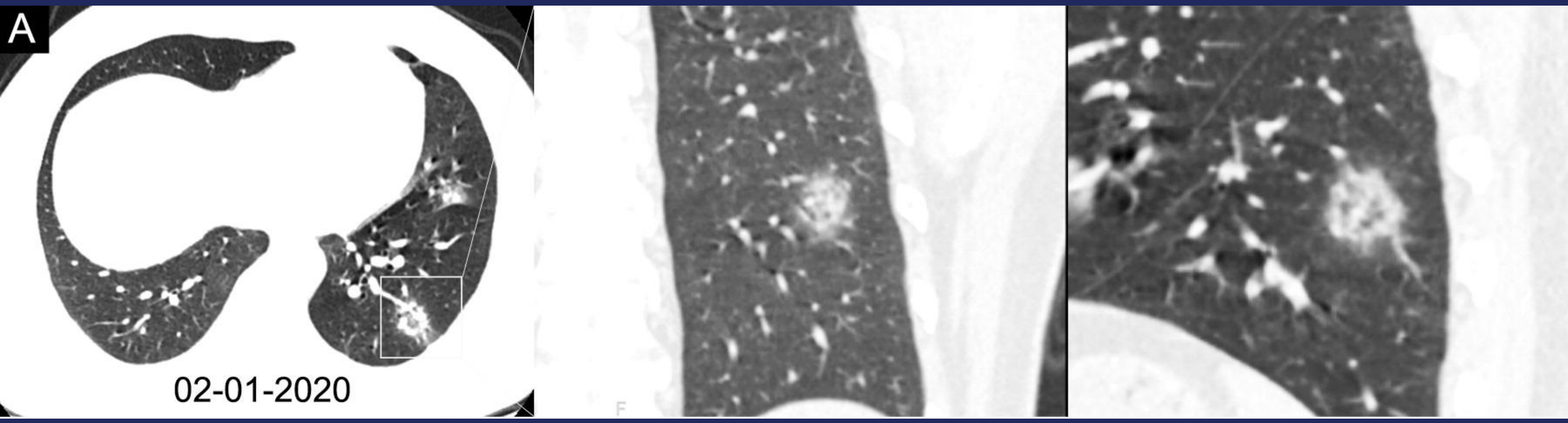
It is caused by partial filling of airspaces, interstitial thickening (due to fluid, cells, and/or fibrosis),partial collapse of alveoli, increased capillary blood volume, or a combination of these, the common factor being the partial displacement of air (59,60). Ground-glass opacity is less opaque than consolidation, in which broncho-vascular margins are obscured

