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## Disclosures

Bisni Narayanan has no real or potential conflicts of interest or financial disclosures related to the subject matter in this presentation.

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3

3



4

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## Bhopal Gas tragedy (1984)

- Union Carbide Corporation's chemical plant in Bhopal
- 40 tons of methyl isocyanate gas
- Estimates of deaths range from 3800-16,000, with >600,000 exposed
- The average compensation to families of the dead was \$2,200
- The plant continues to leak several toxic chemicals and heavy metals into local aquifers

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Broughton E. The Bhopal disaster and its aftermath: a review. *Environ Health.* 2005;4(1):6.

5

### Learning Objectives - Pharmacists

- 1  
Review the pulmonary effects of natural disasters
- 2  
Discuss secondary surge for chronic respiratory diseases following natural disasters
- 3  
Describe preventive clinical management strategies for common respiratory diseases during disasters

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6

### Learning Objectives - Pharmacy Technicians


- 1  
Review the pulmonary effects of natural disasters
- 2  
Discuss secondary surge for chronic respiratory diseases following natural disasters
- 3  
Describe the technician's role in triage during disasters that may exacerbate respiratory illness

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7

**Disasters Don't Wait.  
Make Your Plan Today.**

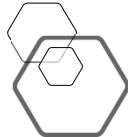
**WHEN WAS  
NATIONAL  
PREPAREDNESS  
MONTH IN 2020?**



**NATIONAL  
PREPAREDNESS  
MONTH**

8

8



**Natural Disasters - Usual Preparation**

Evacuate	Provide	Prevent
Evacuate people from affected areas	Provide transportation, shelter, food, and water	Prevent injury and infectious diseases that may develop in crowded living situations after disasters

Mokdad AH, et al. *Prev Chronic Dis.* 2005;2 Spec no(Spec No):A04.

9

9

- Disaster conditions exacerbate chronic illnesses
- Lack of access to routine health care is a leading cause of mortality after disasters
- Problems of vulnerable populations with chronic illness are inadequately addressed

10

#### Great East Japan Earthquake in 2011

- Hospital visits for patients receiving oxygen therapy
- Significant increase in hospitalizations due to COPD exacerbations in the subacute phase (from the third to the fifth week)
- Increase in admissions for pneumonia and exacerbation of COPD in the elderly

Yamada S, et al. *BMJ Open*. 2013;3(1):e000865; Kobayashi S, et al. *Respir Investig*. 2013;5(1):17-23

11

### Associations of wildfire smoke PM<sub>2.5</sub> exposure with cardiorespiratory events in Colorado 2011-2014

- Children displayed significant associations between smoke exposure and asthma
- Wildfire PM<sub>2.5</sub> associated with asthma, bronchitis, combined respiratory diseases in adults

### Sustained Effects on Lung Function in Community Members Following Exposure to Hazardous PM<sub>2.5</sub> Levels from Wildfire Smoke

- Spirometry testing showed significant decreases in lung function parameters up to two years post exposure

Stowell JD, et al. Environ Int. 2019 Dec;133(Pt A):1105151; Orr A, et al. Toxics. 2020 Aug 5;8(3):53.

12

12

### Adverse Health Outcomes after Hurricane Katrina among Children and Adolescents with Chronic Conditions

- During the first three months post hurricane, of 102 children who reported having asthma, 80 (78.4%) reported that they required more asthma medication or inhalers
- Of these, 30 (39.5%) reported that their asthma had worsened since September 2005

### Chronic Disease and Related Conditions at Emergency Treatment Facilities in the New Orleans area after Hurricane Katrina

- Of 21,673 health care visits, about 12% was for chronic lower-respiratory disease, 7.2% for medication refills, and 5.7% for routine or follow-up care

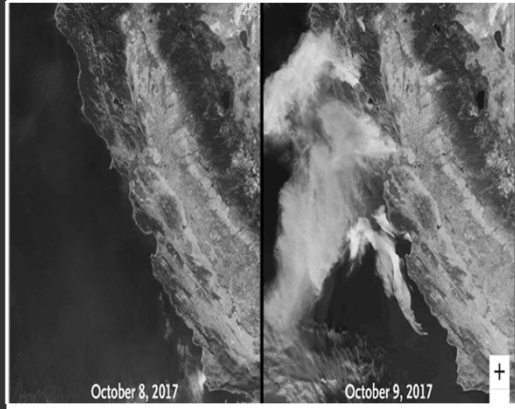
Rath B, et al. J Health Care Poor Underserved. 2007;18(2):405-417; Sharma AJ, et al. Disaster Med Public Health Prep. 2008;2(1):27-32

