

Outbreak of Severe Histoplasmosis Among Tunnel Workers — Dominican Republic, 2015

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Western States Occupational Network —
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Outbreak in Dominican Republic

- Sep 4:** potential outbreak of febrile illness (leptospirosis) in **Sabana Iglesia** reported to Ministry of Health (MoH)
- 30 previously healthy men



Tavera-Bao Dam



Outbreak in Dominican Republic

Sep 8: Company transfers all patients to **Santiago**; histoplasmosis suggested; anti-fungal treatment initiated

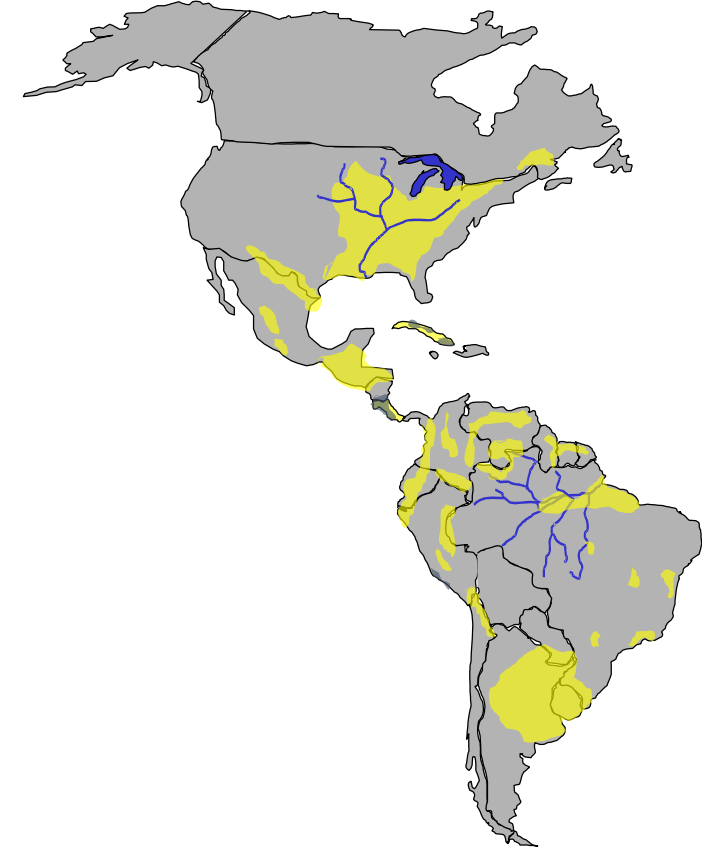
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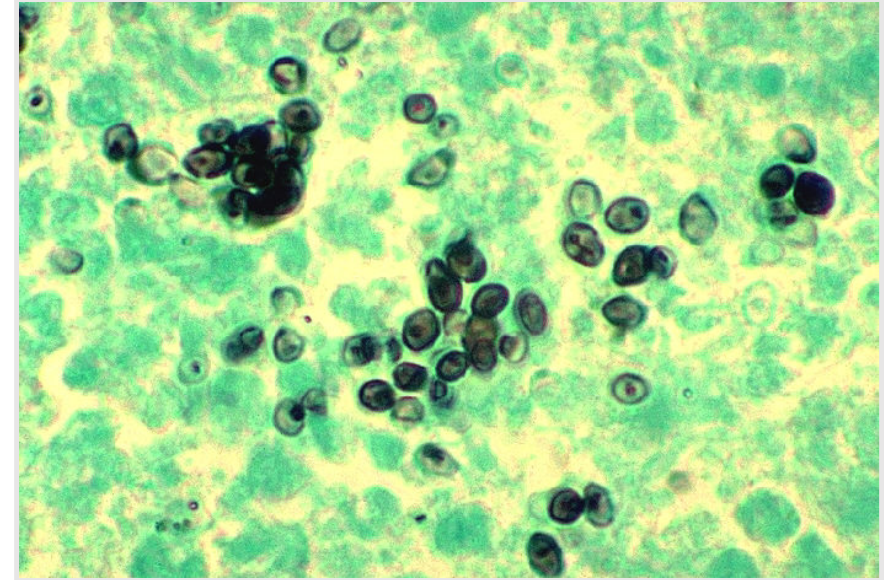
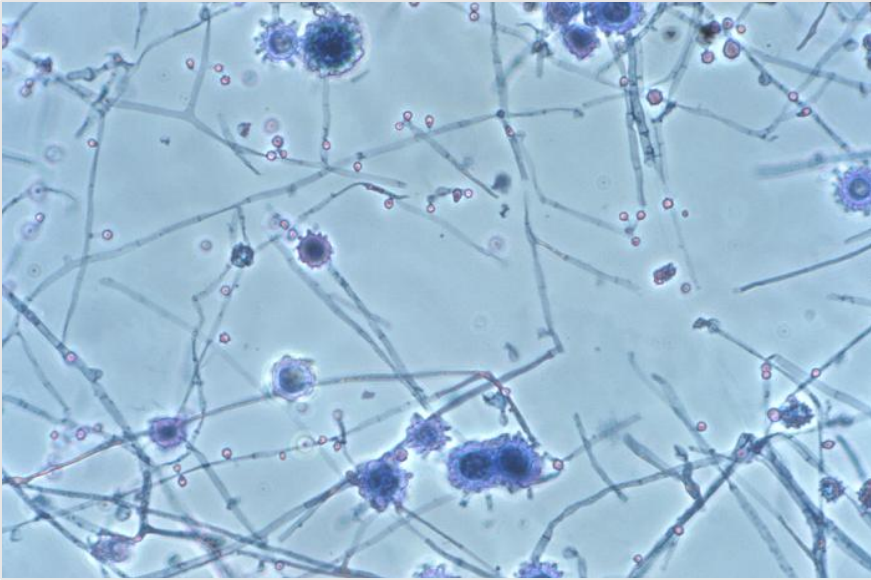


Histoplasma Capsulatum

- Spores reproduce in soil with high nitrogen content
 - Bat guano, bird droppings
 - Caves, tunnels, under trees
 - Released when soil is disturbed
 - Endemic to Americas



H. Capsulatum → Histoplasmosis



Spores
in soil

Inhaled

Infection

Histoplasmosis

Asymptomatic	Acute Pulmonary	Disseminated
No symptoms	Cough, fever, chills, fatigue, headache, etc.	Fever, gastrointestinal symptoms, bone marrow suppression, hepatosplenomegaly, lymphadenopathy

- Severity of illness depends on
 - Amount of *H. capsulatum* (i.e., inoculum)
 - Immune status of infected person
- Develop respiratory illness 3-17 days after exposure
- Treat with appropriate antifungal medication

Outbreaks of Histoplasmosis in U.S.

- 77% in settings with birds, bats, or their droppings
- 41% occupational exposure
- 15% hospitalized
- 1% died



Outbreak in Dominican Republic

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Sep 12-16: 3 men die

Outbreak in Dominican Republic

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Sep 17: DR MoH requests U.S. CDC assistance to investigate outbreak in tunnel cleaning workers

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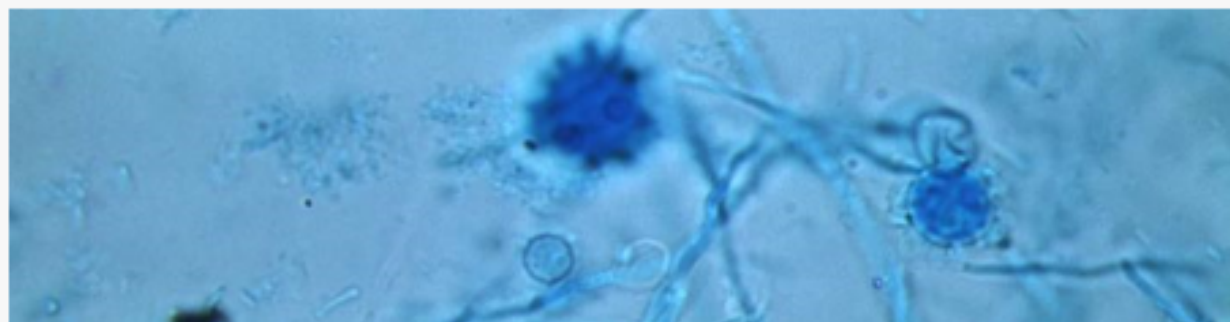
Sep 21: CDC staff arrive in **Santo Domingo** and spend 10 days assisting DR MoH with outbreak investigation

Media Highlights Outbreak

Histoplasmosis kills 3, sickens 20 more in the Dominican Republic

Posted by Robert Herriman on September 21, 2015 // 2 Comments

Dozens of workers at the Taveras dam in Santiago province, Dominican Republic have contracted the serious fungal disease, histoplasmosis, in which three people have lost their lives.



The workers were infected while cleaning a pipe vent that serves the dam, according to a El Veedor Digital report (computer translated). In addition to the three fatalities, more than 20 workers that currently fighting for their

Our Assignment

- Investigate outbreak
- Identify cause
- Recommend preventive measures



Study Design and Planning

- Retrospective cohort study
 - All men who worked in tunnels
- Data collection instruments/methods
 - Worker interviews
 - Medical chart abstraction
 - Laboratory tests

Ministerio de Salud Pública	
Dirección General de Epidemiología	
Ficha epidemiológica de investigación de casos sospechosos de histoplasmosis	
ANTECEDENTES DE RIESGO DE INFECCIÓN	
Nombre del caso _____	Edad _____ en años
Historia de trabajo en los túneles	
Túnel 1	1.Sí 2.No Fecha de inicio ____/____/____ Fecha de fin ____/____/____ Duración (en semanas): 1. De 1-2 2. De 3-4 3. De 5-6 4. 7 o más semanas al día _____
Túnel 2	1.Sí 2.No Fecha de inicio ____/____/____ Fecha de fin ____/____/____ Duración (en semanas): 1. De 1-2 2. De 3-4 3. De 5-6 4. 7 o más semanas al día _____
Túnel 3	1.Sí 2.No Fecha de inicio ____/____/____ Fecha de fin ____/____/____ Duración (en semanas): 1. De 1-2 2. De 3-4 3. De 5-6 4. 7 o más semanas al día _____
Tipo de trabajo en los túneles	
Túnel 1	1. Palanquero/cargador 2. Carroñero 3. Supervisión 4. Otro _____
Túnel 2	1. Palanquero/cargador 2. Carroñero 3. Supervisión 4. Otro _____
Túnel 3	1. Palanquero/cargador 2. Carroñero 3. Supervisión 4. Otro _____
Uso de equipos de protección personal	
Túnel 1	1.Sí 2.No Tipo de mascarilla _____ Otro tipo de cubridor de nariz _____
Túnel 2	1.Sí 2.No Guanteros 1.Sí 2.No Botas 1.Sí 2.No
Túnel 3	1.Sí 2.No Guanteros 1.Sí 2.No Botas 1.Sí 2.No
Morbilidad preexistente	
Osteopor 1.Sí 2.No	Diabético 1.Sí 2.No Tuberculoso 1.Sí 2.No VIH 1.Sí 2.No
Arma 1.Sí 2.No	Otra enfermedad respiratoria 1.Sí 2.No
Tarjador de 6 meses 1.Sí 2.No	Otra enfermedad _____
¿Tuvo gripe en alguna ocasión durante los 3 meses antes de empezar el trabajo? 1.Sí 2.No	
¿Usó fuma? 1.Sí 2.No ¿Cuánta tiempo tiempo fumando? _____ en años de cigarrillo al día _____	