SARS-CoV-2



Valley Fever Institute

SARS-CoV-2

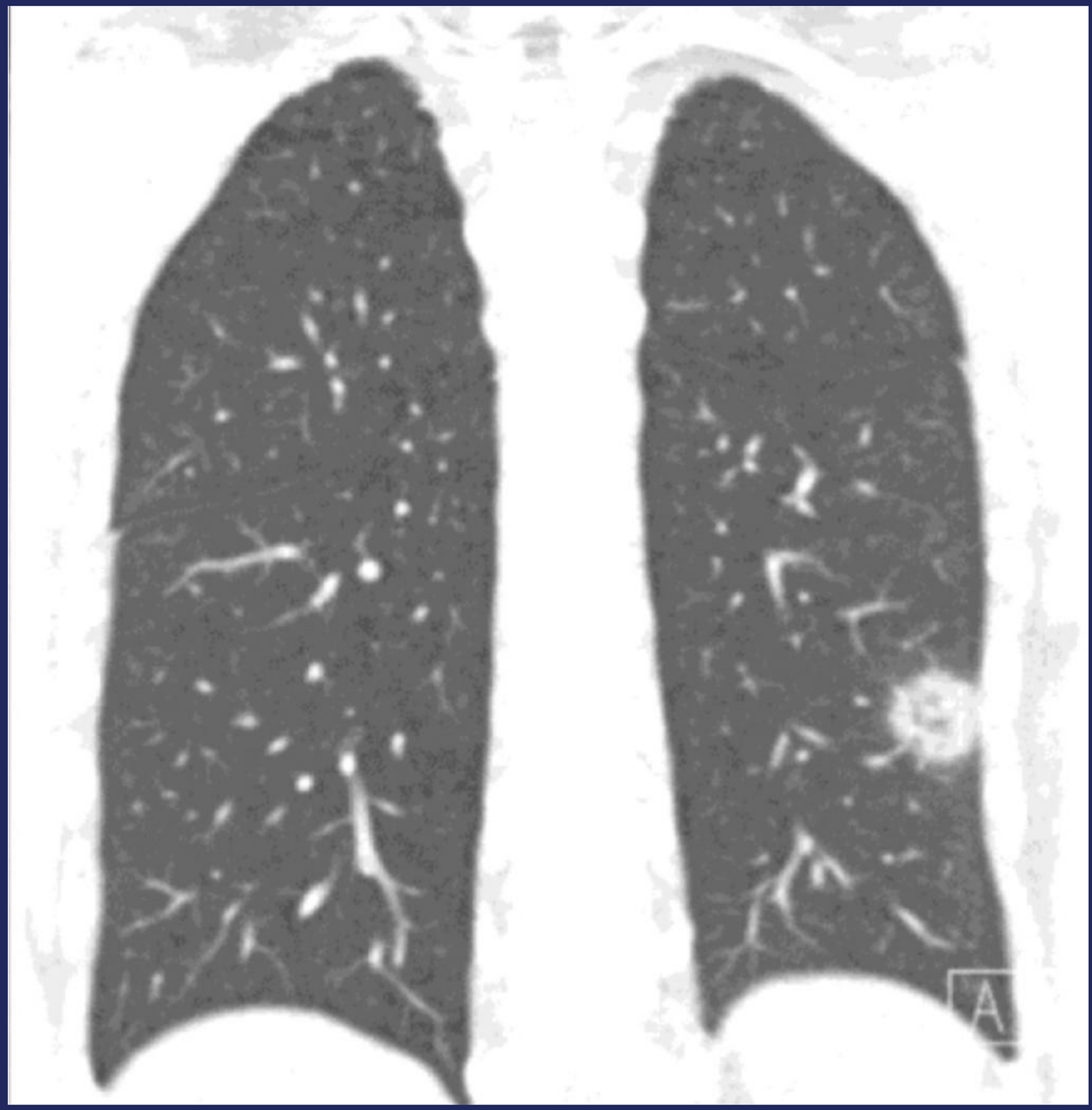


Nodule with reversed halo sign in left lower lobe

Valley Fever Institute