13

13

## Pulmonary effects of wildfires

Satellite images from the National Oceanic and Atmospheric Administration



14

14

## Particulate Matter (PM)

- A complex mixture of extremely small particles and liquid droplets, made up of acids, organic chemicals, metals, and soil or dust particles
- Particulate pollution is divided into several categories based on its size. E.g.  $PM_{10}$ ,  $PM_{2.5}$
- Direct link between the size of PM and potential for health problems,  $PM_{2.5}$  is the component in wildfire smoke of most concern for health

**In the US, the daily average National Ambient Air Quality Standard for  $PM_{2.5}$  is  $35 \mu\text{g}/\text{m}^3$ , however the World Health Organization recommends that daily  $PM_{2.5}$  not exceed  $25 \mu\text{g}/\text{m}^3$**

Balmes JR. N Engl J Med. 2018 Mar 8;378(10):881-883.

15

15

## PM<sub>2.5</sub> and respiratory system

**Inflammatory injury**

- PM can interact with the alveolar-capillary cells causing oxidative stress reactions and local and systemic inflammatory responses
- Structural damage to the lungs and functional deficits in chronic respiratory illness
- Increases airway hyper responsiveness

PM enters through nose and throat

Larger PM<sub>10</sub> is eliminated through sneezing, coughing and swallowing

PM<sub>2.5</sub> can penetrate deep into the lungs. It can travel all the way to the alveoli, causing lung and heart problems. And delivering harmful chemicals into the blood stream

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16

Smoke

PM

Alveolar space

ROS

TNF- $\alpha$

Cell barrier damage

Innate Immunity

Activated T-cell

Adaptive Immunity

MAPK

NF $\kappa$ B

AP-1

Oxidative Stress

Asthma, COPD, Acute Lung Injury

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Leikauf GD, et al. *Exp Mol Med.* 2020;52, 329–337 (2020).

17



- Air Quality Index (AQI): ground-level ozone, PM, carbon monoxide, sulfur dioxide, and nitrogen dioxide
- Wildland fires: **PM, carbon monoxide**, methane, nitrous oxide, **nitrogen oxides**, volatile organic carbon etc.
- Carbon monoxide and hydrogen cyanide → impaired oxygen delivery and cellular respiration

18

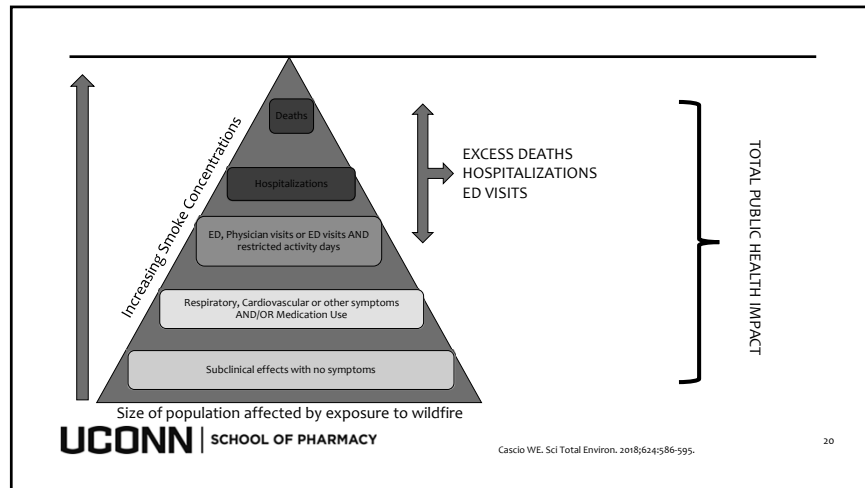
## Air Quality Index (AQI)