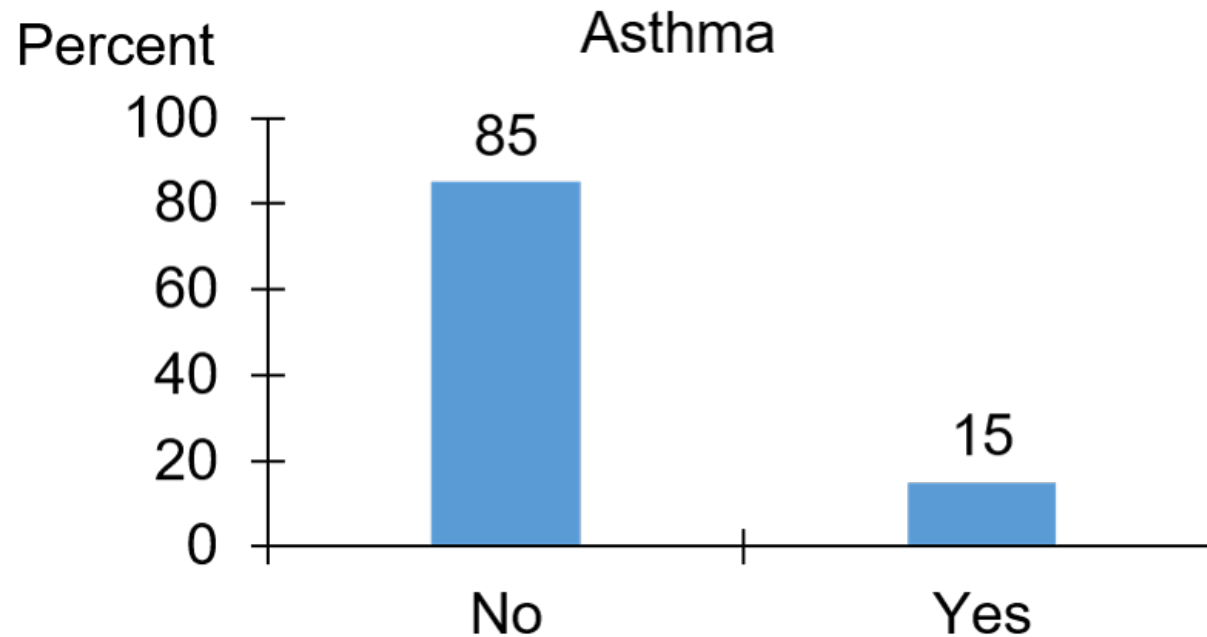
Worker Interviews

- Demographics
- Comorbidities
- Tunnels
- Work conditions and behaviors
- Work history
- Personal protective equipment

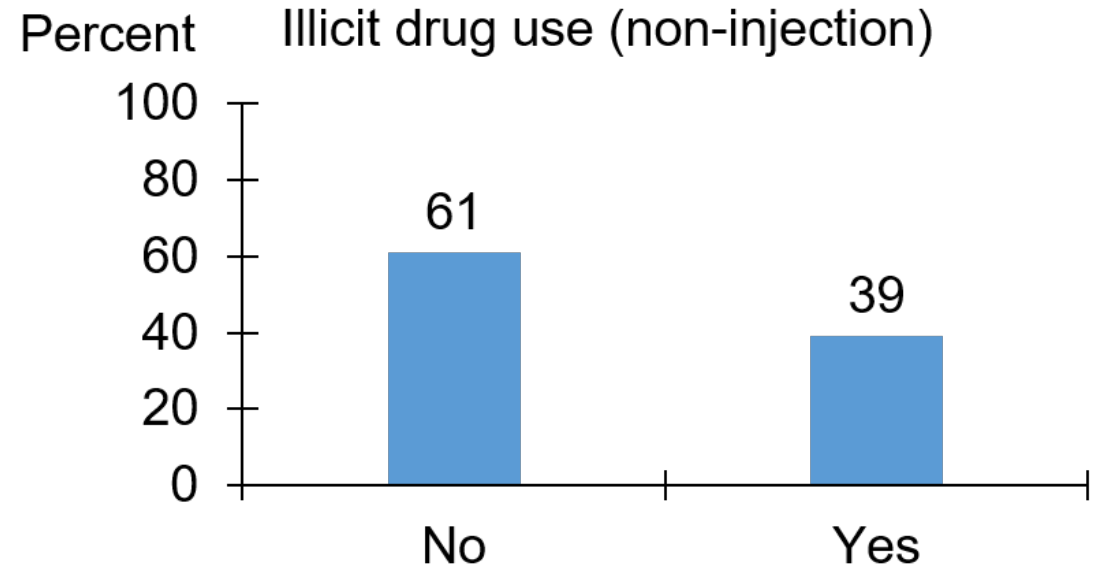
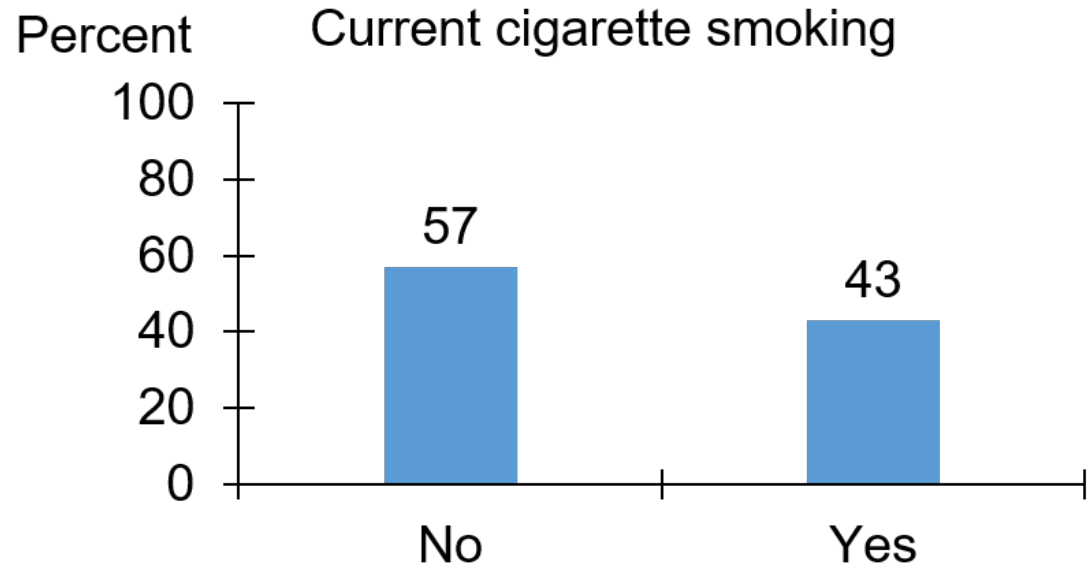


Demographics and Comorbidities

- 36 men
- Ages 18-62 (median: 32)



Demographics and Comorbidities



Tunnels

- Constructed 1972, last cleaned 1982
- Allow access for dam inspection
- 1-2 km long
- 1-2 feet deep of bat guano throughout

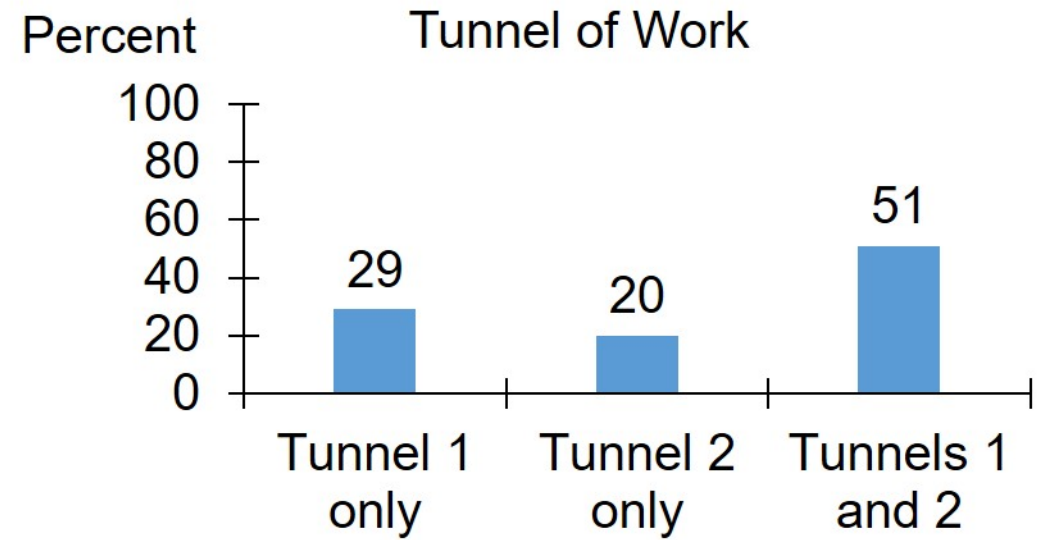
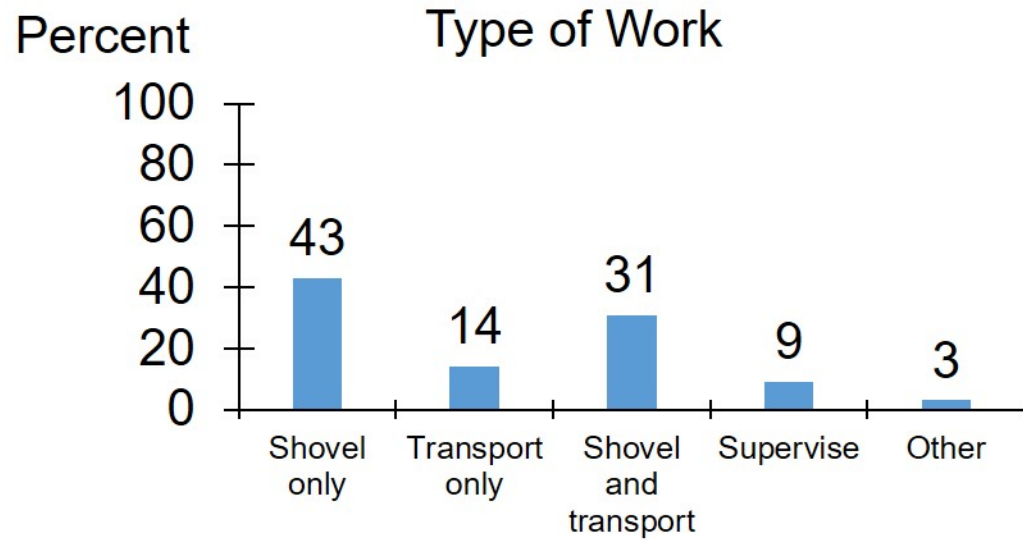


Work on Tunnels

- 3 of 5 tunnels partially cleaned
- 2-4 hours/day, 5 days/week, Jul 30-Sep 2
 - 1-25 (median: 24) days in tunnels
- Shovel guano into wheelbarrow, dump outside
- Substitutions in workers