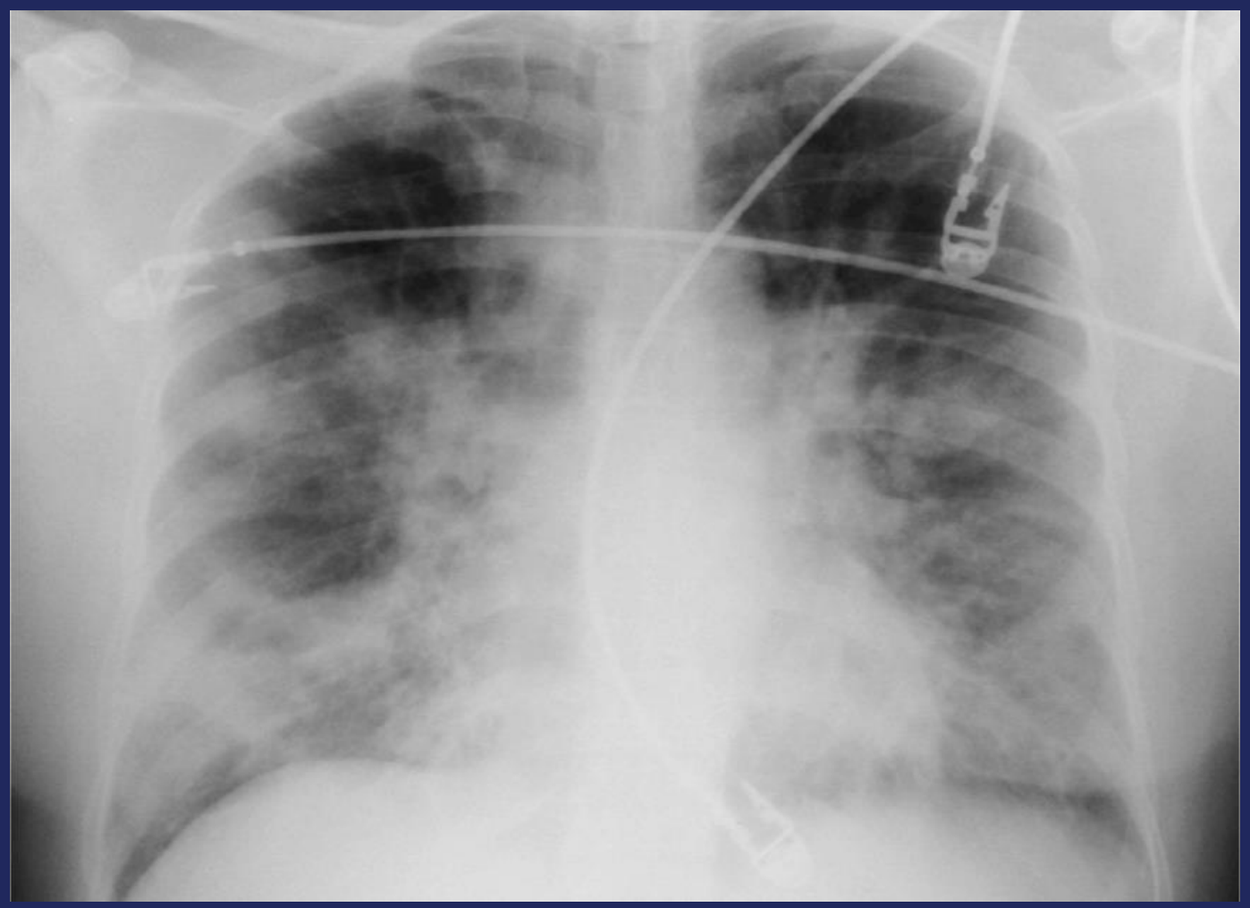
SARS-CoV-2

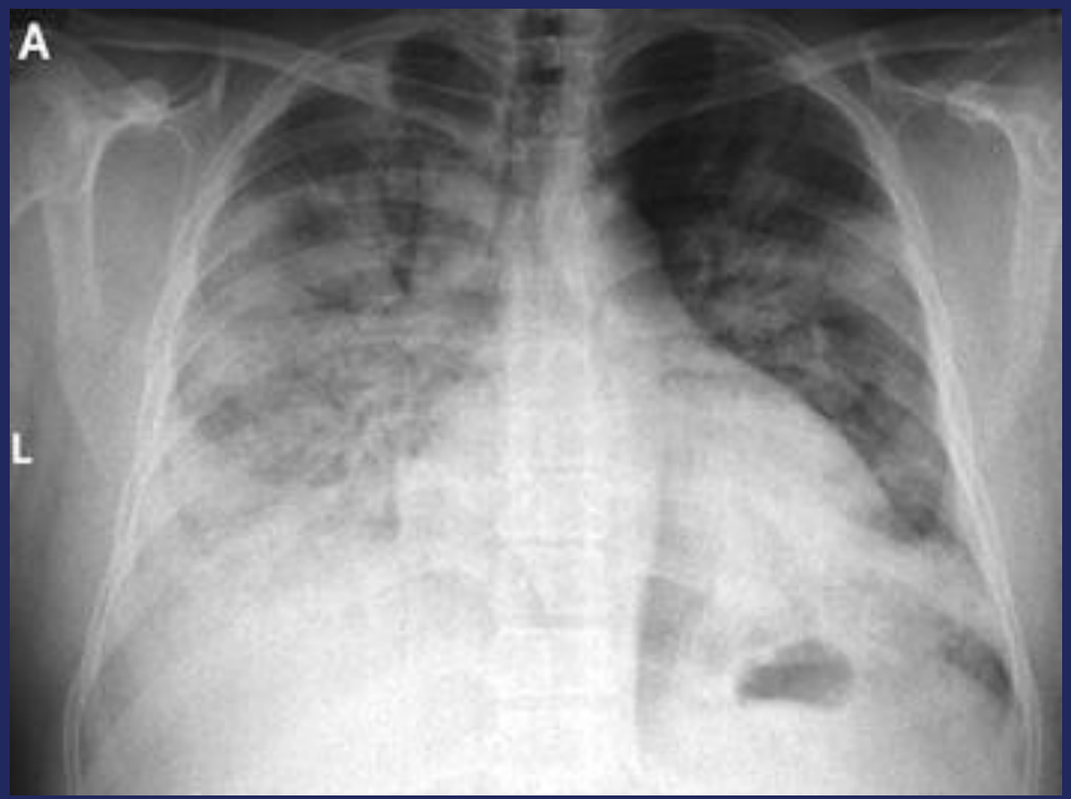
Nodule with reversed halo sign in left lower lobe