- A nationally uniform color-coded index reporting and forecasting daily air quality
- Focuses on health effects that may be experienced within hours or days
- Reports air pollutants that are regulated under the Clean Air Act

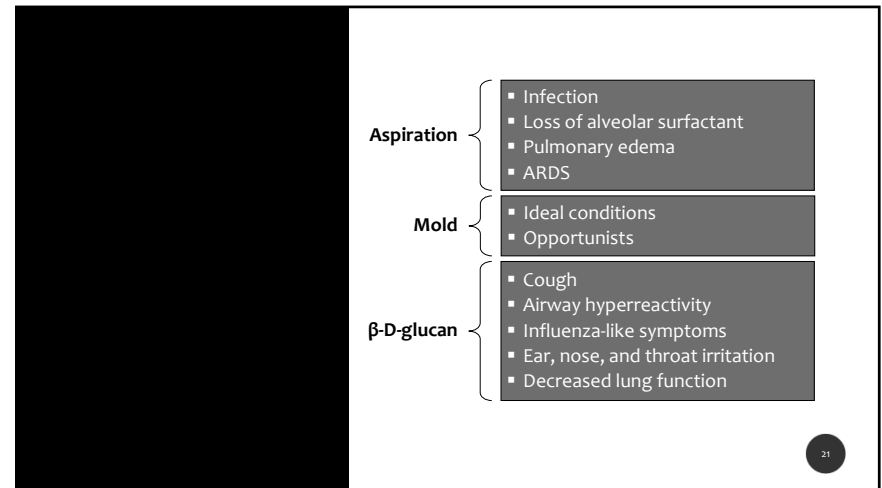
Air Quality Index		
AQI Category and Color	Index Value	Description of Air Quality
Good Green	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Moderate Yellow	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups Orange	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Unhealthy Red	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy Purple	201 to 300	Health alert: The risk of health effects is increased for everyone.
Hazardous Maroon	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

Table 2. The Air Quality Index includes AQI categories and colors, corresponding index values and cautionary statements for different levels of health concern.

19



20



21

- Headaches
- Runny nose
- Sore throat or hoarseness
- Cough, chest tightness, shortness of breath, wheezing
- Skin and mucous membrane irritation
- Severe fatigue and exhaustion
- Nausea and GI problems
- Flu-like symptoms
- Joint and muscle aches
- Cognitive dysfunction
- Unusual nosebleeds and coughing up of blood (rare)

22

Organ system	Clinical Effect	Exposure/Agents
Upper airway, nose, sinuses, throat	Rhinitis, Sinusitis, Laryngitis	Fungi, allergens, irritants, PM
Lower airway, lung with bronchial system, alveoli	Bronchitis, Asthma, Allergic bronchopulmonary aspergillosis, toxic alveolitis, pneumonitis	Fungi, allergens, fungal byproducts, fine particles
Combined upper and lower airway	Aspergillosis, fungal rhino-sinusitis	Fungi, allergens, fine particles

23

- People are more vulnerable in emergencies and disasters
- Emergencies exacerbate chronic conditions leading to acute complications
- Long-term implications resulting from emergencies and their management

Demaio A, et al. PLoS Curr. 2013;ecurrents.dis.53e08b951d59ff913ab8b9bb51c4d0de

24

24

## Question

Schools had to be shut in Nov 2019 in this Indian city due to AQI of 472

- a. New Delhi
- b. Bangalore
- c. Mumbai



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25

<https://www.theatlantic.com/photo/2019/11/photos-delhis-toxic-sky/601357/>

25

## Learning Objectives

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26

26

The Agency for Healthcare Research and Quality (AHRQ) defines surge capacity as a “health care system’s ability to expand quickly beyond normal services to meet an increased demand for medical care in the event of bioterrorism or other large-scale public health emergencies”