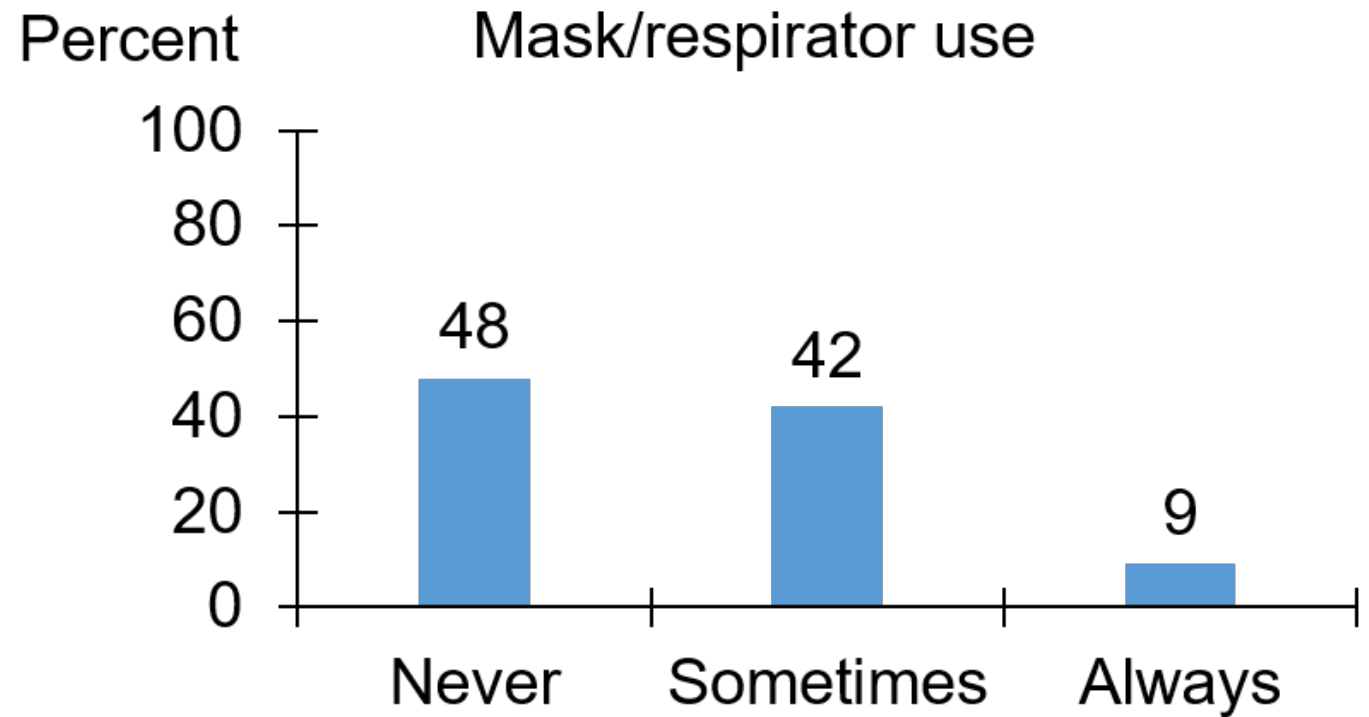


Type and Tunnel of Work



Personal Protective Equipment

- Hard hats
- Boots
- Gloves
- Masks/respirators



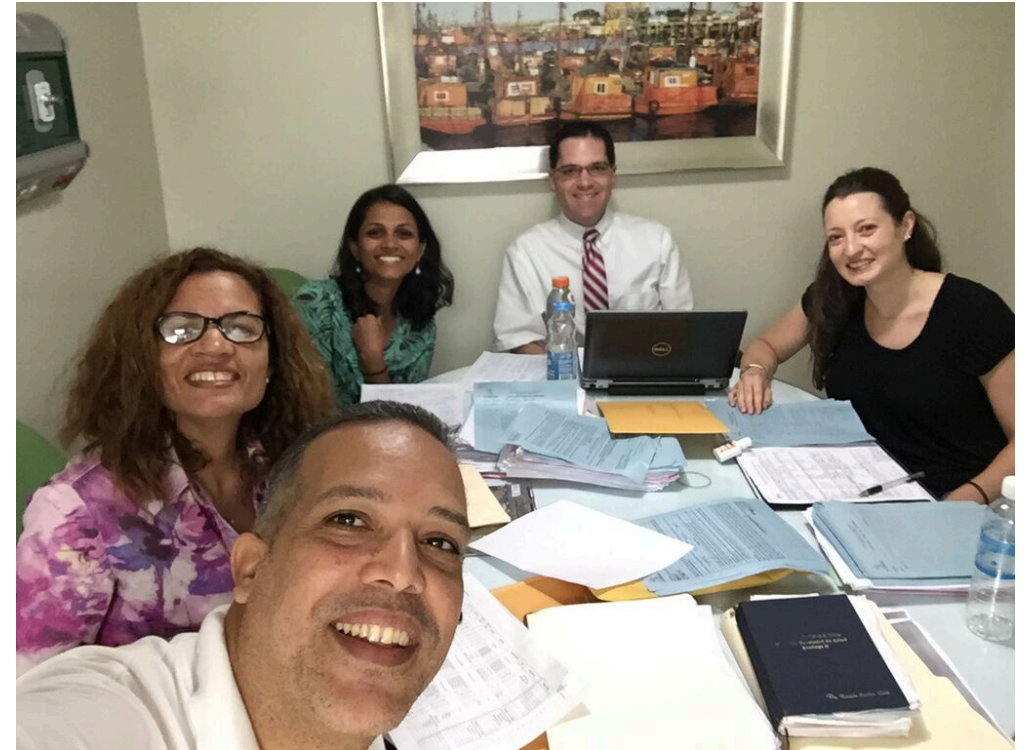
Medical Chart Abstraction

- Symptoms
- Dates of onset, hospitalization, etc.
- Diagnostic tests
- Laboratory tests
- Treatment

misp		Ministerio de Salud Pública y Asistencia Social		Dirección General de Epidemiología	
Ficha clínica de investigación de casos sospechosos de histoplasmosis					
DATOS DEL NOTIFICADOR					
Nombre del revisor		Fecha de revisión			
No. de expediente		Nombre del centro			
DATOS DEL ENFERMO					
Apellidos		Nombre			
Sexo: 1. Masculino 2. Femenino		Fecha de nacimiento		Edad en años	
Fecha de ingreso en el hospital		Fecha de egreso del Hospital			
Fecha de ingreso al UCI		Fecha de egreso del UCI		Condición de egreso: <input type="checkbox"/> Vivo <input type="checkbox"/> Muerto	
DATOS DEL ENFERMO					
A Nivelación de Riesgo					
Comorbilidades:					
Diabetes	<input type="checkbox"/> SI <input type="checkbox"/> No	Asma	<input type="checkbox"/> SI <input type="checkbox"/> No	Otro: _____	
Cáncer	<input type="checkbox"/> SI <input type="checkbox"/> No	EPOC	<input type="checkbox"/> SI <input type="checkbox"/> No		
VIIH	<input type="checkbox"/> SI <input type="checkbox"/> No	Tuberculosis	<input type="checkbox"/> SI <input type="checkbox"/> No		
Imunosupresión	<input type="checkbox"/> SI <input type="checkbox"/> No	Otra patología respiratoria	<input type="checkbox"/> SI <input type="checkbox"/> No		
Uso de esteroides	<input type="checkbox"/> SI <input type="checkbox"/> No				
Hábitos:					
Fuma	<input type="checkbox"/> SI <input type="checkbox"/> No				
SIGNOS Y SÍNTOMAS					
		Fecha de inicio de síntomas: / /		Duración de síntomas: días	
Generales o sistémicos		Respiratorios y cardiovasculares		Gastrointestinales y renales	
Fiebre		Tos seca		Náuseas	
Escalofríos		Dificultad respiratoria		Vómitos	
Sudoración nocturna		Claudicatio		Alteración del sueño	
Malestar general		Taquipnea		Diarrea	
Debilidad		Taquicardia		Hematuria	
Cansancio		Hipotensión		Embarazo	
Prostración		Dolor torácico		Ins. Hepáticas	
Lentitud de marcha		Brete pericardico		Ins. Renal Aguda	
Dolor de cabeza		Asma pleural			
Otro: _____					
DATOS CLINICOS					
Estadío de Inmunos		Marcar X		Laboratorio	
Nódulos	<input type="checkbox"/> SI <input type="checkbox"/> No			Leucocitos (valor Max)	Valor
Arraigo pleural	<input type="checkbox"/> SI <input type="checkbox"/> No			Leucopenia (valor min)	
Consolidación alveolar	<input type="checkbox"/> SI <input type="checkbox"/> No			Leucocitos (% Max)	
Consolidación intersticial	<input type="checkbox"/> SI <input type="checkbox"/> No			Creatinina (valor Max)	
Adenopatías	<input type="checkbox"/> SI <input type="checkbox"/> No			Hemoglobina (valor Max)	
Infiltrado bilateral	<input type="checkbox"/> SI <input type="checkbox"/> No			LDL (valor Max)	
Calcificación	<input type="checkbox"/> SI <input type="checkbox"/> No			HDL (valor Max)	
Cavitación	<input type="checkbox"/> SI <input type="checkbox"/> No			Plaquetas (valor min)	
Otro: _____	<input type="checkbox"/> SI <input type="checkbox"/> No			Proteína C reactiva (valor Max)	
TRATAMIENTO					
		Fecha inicio		Fecha término	
Amplitermina II		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	Dosis
Itracozanol		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	Duración en días
Voriconazol		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	
Isavuconazol		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	
Isoniazida		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	
Rifampicina		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	
UR (quimioterapia)		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	
Utrabación		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	No aplica
Otrabacina		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	No aplica
Otro: _____		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	
Otro: _____		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	
Otro: _____		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	
Otro: _____		<input type="checkbox"/> SI <input type="checkbox"/> No	/ /	/ /	
DEFINICION CASO					
<input type="checkbox"/> Sospechoso: Toda persona con fiebre y dos o más signos y síntomas					
<input type="checkbox"/> Probable: Todo caso sospechoso con reporte de citología y/o niveles de anticuerpos en suero compatibles con Histoplasmosis.					
<input type="checkbox"/> Confirmado: Todo caso sospechoso con identificación de antígeno específico para Histoplasmosis en muestra de orina o suero. Muerto con clínica compatible.					
CLASIFICACION DE CASO					
<input type="checkbox"/> Asintomático: Toda persona con identificación de antígeno y/o anticuerpos específico sin presencia de signos y síntomas compatibles a histoplasmosis.					
<input type="checkbox"/> Leve: Toda persona con síntomas que no limitaron sus actividades cotidianas.					
<input type="checkbox"/> Moderada: Toda persona con dificultad respiratoria acompañada de signos de hipoxia (taquipnea, cianosis, taquicardia) o prostración u otro síntomas que limitan las actividades cotidianas.					