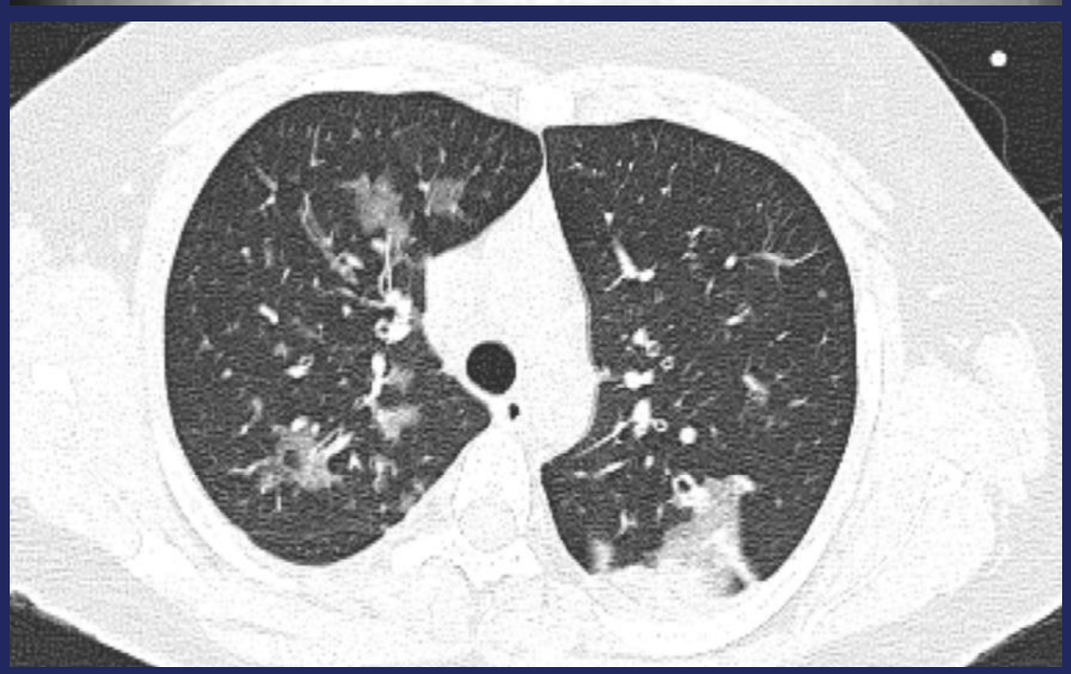


Valley Fever Institute

H1N1: 2009

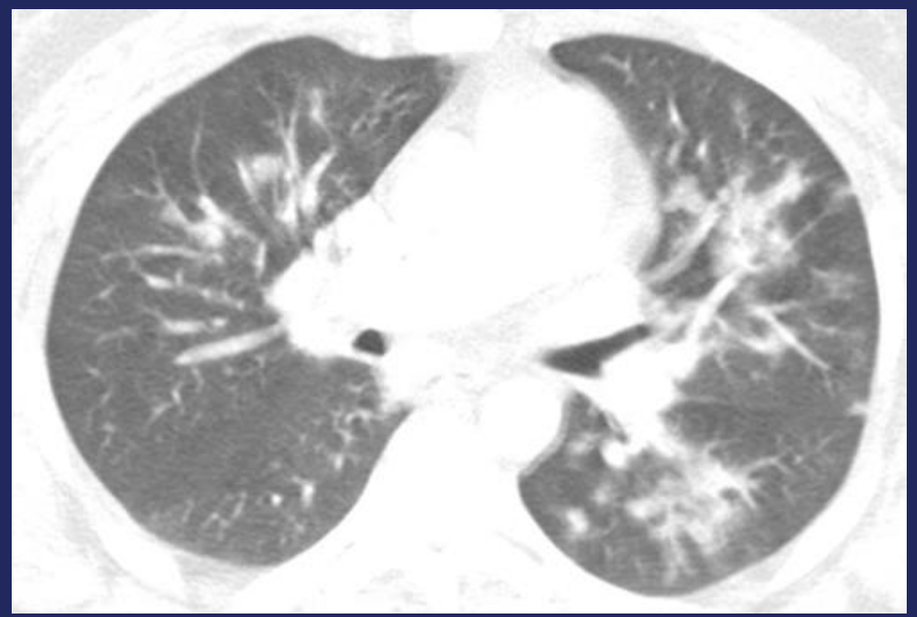


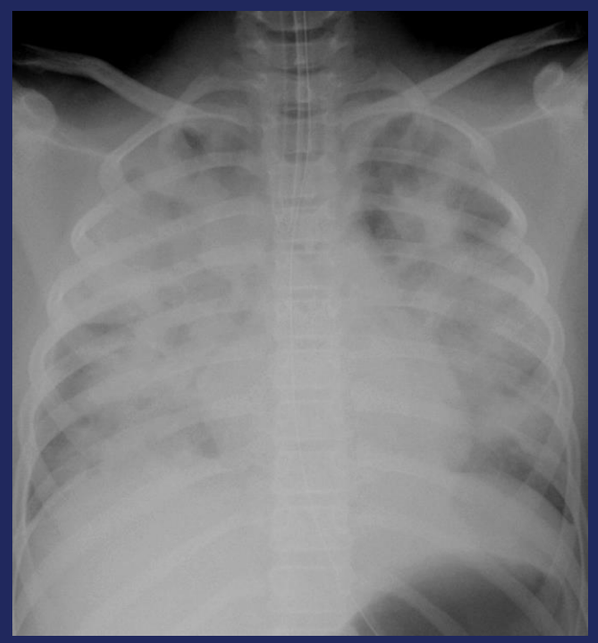


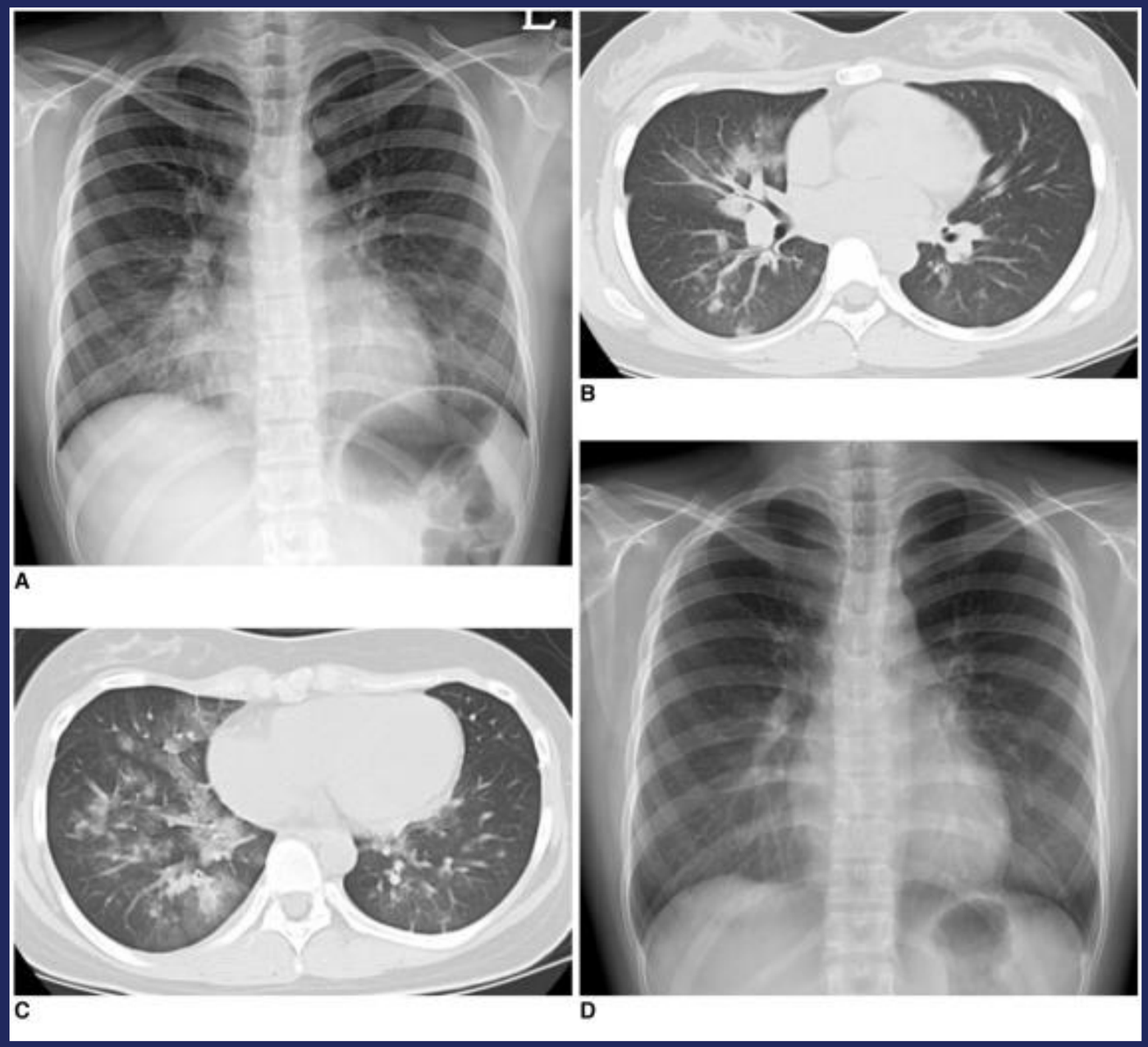


Valley Fever Institute

H1N1: 2009

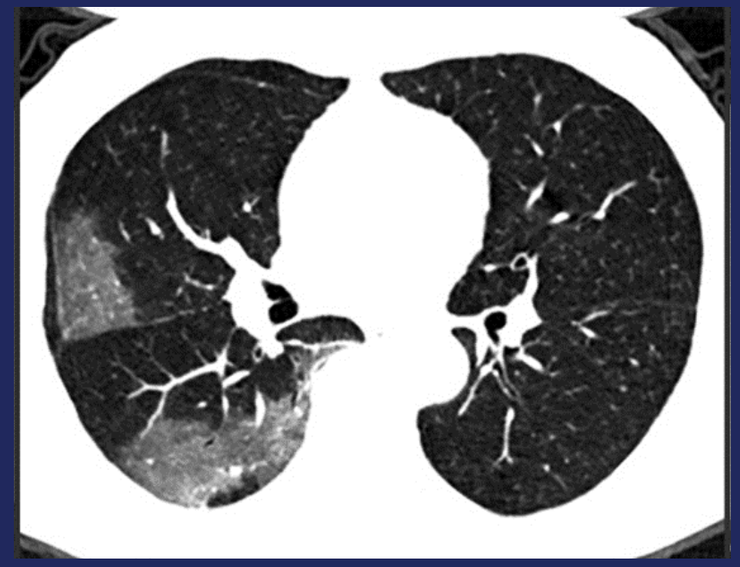




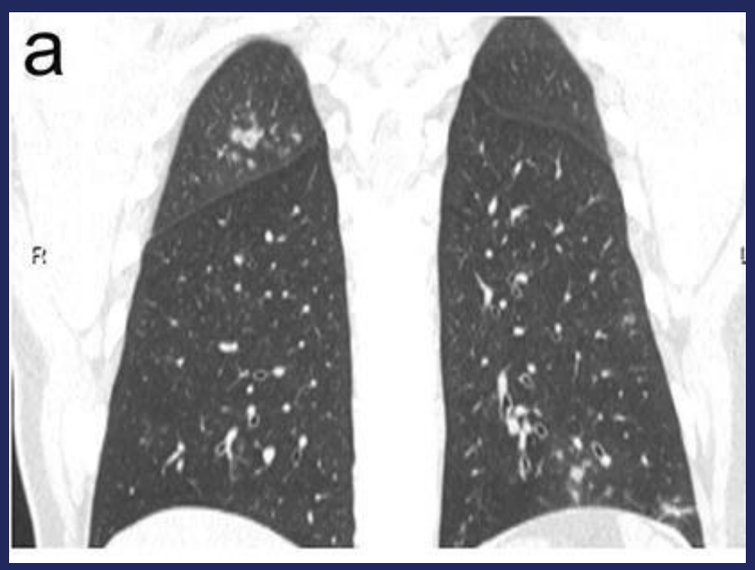


Valley Fever Institute