27

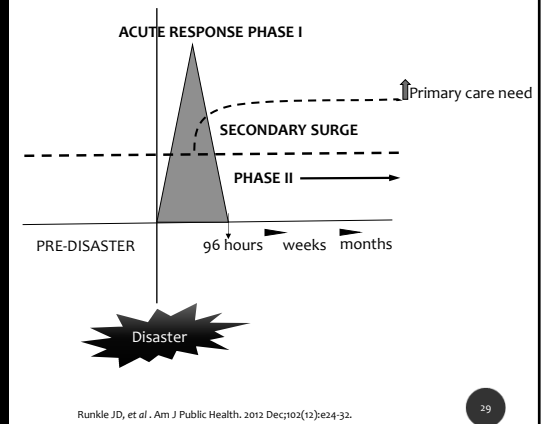
27

- Hospital bed capacity
- Medical equipment and supplies
- Population to provider ratios
- Personnel availability
- Prescription medication refills
- Portable triage and decontamination centers
- The ability to legally delivery health services under situations that exceed authorized capacity

Runkle JD, et al. Am J Public Health. 2012 Dec;102(12):e24-32.

28

28



Runkle JD, et al. Am J Public Health. 2012 Dec;102(12):e24-32.

29

29

### DMAT in Gulfport, MS and New Orleans, LA

#### Expectation- Acute Illness

Study results- More than 40% of the health problems treated at the two sites were related to chronic conditions and the lack of access to routine care

The most common presentation overall was for chronic health conditions

- > medication refills (20.6%)
- > immunizations (11%)
- > obtaining community resources (6%)

Millin MG, et al. Prehosp Emerg Care. 2006 Oct-Dec;10(4):451-6.

30

30

Which of the following is a benchmark for surge capacity?

- A. Immunization availability
- B. Prescription medication refills
- C. Ability to close schools quickly

31

31

## Learning Objectives


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32

32

## What's our role in disaster management?



33

33



- We often hear about doctors and nurses in disaster management
  - Where are our pharmacists and pharmacy technicians?
- **DRUGS, VACCINATIONS, COUNSELING**

34

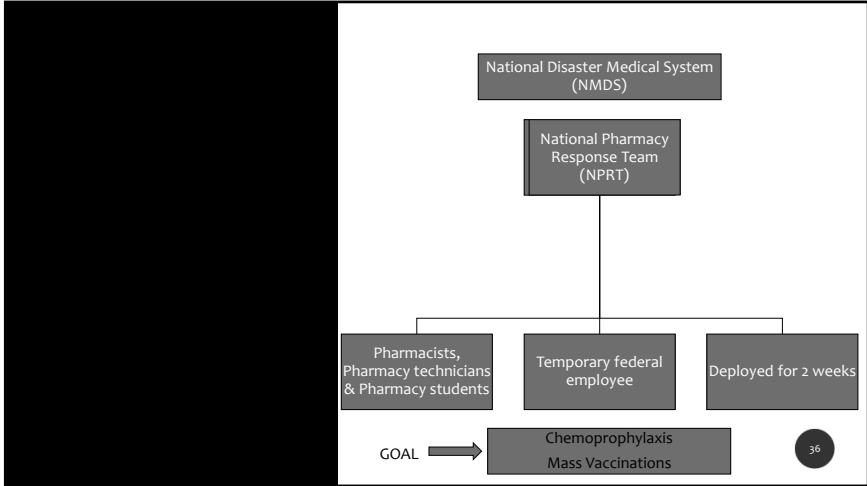
34

- Pharmacists should have a key role in the
  - **planning and execution of pharmaceutical distribution**
  - control drug therapy management of patients during disasters
- Pharmacists should aid in the following
  - Develop guidelines for the diagnosis and treatment of casualties and exposed individuals
  - Select pharmaceuticals and related supplies for national and regional stockpiles and local emergency inventories in emergency preparedness programs
  - Ensure proper packaging, storage, handling, labeling, and dispensing of emergency supplies of pharmaceuticals
  - **Ensure appropriate deployment of emergency supplies of pharmaceuticals**
  - Ensure appropriate education and counseling of individuals who receive pharmaceuticals from an emergency supply in response to a disaster
- **Pharmacists should advise public health officials** on appropriate messages to convey to the public about the use of essential pharmaceuticals in response to disasters
- Pharmacists should collaborate with physicians in managing the drug therapy of individual victims