Medical Chart Abstraction

- Workers were seen in
 - Local hospital in Sabana Iglesia
 - 5 hospitals throughout Santiago

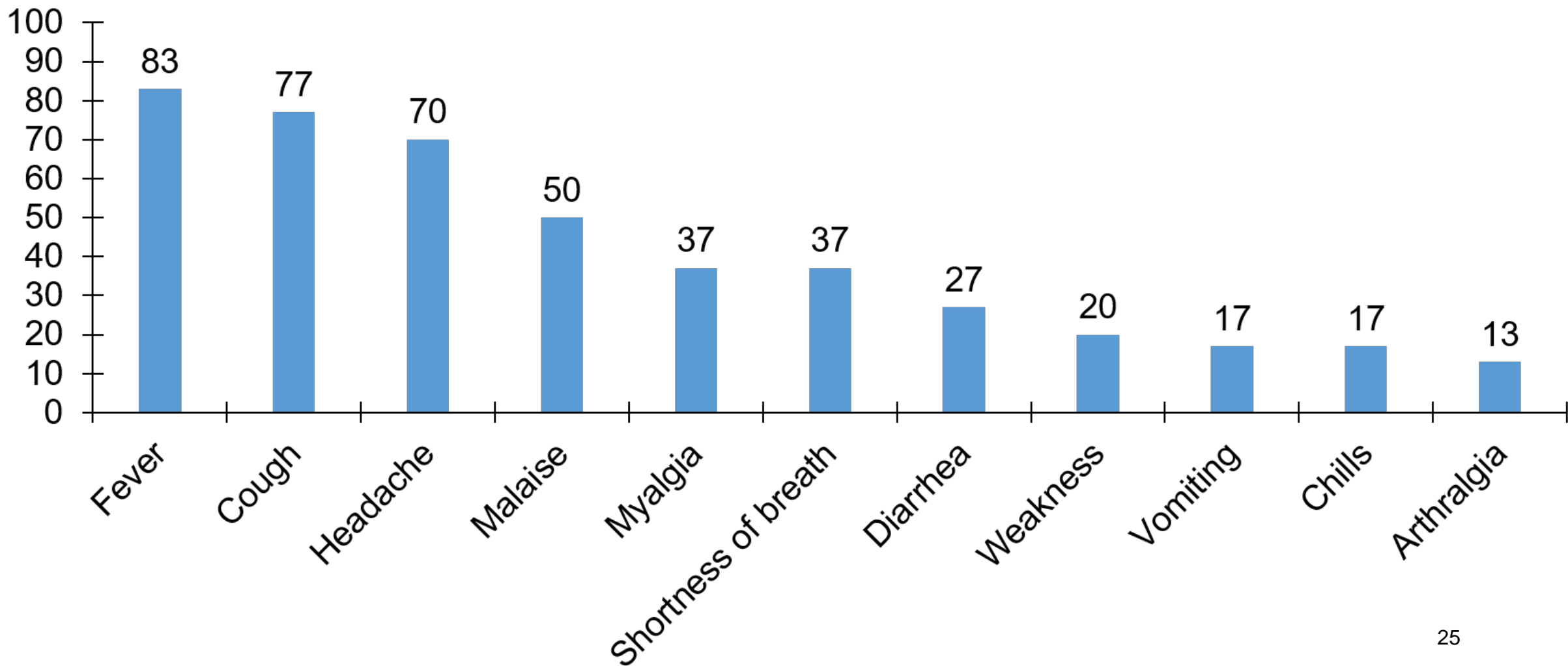


Case Definition

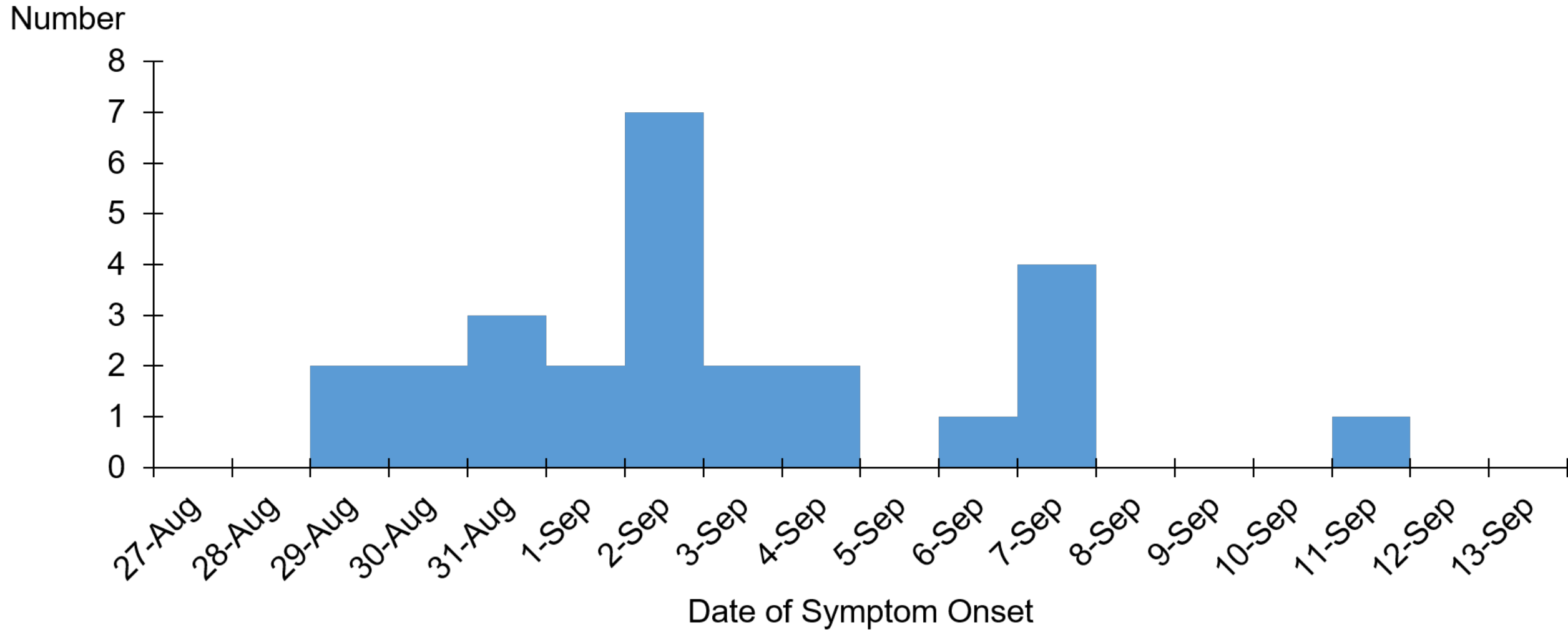
- Person who worked in the tunnels Jul 30-Sep 2:
 - Fever
 - ≥ 2 of following:
 - Headache
 - Chills
 - Malaise
 - Fatigue
 - Myalgias
 - Cough
 - Nausea
 - Vomiting
 - Diarrhea
 - Respiratory difficulty