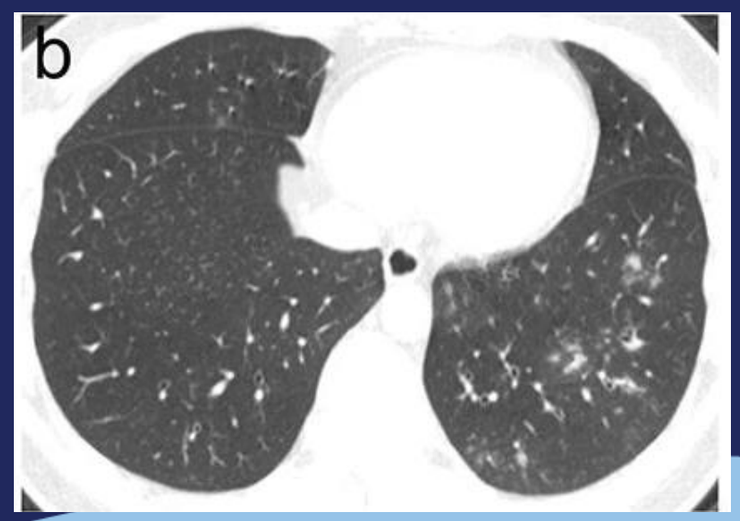
GGO with Clear Margins:
SARS-CoV-2



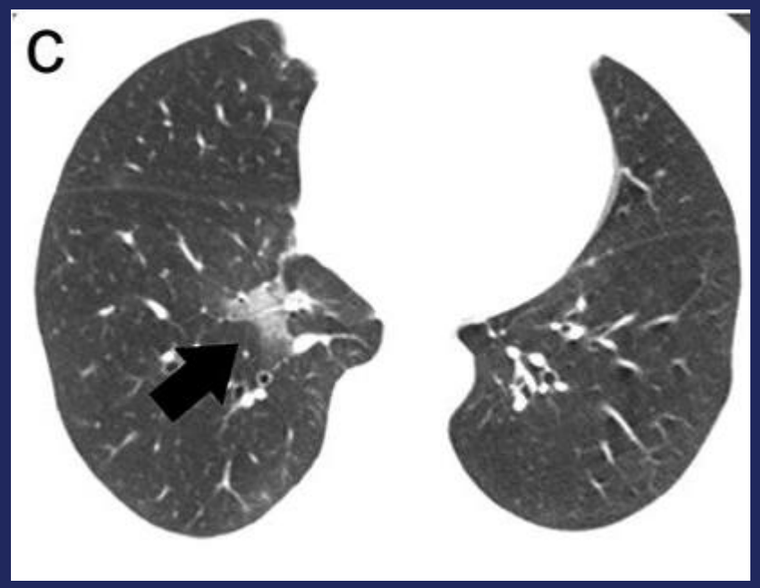
GGO Lesions	SARS-CoV-2	Influenza
Peripheral distribution	++	+
Location (lobes)	Balanced Multiple	More Inferior
With consolidation	+	+
Margins	>50% clear	vague
Pattern	Patchy	Cluster like
Shrinking contour	+	
Bronchial wall thickening		+