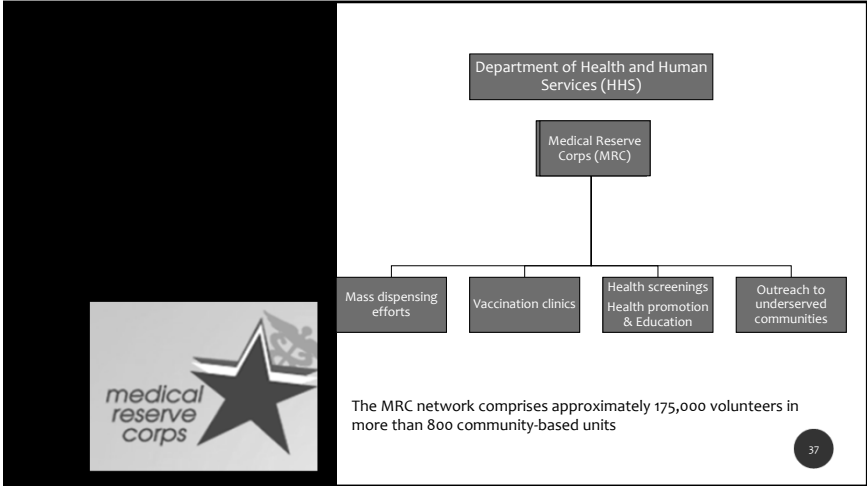
Am J Health Syst Pharm. 2003;60(19):1993-1995.

35

35



36



37

Which of the following is a health system Pharmacist's role?

- A. Maintain appropriate pharmacist to technician ratios mandated by states
- B. Ensure appropriate deployment of emergency supplies of pharmaceuticals
- C. Report to work on time, even if you are experiencing viral symptoms

38

38

**Utilization of skills, knowledge and expertise is warranted!**

- Medication history
- Triage patients
- Vaccinate in some states
- Restock carts
- First receivers in a community setting
- Volunteer in MRC or other organizations

39

39

Which of the following is a Technician's role?

- A. Take medication histories and triage patients to streamline care
- B. Report to work on time, even if you are experiencing cough and fever
- C. Assume responsibilities usually only allowed for pharmacists

40

40

## Learning Objectives

1

Review the pulmonary effects of natural disasters ✓

2

Discuss secondary surge for chronic respiratory diseases following natural disasters ✓

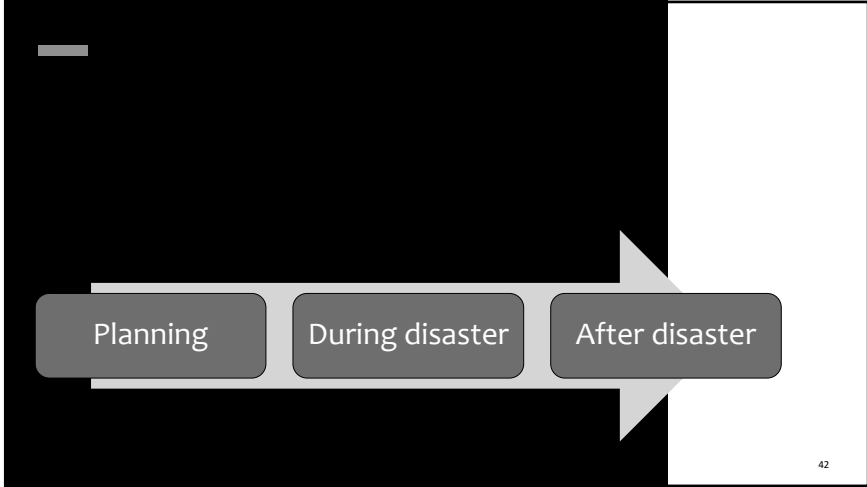
3

Describe preventive clinical management strategies for common respiratory diseases during disasters

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41

41



42

Medications

- At least 2-week supply
- Maximum frequency of inhaler use
- Antibiotic prescription
- Prescription for metered dose inhaler in addition to nebulizer medications