Symptoms

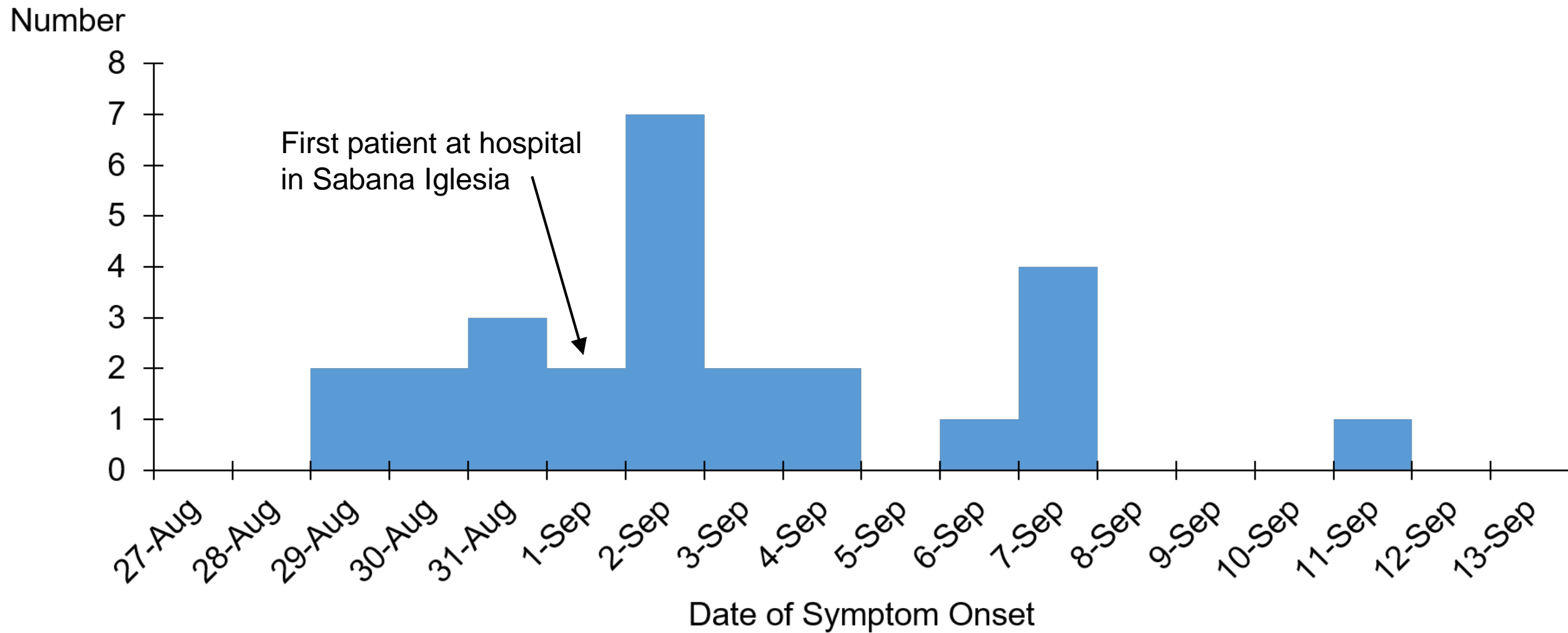
Percent



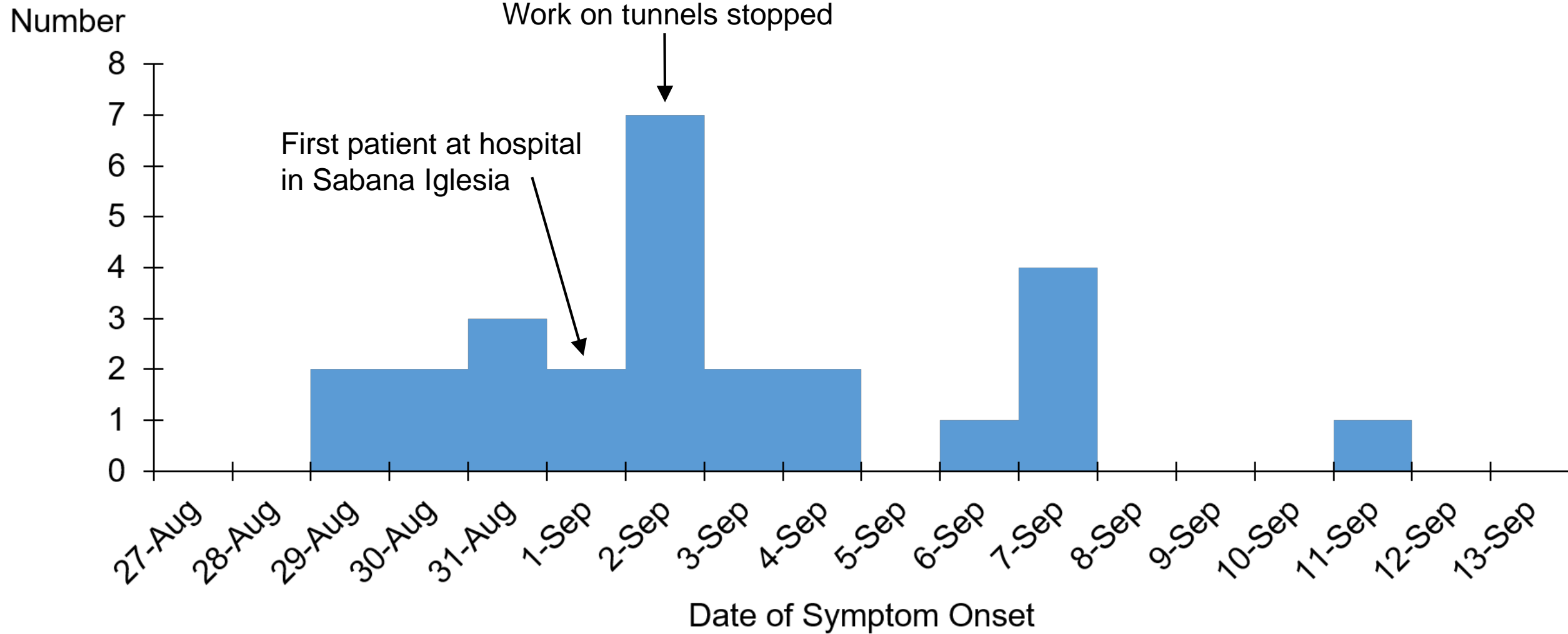
Epidemic Curve



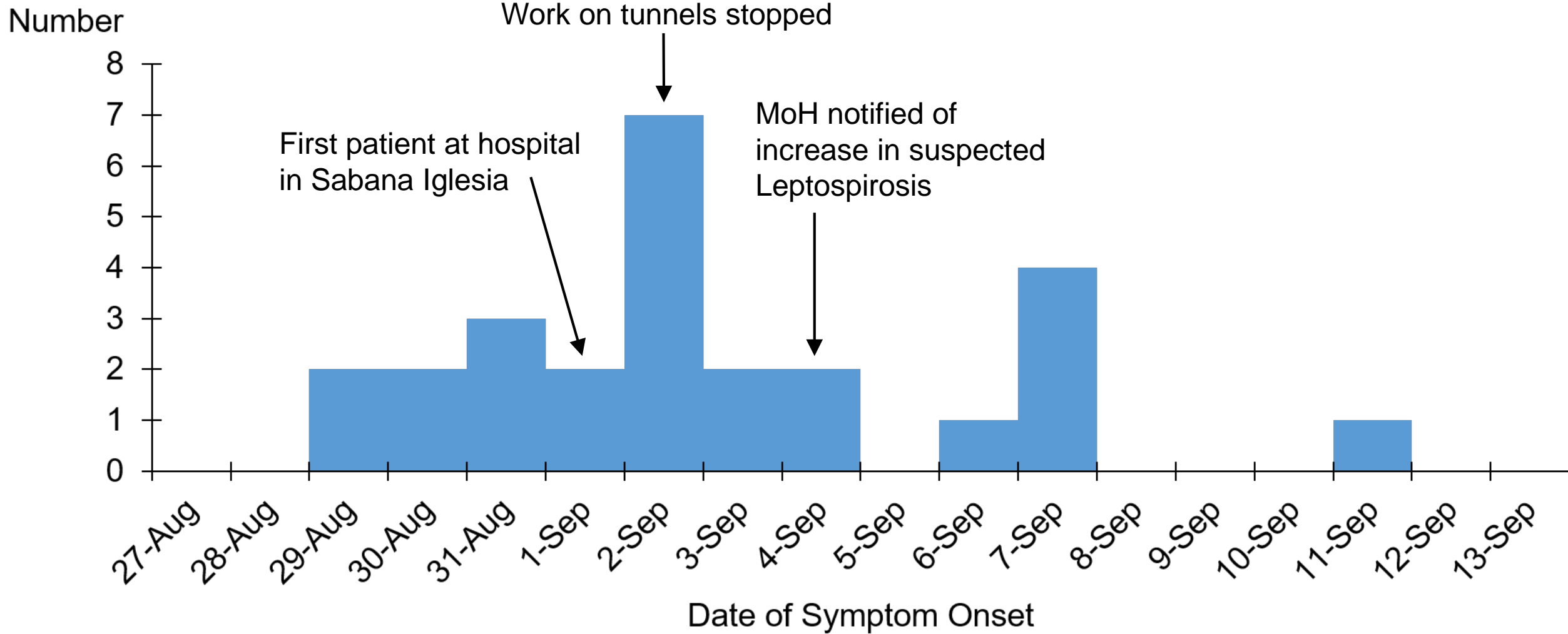
Epidemic Curve



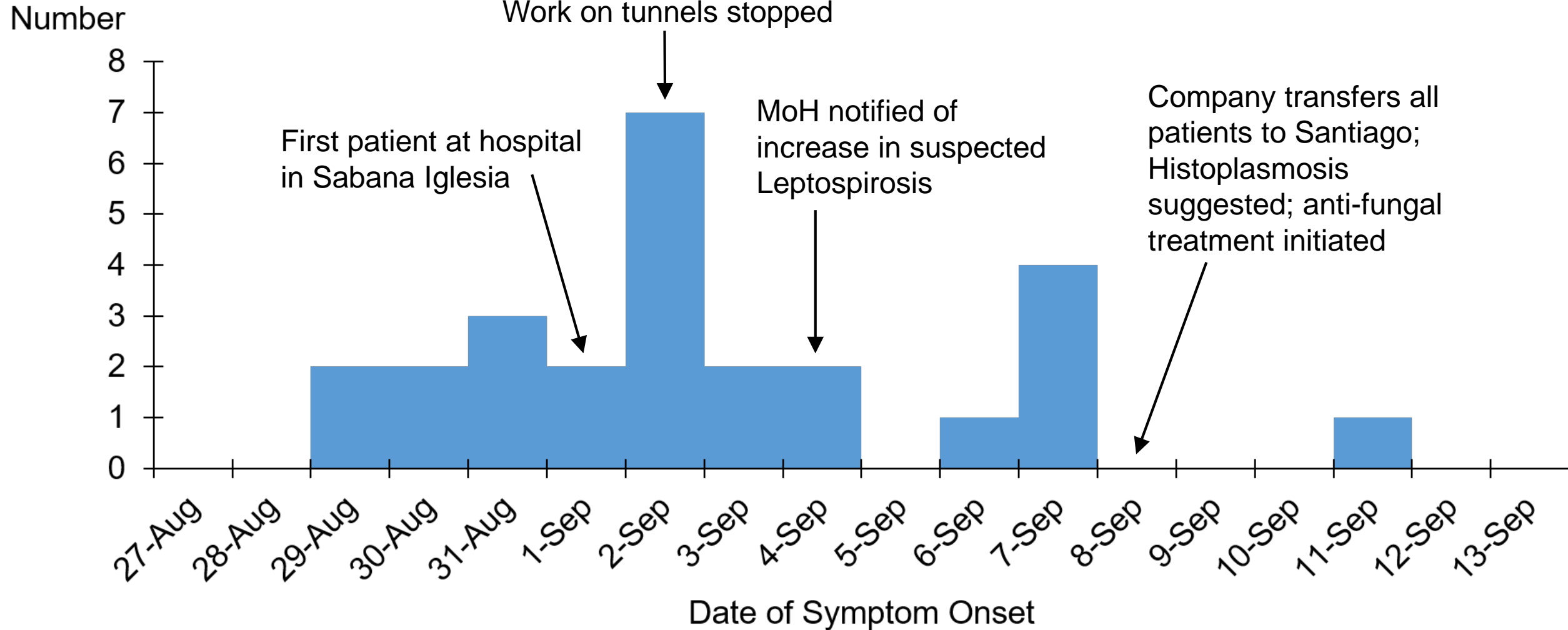
Epidemic Curve



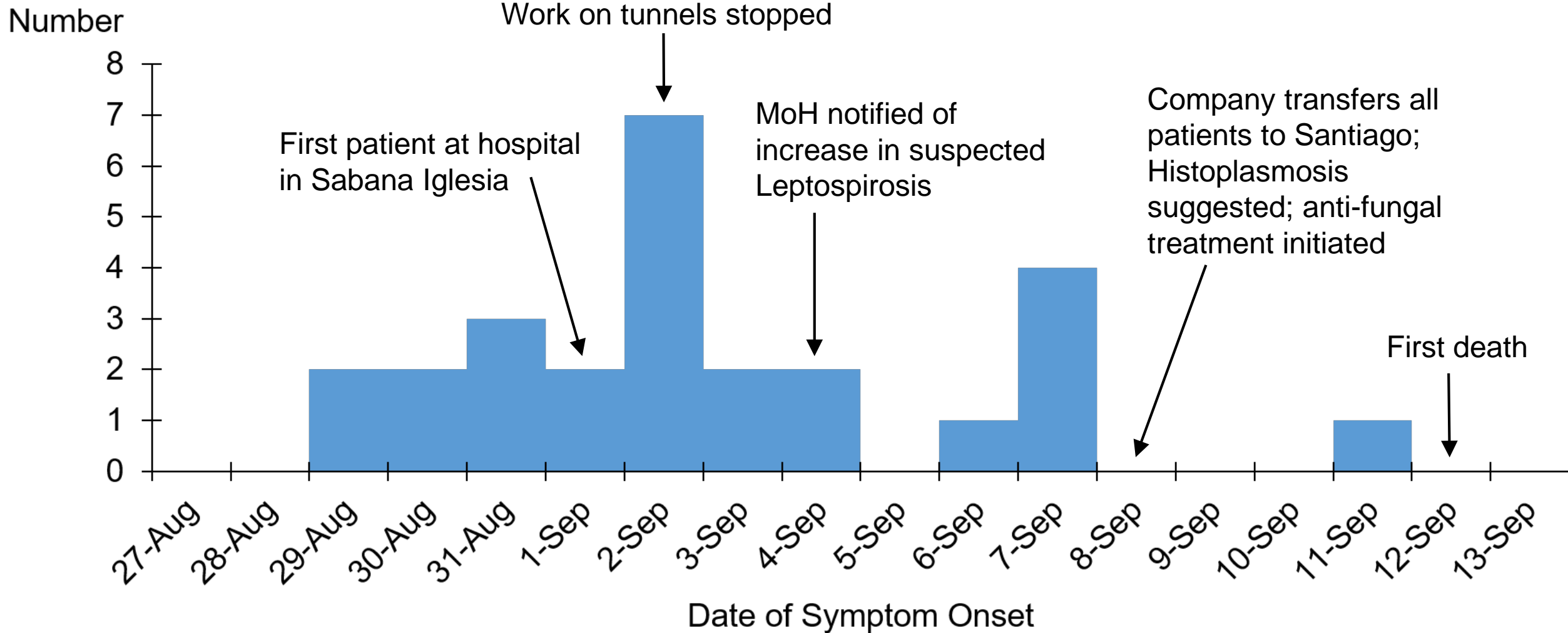
Epidemic Curve



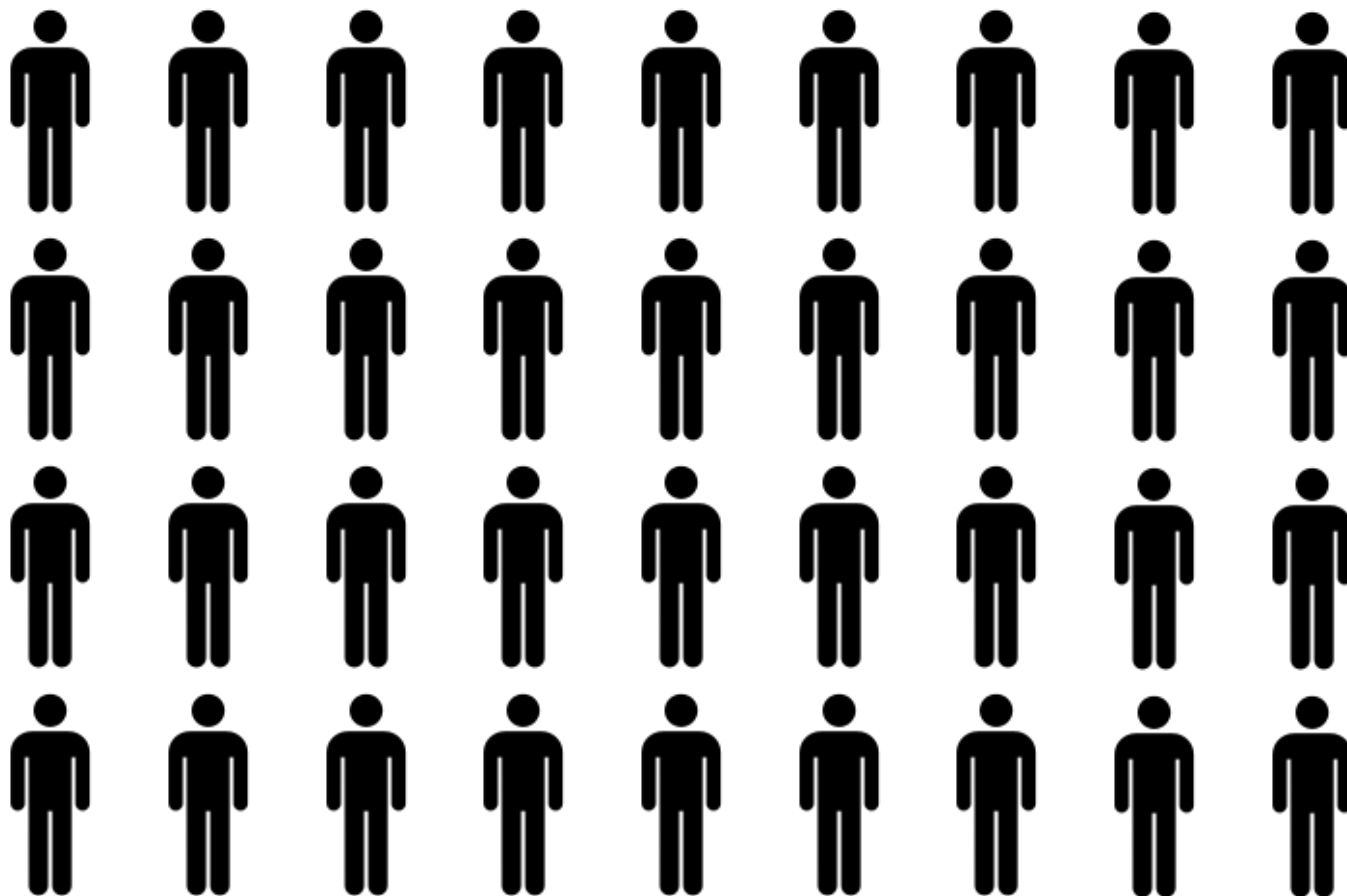