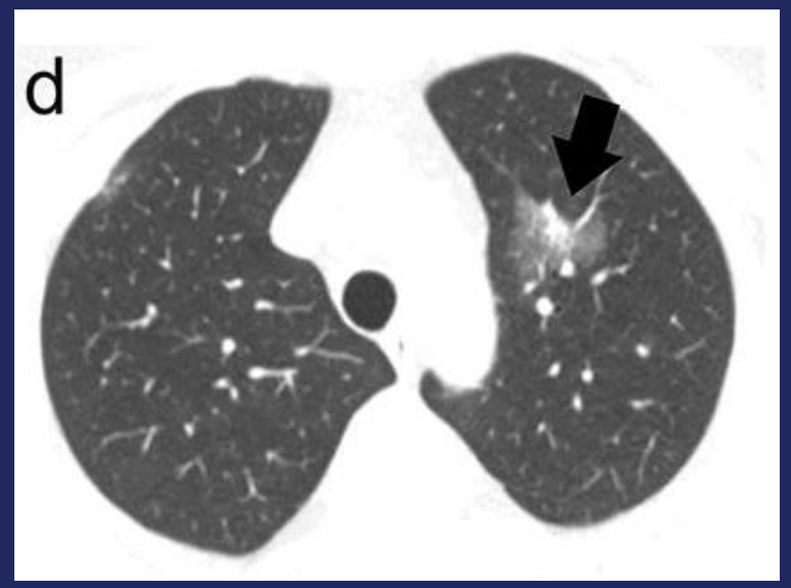
Cluster Like GGO:
Influenza



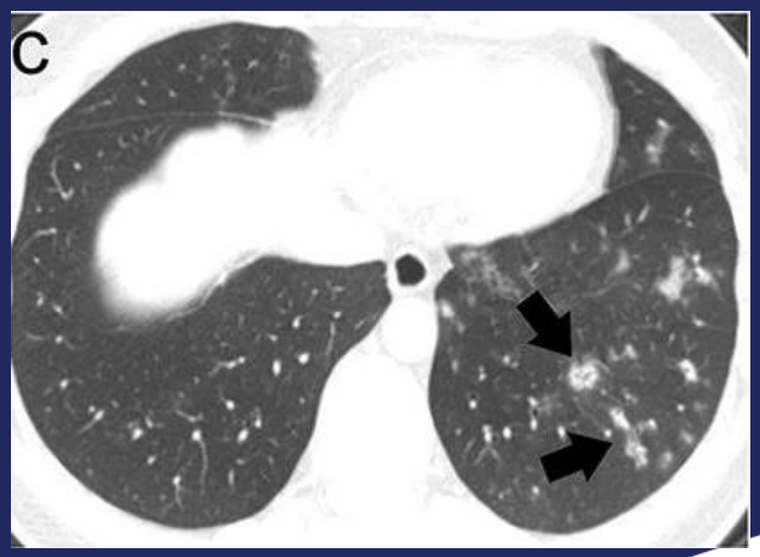
Valley Fever Institute



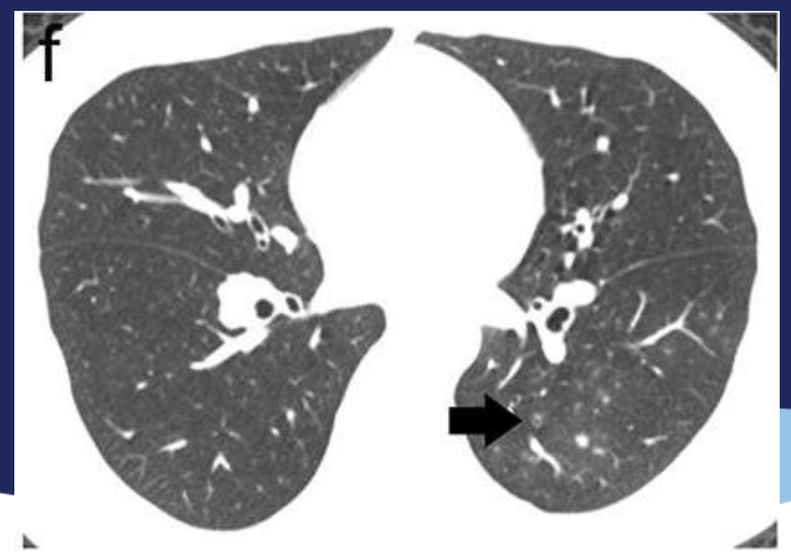
Shrinking Contour: SARS-CoV-2



GGO Lesions	SARS-CoV-2	Influenza
Peripheral distribution	++	+
Location (lobes)	Balanced Multiple	More Inferior
With consolidation	+	+
Margins	>50% clear	vague
Pattern	Patchy	Cluster like
Shrinking contour	+	
Bronchial wall thickening		+