Lung Function

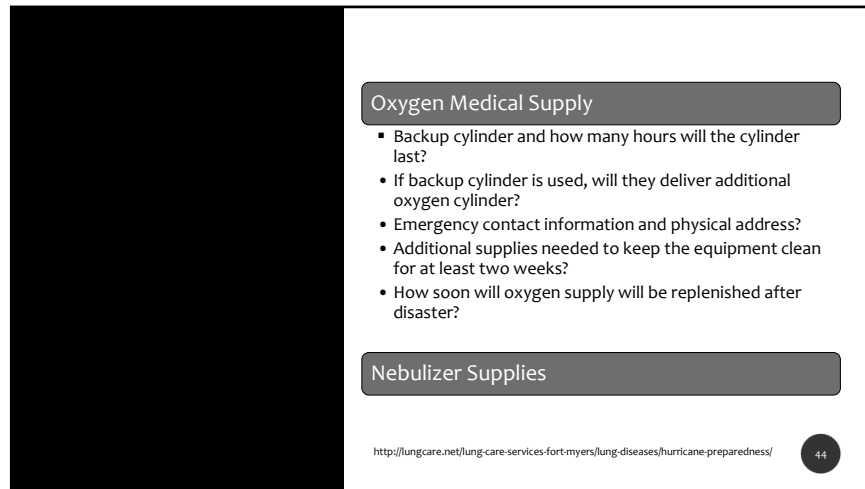
- Access lung function with peak flow meter

Hospitalization?

- Should the patient be admitted in the hospital as precautionary measure?
- Identify hospital that has available physician

<http://lungcare.net/lung-care-services-fort-myers/lung-diseases/hurricane-preparedness/>

43



Slide 44 features a black vertical bar on the left side. The main content area is white and contains two sections. The first section, titled "Oxygen Medical Supply", lists five bullet points: "Backup cylinder and how many hours will the cylinder last?", "If backup cylinder is used, will they deliver additional oxygen cylinder?", "Emergency contact information and physical address?", "Additional supplies needed to keep the equipment clean for at least two weeks?", and "How soon will oxygen supply will be replenished after disaster?". The second section, titled "Nebulizer Supplies", is currently empty. At the bottom left, there is a URL: <http://lungcare.net/lung-care-services-fort-myers/lung-diseases/hurricane-preparedness/>. A small circular icon with the number "44" is located at the bottom right of the slide.

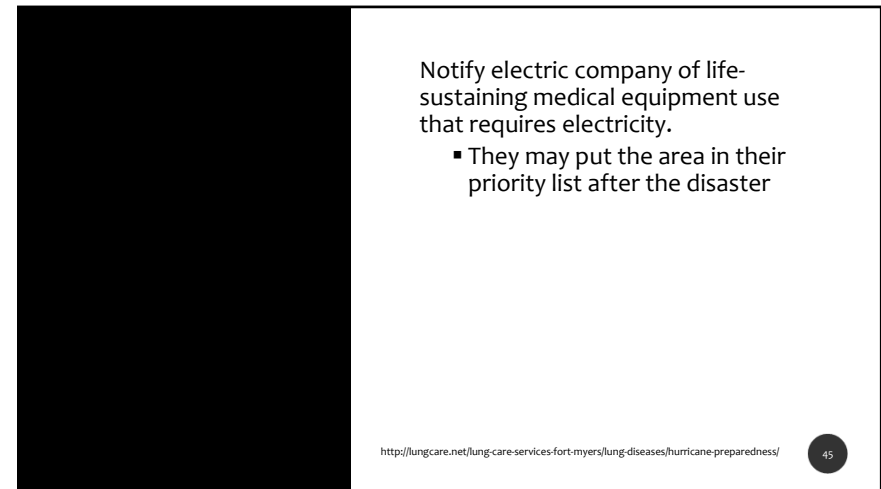
### Oxygen Medical Supply

- Backup cylinder and how many hours will the cylinder last?
- If backup cylinder is used, will they deliver additional oxygen cylinder?
- Emergency contact information and physical address?
- Additional supplies needed to keep the equipment clean for at least two weeks?
- How soon will oxygen supply will be replenished after disaster?

### Nebulizer Supplies

<http://lungcare.net/lung-care-services-fort-myers/lung-diseases/hurricane-preparedness/>

44



Slide 45 features a black vertical bar on the left side. The main content area is white and contains one section. The text reads: "Notify electric company of life-sustaining medical equipment use that requires electricity." followed by a bullet point: "They may put the area in their priority list after the disaster". At the bottom left, there is a URL: <http://lungcare.net/lung-care-services-fort-myers/lung-diseases/hurricane-preparedness/>. A small circular icon with the number "45" is located at the bottom right of the slide.