Epidemic Curve



Epidemic Curve

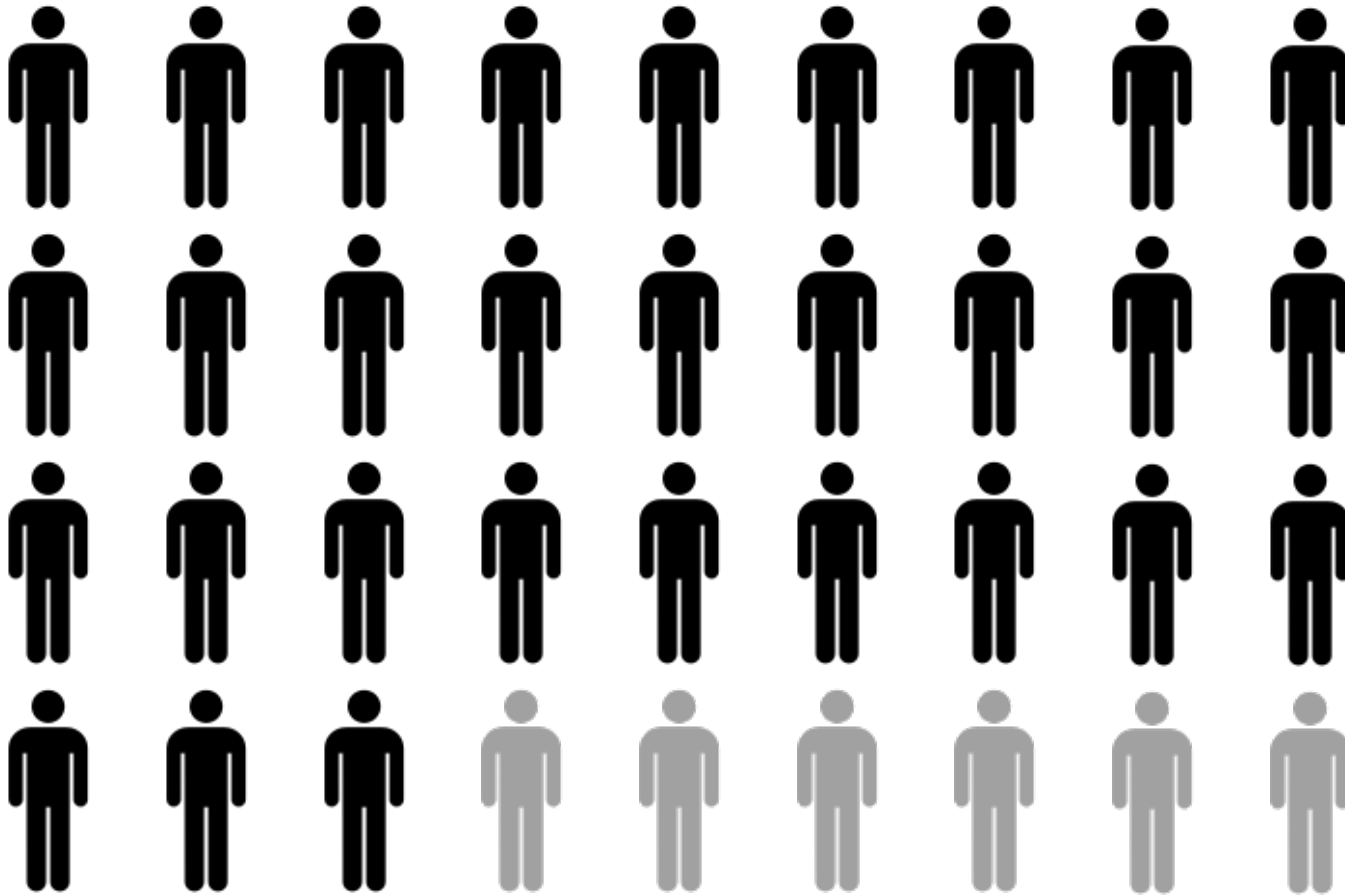


Results



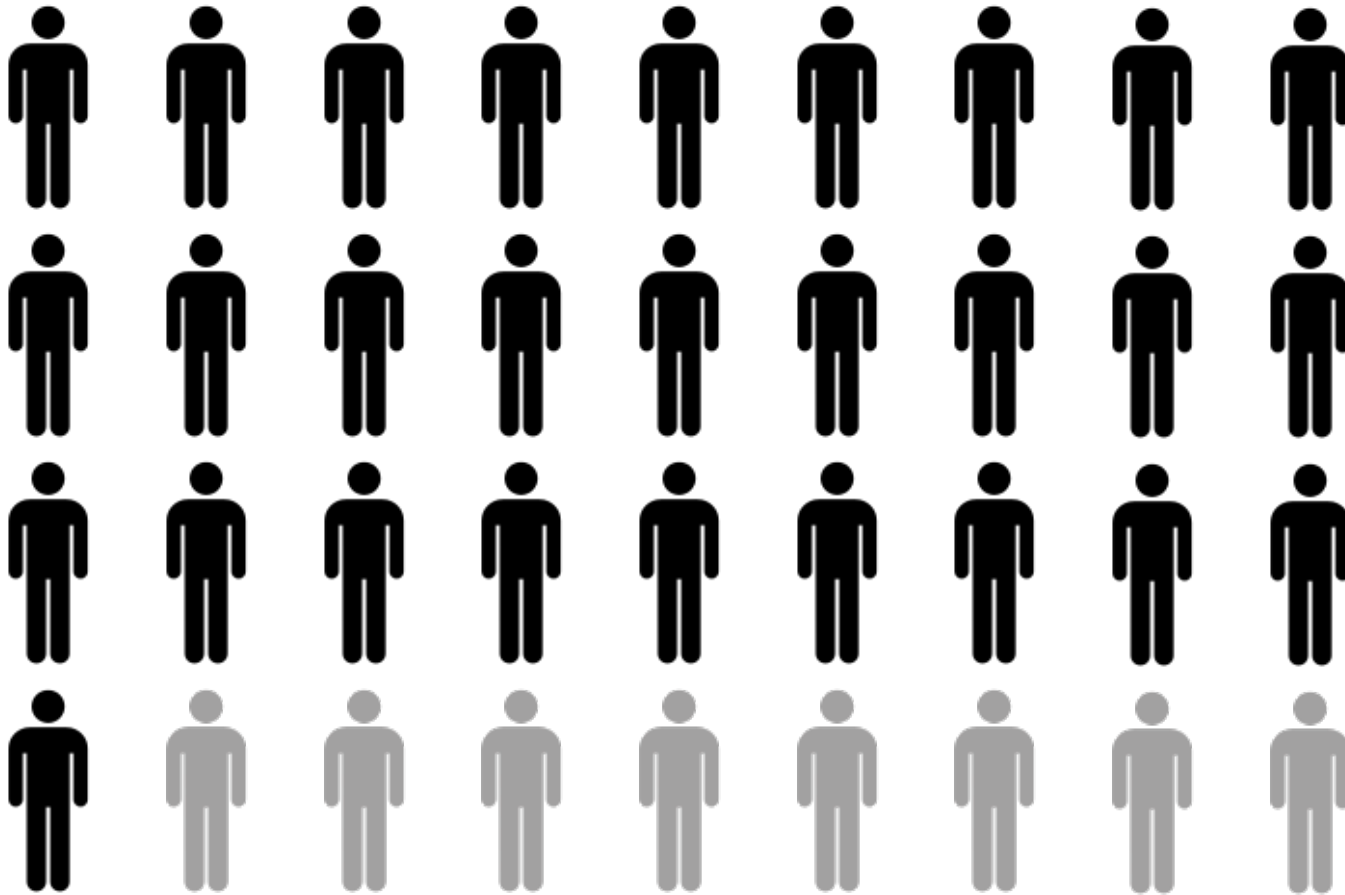
36 exposed

Results



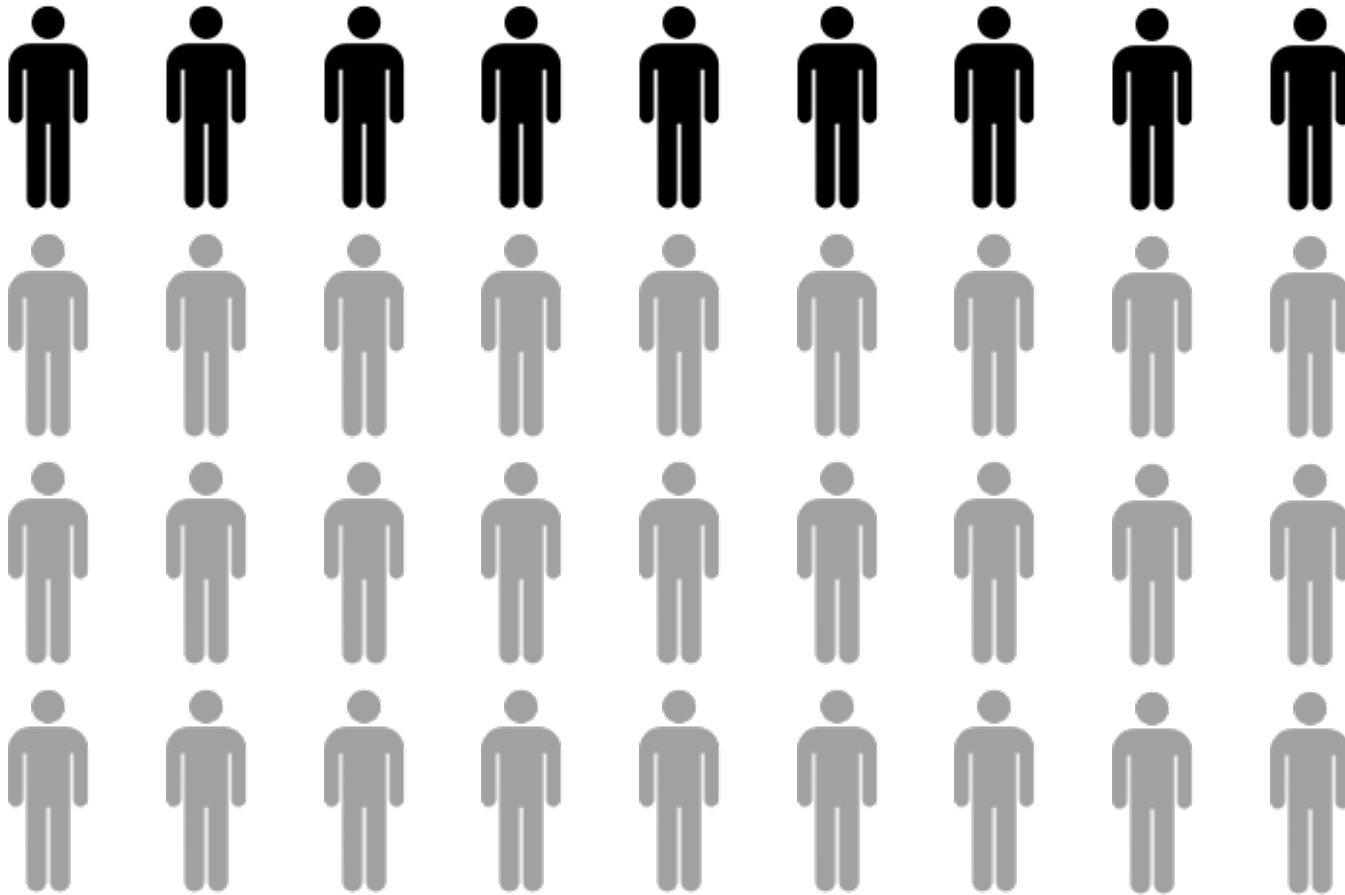
36 exposed
30 symptomatic

Results



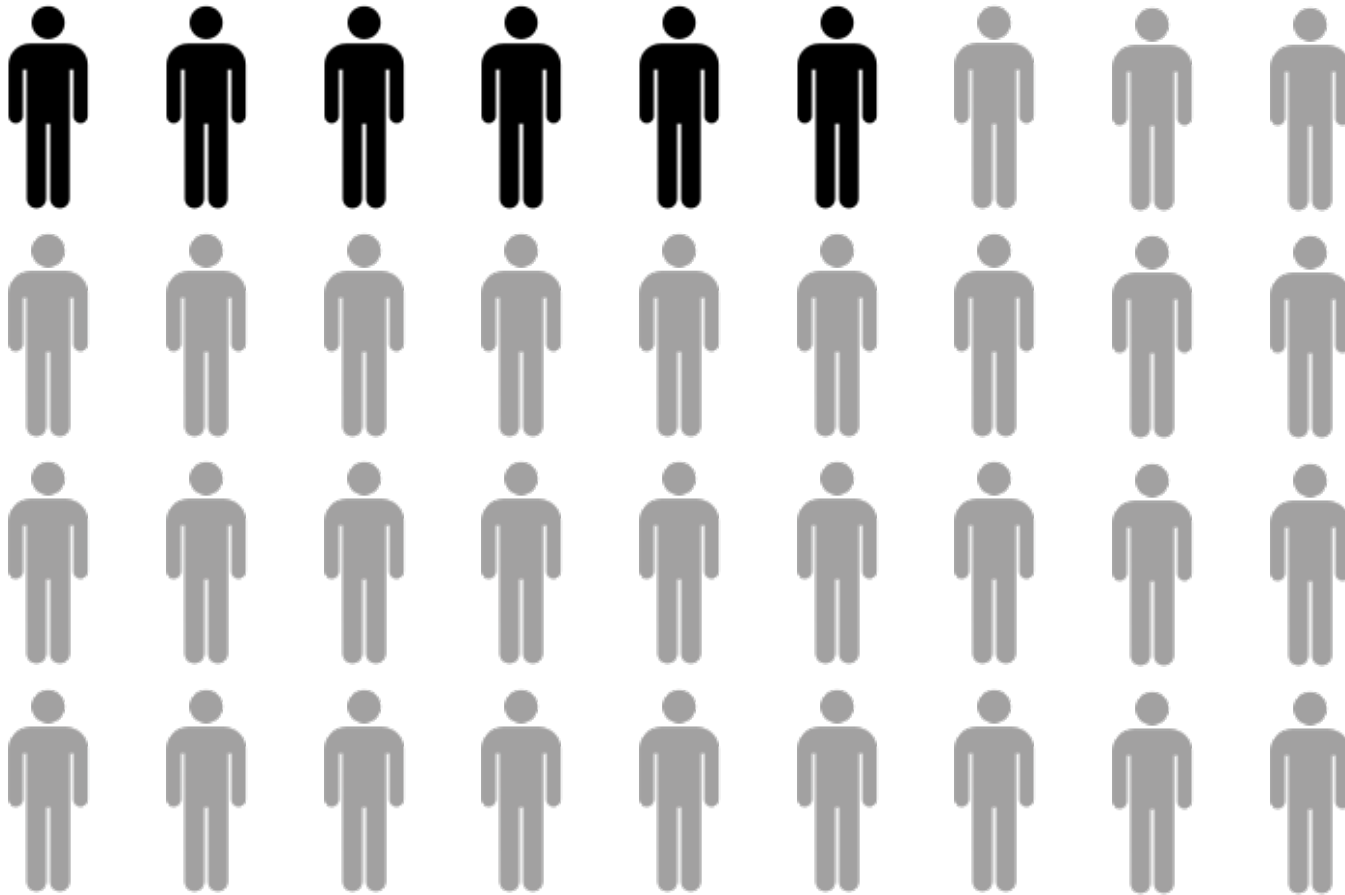
36 exposed
30 symptomatic
28 hospitalized