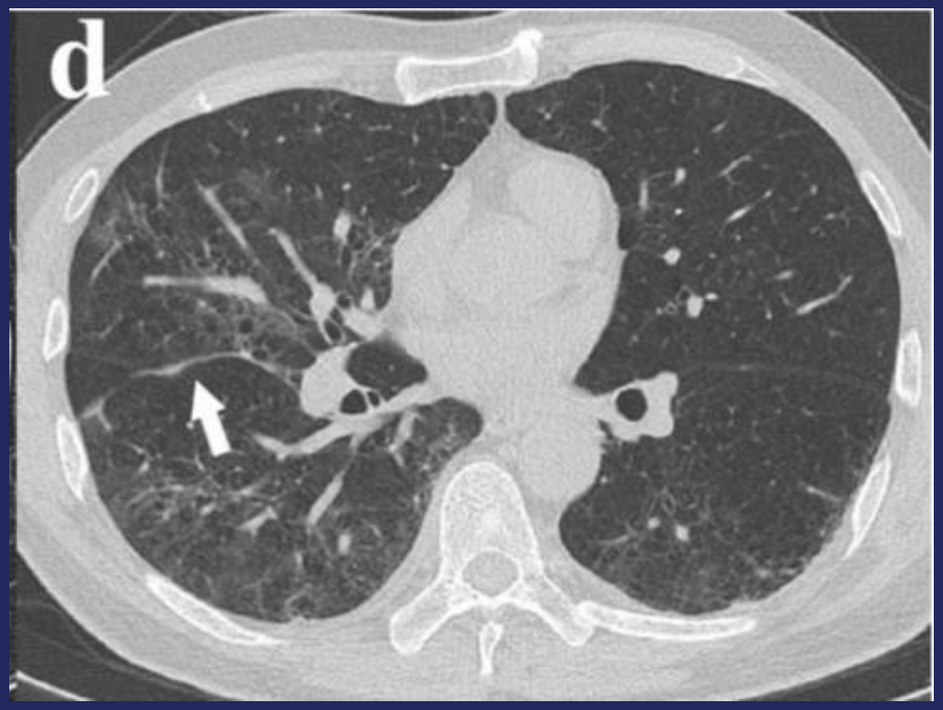


Bronchial Wall Thickening: Influenza



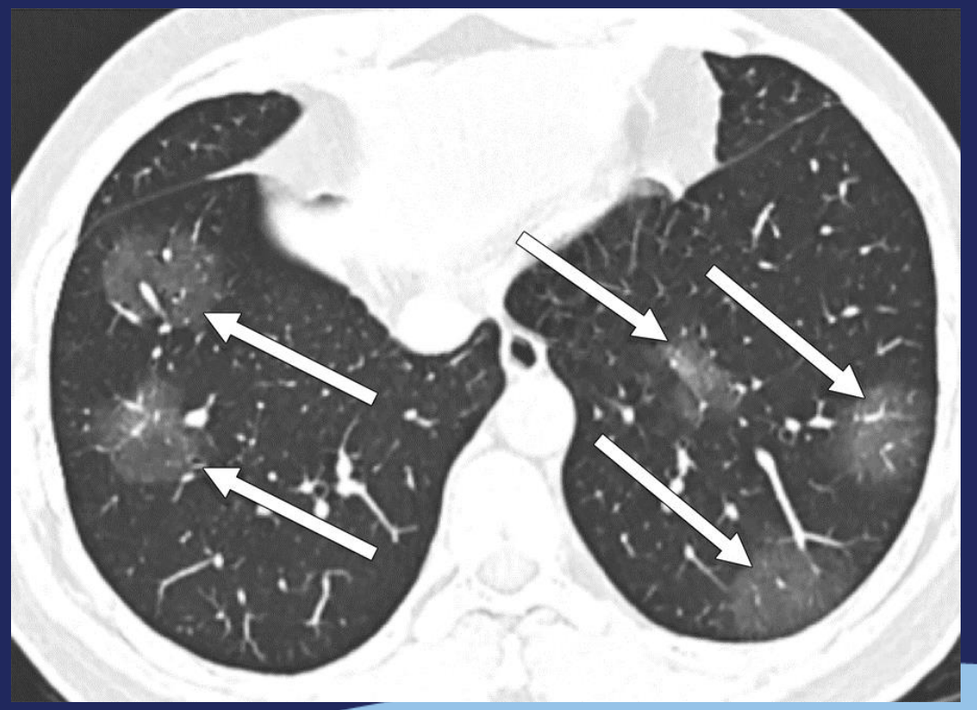
Valley Fever Institute

CT Characteristics	SARS-CoV-2	Influenza
Rounded GGO	+	
Nodules		+
Tree-in-bud sign		+
Intralobular Septal thickening	+	
Pleural effusion		+
Pure GGO with no nodules	+++	
Pure GGO with Intralobular Septal thickening	++	
Rounded GGO with no nodules	++	
Intralobular Septal thickening with no nodules	+++	
Rounded GGO with Intralobular Septal thickening with no pleural effusion	++	