Results



36 exposed
30 symptomatic
28 hospitalized
9 in the ICU

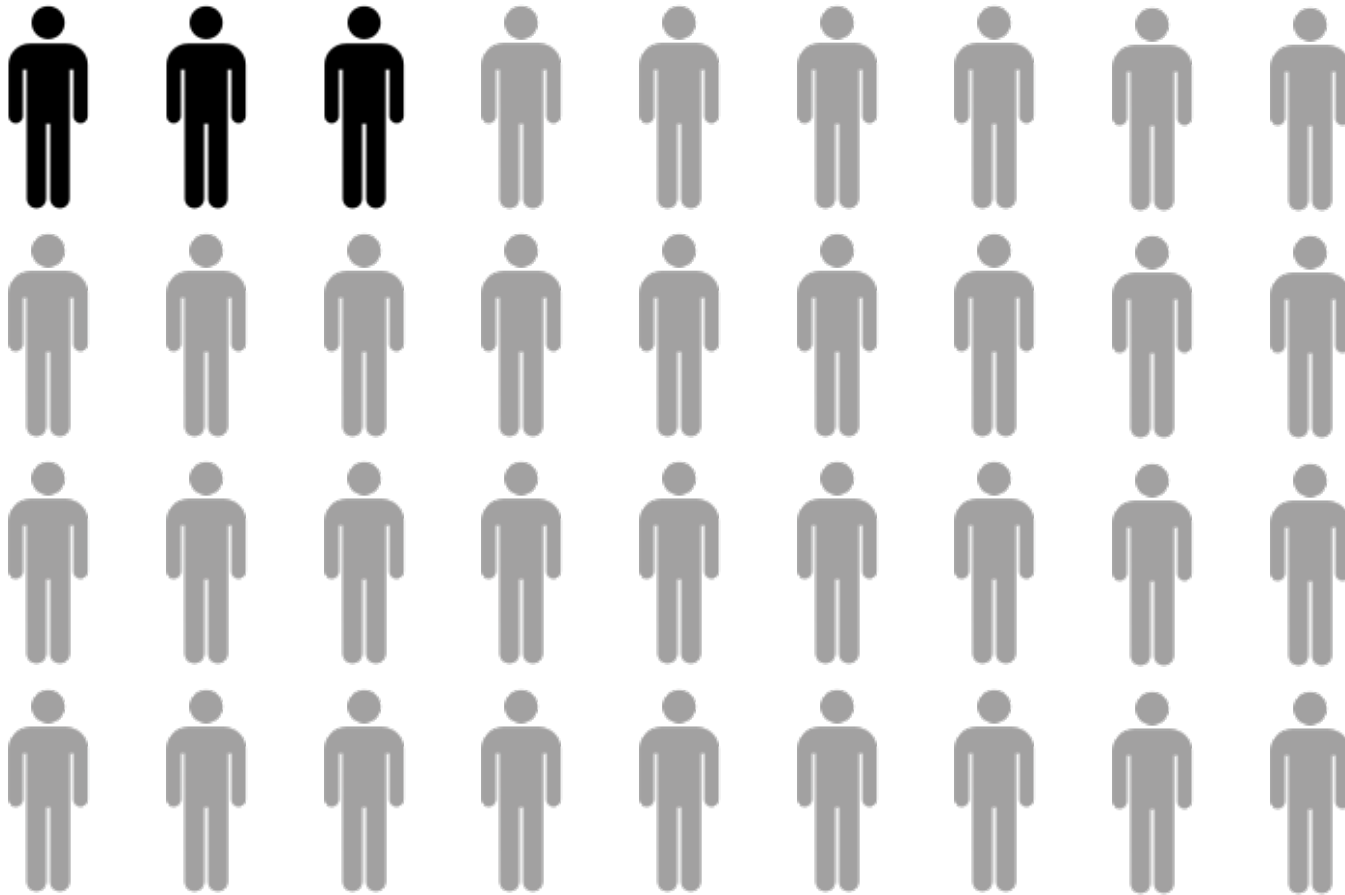
Results



36 exposed
30 symptomatic
28 hospitalized
9 in the ICU
6 intubated

Results

Case fatality = 10%



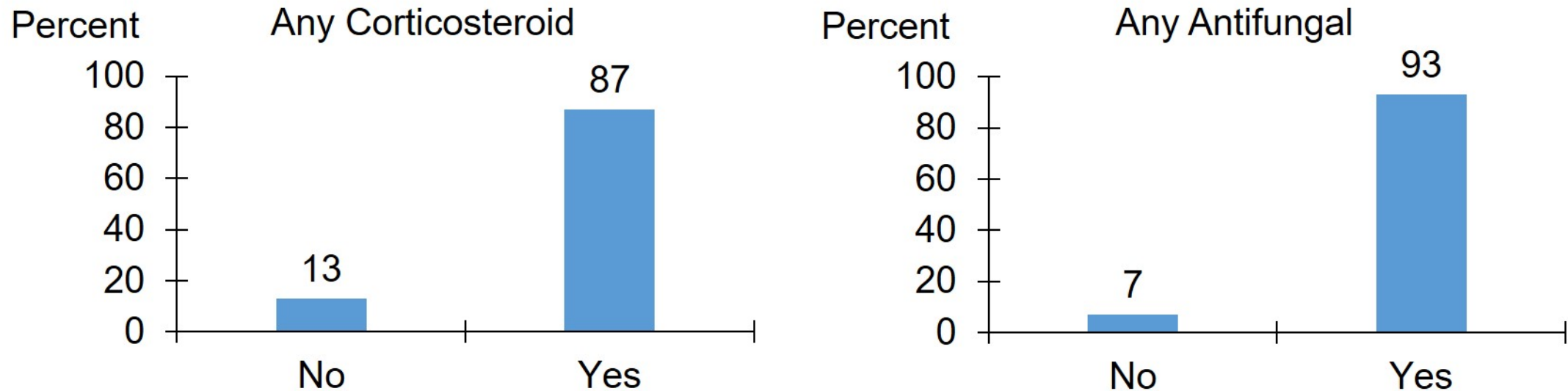
36 exposed
30 symptomatic
28 hospitalized
9 in the ICU
6 intubated
3 died