Rounded GGO:
SARS-CoV-2

Intralobular Septal Thickening

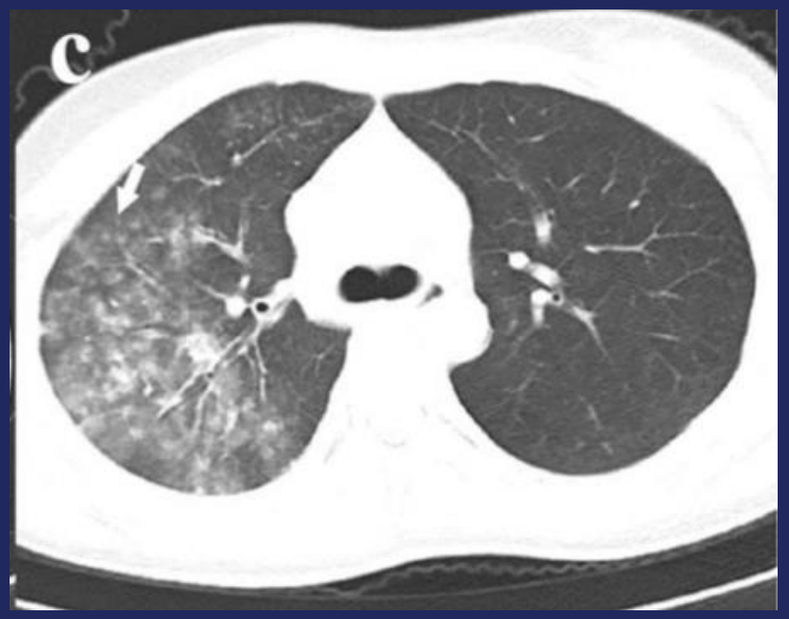


Valley Fever Institute

CT Characteristics	SARS-CoV-2	Influenza
Rounded GGO	+	
Nodules		+
Tree-in-bud sign		+
Intralobular Septal thickening	+	
Pleural effusion		+
Pure GGO with no nodules	+++	
Pure GGO with Intralobular Septal thickening	++	
Rounded GGO with no nodules	++	
Intralobular Septal thickening with no nodules	+++	
Rounded GGO with Intralobular Septal thickening with no pleural effusion	++	

Nodules &
Tree-in-Bud Sign:

Influenza



Valley Fever Institute

SAnds PPC

- An observational **S**tudy to **A**ssess the Prevale**n**ce an**d** Outcome**s** of **P**rimary **P**ulmonary **C**occidioidomycosis in Persons Aged >14 years Presenting with Community Acquired Pneumonia (CAP) in Endemic Areas

- Identify CAP patient or patient with Newly diagnosed CAP & Cocci

- Study Phone line at (**661) 706-6748**

- Research Team will determine participant eligibility and reach out to them if they qualify

NIH U.S. National Library of Medicine
ClinicalTrials.gov

Duke Human Vaccine Institute
Duke University School of Medicine

Valley Fever Institute

References

(Slide 19) CDC.gov

(Slide 20) Dr. Royce Johnson
Pulmonary Coccidioidomycosis:Pictorial Review of Chest Radiographic and CT Findings Cecilia M. Jude RadioGraphics 2014

(Slide 21) Pulmonary Coccidioidomycosis:Pictorial Review of Chest Radiographic and CT Findings Cecilia M. Jude RadioGraphics 2014

(Slide 22) Dr. Royce Johnson

(Slide 23) Dr. Royce Johnson: Pulmonary Coccidioidomycosis:Pictorial Review of Chest Radiographic and CT Findings Cecilia M. Jude RadioGraphics 2014

(Slide 24) Dr. Royce Johnson
Pulmonary Coccidioidomycosis:Pictorial Review of Chest Radiographic and CT Findings Cecilia M. Jude RadioGraphics 2014

(Slide 25) Dr. Royce Johnson

(Slide 26) [A case of psittacosis treated with rifampicin (author's transl)]. Kanazawa Y, Suga S, Niwayama S Jpn J Antibiot. 1976 Jun;29(6):601
Peripheral opacities in chronic eosinophilic pneumonia: the photographic negative of pulmonary edema EA Gaensler and CB Carrington: American Journal of Roentgenology. 1977

(Slide 27) Fleischner Society: Glossary of Terms for Thoracic Radiology; Tottenham W.J; AJR September 1984

(Slide 28) Fleischner Society:Glossary ofTerms for Thoracic Imaging David M. Hansell, Radiology RSNA March 2008

(Slide 29) Correlation of Chest CT and RT-PCR Testing for Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases Tao Ai; Radiology Feb 2020

(Slide 30) Correlation of Chest CT and RT-PCR Testing for Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases Tao Ai; Radiology Feb 2020

(Slide 32) Pneumonia and Respiratory Failure from Swine-Origin Influenza A (H1N1) in Mexico NEJM Rogelio Perez-Padilla August 2009

(Slide 33) Pulmonary Complication of Novel Influenza A (H1N1) Infection: Imaging Features in Two Patients Choong Wook Lee October 2009
Chest radiographic and CT findings in novel swine-origin influenza A (H1N1) virus (S-OIV) infection Prachi P Agarwa December of 2009
Swine-Origin Influenza A (H1N1) Viral Infection in Children: Initial Chest Radiographic Findings Edward Y. Lee February 2010

(Slide 34) Characteristic CT findings distinguishing 2019 novel coronavirus disease (COVID-19) from influenza pneumonia, Hao Wang, April 2020 European Radiology

(Slide 35) Characteristic CT findings distinguishing 2019 novel coronavirus disease (COVID-19) from influenza pneumonia, Hao Wang, April 2020 European Radiology

(Slide 36) COVID-19 pneumonia: CT findings of 122 patients and differentiation from influenza pneumonia; Mengqi Lie, ; Apriil 2020, European Radiology

(Slide 37) COVID-19 pneumonia: CT findings of 122 patients and differentiation from influenza pneumonia; Mengqi Lie, ; Apriil 2020, European Radiology

Valley Fever Institute
at Kern Medical

Questions?

Valley Fever Institute
at Kern Medical

Thank You

ValleyFeverInstitute.com

FOLLOW US ON SOCIAL MEDIA

facebook.com/ValleyFeverInstitute

instagram.com/ValleyFeverInstitute