Complications

- All 6 intubated patients had ventilator-assisted pneumonia



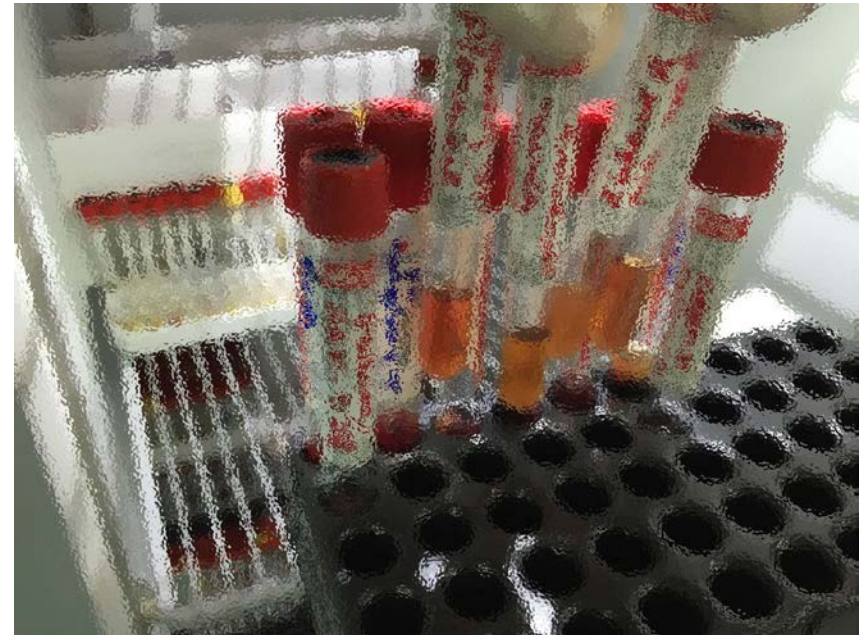
Treatment



- 1-11 (median: 6) days to treatment with any antifungal
- Ideal medication for critically ill patients (amphotericin B) not available for 2 weeks

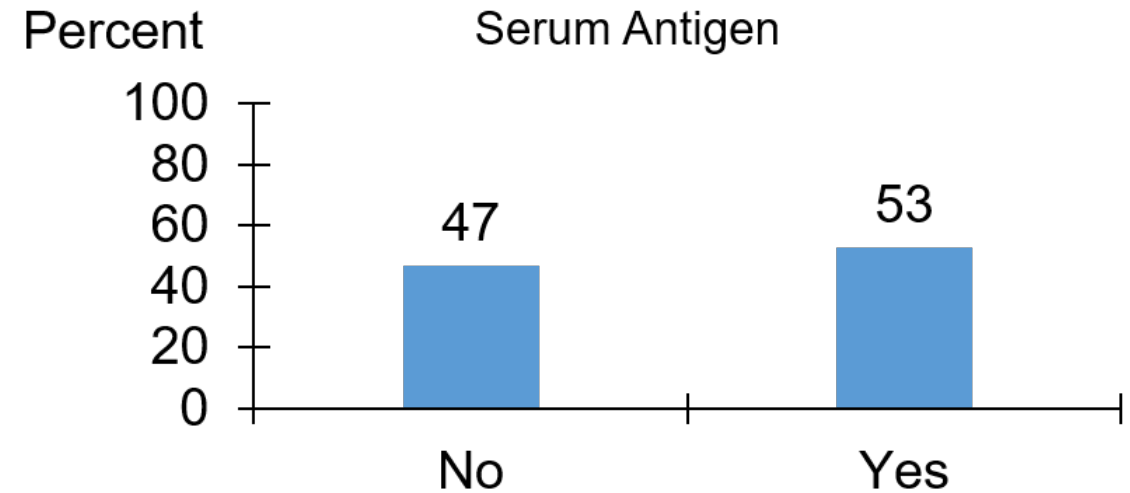
Laboratory Tests

- No diagnostic capabilities for Histoplasmosis in country
- Blood and urine samples sent to CDC in Atlanta

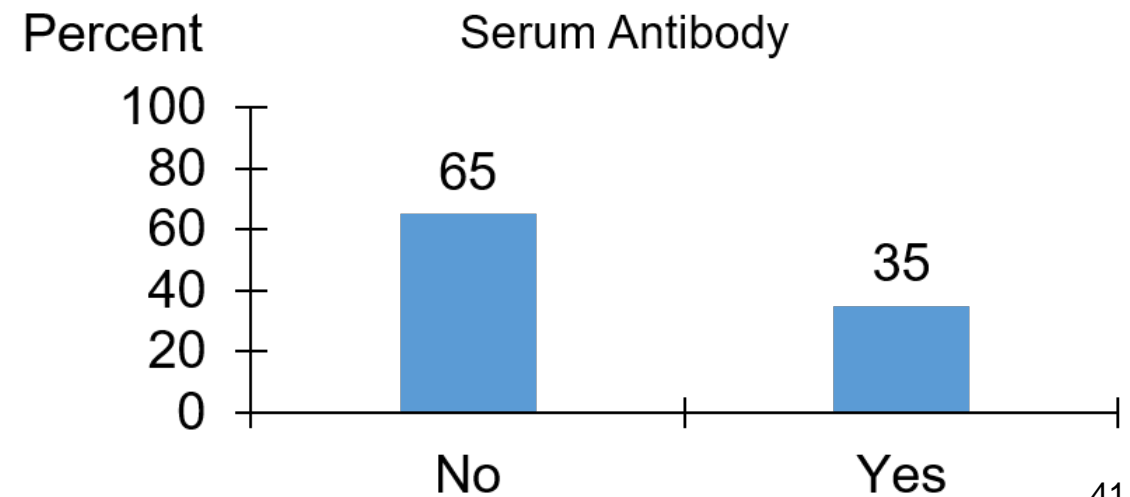


Laboratory Tests: Serum

- Serum antigen: 34 workers

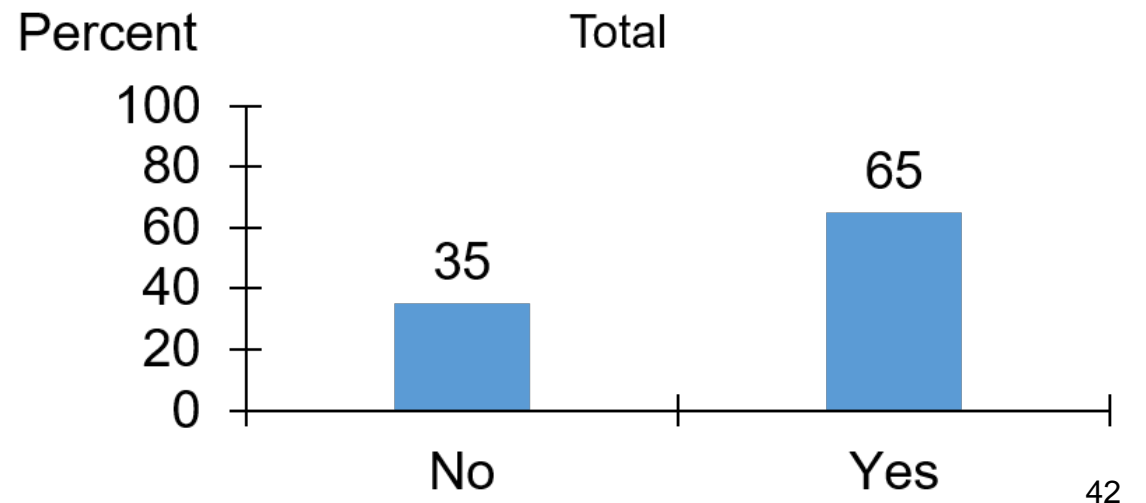
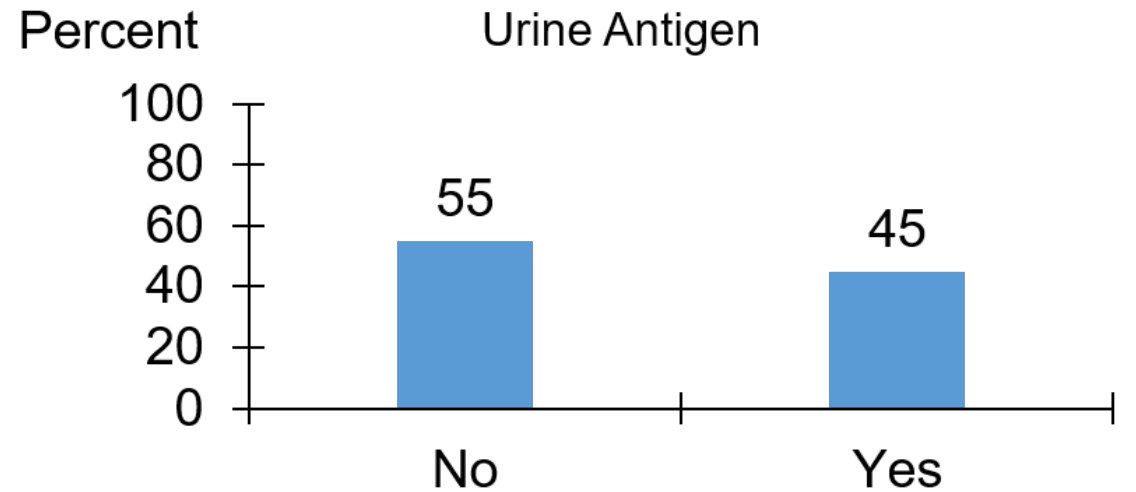


- Serum antibody: 31 workers



Laboratory Tests: Urine and Total

- Urine antigen: 29 workers
- Total: 34 workers



Risk Factors for Histoplasmosis and ICU

- No demographic, comorbid, clinical, or occupational risk factors for developing histoplasmosis identified

Risk Factor	ICU Admission		Unadjusted OR	Exact 95% CI	Exact p-value
	Yes	No			
Difficulty breathing	6 (67%)	5 (24%)	5.95	0.89, 51.67	0.06
Days worked in tunnels ^a			1.18	1.00, 1.59	0.07

^a Per additional day worked

Summary of Results

Environmental	Occupational
<ul style="list-style-type: none">• Insufficient waste disposal	<ul style="list-style-type: none">• Inadequate worker protection
Clinical	Laboratory
<ul style="list-style-type: none">• Limited awareness among clinicians• Delay in treatment	<ul style="list-style-type: none">• Lack of diagnostic capability• Confirmed diagnosis

Environmental Safety Recommendations

- Existing waste partially treated with formaldehyde
- Additional waste requires biohazard site disposal
 - Strongly suggest hiring professional remediation firm
- Adequate security to prevent access to tunnels
- Minimize human contact with bats



Occupational Health Recommendations

- Need for planning before initiating work
- Adequate personal protective equipment
- Appropriate training of workers
- Enforcement of local laws and regulations surrounding:
 - Work sites
 - Disposal of waste
 - Work conditions



Clinical/Laboratory Recommendations

- Improve diagnostic capability and support for histoplasmosis and other fungal diseases
- Improve access to antifungal treatment
 - Critically ill patients require Amphotericin B
- Increase screening for HIV



Summary

- First Histoplasmosis outbreak in Dominican Republic
- Called attention to environmental/occupational health
- Highlighted lack of diagnostic and treatment capability



Acknowledgements

- DR Ministry of Health
 - Raquel Pimentel
 - Delia Castillo
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- NIOSH
 - Marie De Perio
 - Max Kiefer
- NCEZID
 - Paige Armstrong
 - Sae-Rom Chae
 - Snigdha Vallabhaneni
 - Mark Lindsley
 - Tom Chiller
 - Rajal Mody
- CGH
 - Myron Schultz
 - Rossanne Philen
 - Serena Fuller