Notify electric company of life-sustaining medical equipment use that requires electricity.


- They may put the area in their priority list after the disaster

<http://lungcare.net/lung-care-services-fort-myers/lung-diseases/hurricane-preparedness/>

45

## Build A Kit

Have enough food, water and other supplies to support your needs for several days.



**Read:**

- 14-day supply of inhalers, nebulizer and other medications
- Back up oxygen cylinder including cleaning supplies
- Portable battery-operated nebulizer machine
- A DC adapter to operate a nebulizer from a car cigarette outlet
- Water and non-perishable foods for 2 weeks
- A small cooler with frozen gel packs
- Flashlight, radio and extra batteries
- Blanket and pillows
- Keep important papers

## Breathe Easy Hurricane Survival Kit

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46

## ASTHMA ACTION PLAN

Asthma and Allergy Foundation of America

The colors of a traffic light will help you use your asthma medicines.

**GREEN means Go Zone!** Use preventive medicine.  
**YELLOW means Caution Zone!** Add quick-relief medicine.  
**RED means Danger Zone!** Get help from a doctor.

Name: \_\_\_\_\_ Date: \_\_\_\_\_  
 Doctor: \_\_\_\_\_ Medical Record #: \_\_\_\_\_  
 Doctor's Phone #: Day \_\_\_\_\_ Night/Weekend \_\_\_\_\_  
 Emergency Contact: \_\_\_\_\_  
 Doctor's Signature: \_\_\_\_\_

Personal Best Peak Flow: \_\_\_\_\_

**GO** Use these daily controller medicines:

**You have all of these:**  
 • Breathing is good  
 • No cough or wheeze  
 • Sleep through the night  
 • Can work & play

Peak Flow	MEDICINE	HOW MUCH	HOW OFTEN/WHEN
from _____ to _____			
For asthma with exercise, take:			

**CAUTION** Continue with green zone medicine and add:

**You have any of these:**  
 • First signs of a cold  
 • Exposure to illness  
 • Sneeze  
 • Cough  
 • Rapid wheeze  
 • Tight chest  
 • Coughing at night

Peak Flow	MEDICINE	HOW MUCH	HOW OFTEN/WHEN
from _____ to _____			
CALL YOUR ASTHMA CARE PROVIDER.			

**DANGER** Take these medicines and call your doctor now:

**Your asthma is getting worse fast:**  
 • Medicine is not helping  
 • Breathing is hard  
 • A fast heartbeat  
 • Nose opens wide  
 • Trouble speaking  
 • Lips show (in children)

Peak Flow	MEDICINE	HOW MUCH	HOW OFTEN/WHEN
reading below _____			

**GET HELP FROM A DOCTOR NOW!** Your doctor will want to see you right away. It's important! If you cannot contact your doctor, go directly to the emergency room. **DO NOT WAIT.** Make an appointment with your asthma care provider within two days of an ER visit or hospitalization.

47

**MY COPD ACTION PLAN**

It is recommended that patients and physicians /healthcare providers complete this action plan together. This plan should be discussed at each physician visit and updated as needed.

**AMERICAN LUNG ASSOCIATION**  
Fighting for Air

The green, yellow and red zones show symptoms of COPD. This list of symptoms is not comprehensive, and you may experience other symptoms. In the "Notes" column, your healthcare provider will recommend actions for you to take based on your symptoms by checking the appropriate boxes. Your healthcare provider may write down other actions in addition to those listed here.

Green Zone: I am doing well today	Actions
<ul style="list-style-type: none"> <li>Usual energy and exercise level</li> <li>Usual amounts of cough and phlegm/sputum</li> <li>Sleep well at night</li> <li>Appetite is good</li> </ul>	<ul style="list-style-type: none"> <li>Take daily medications</li> <li>Use oxygen as prescribed</li> <li>Continue regular maintenance plan</li> <li>At all times avoid cigarette smoke, second hand smoke*</li> </ul>
Yellow Zone: I am having a bad day or a COPD flare	Actions
<ul style="list-style-type: none"> <li>More breathless than usual</li> <li>Don't have energy for my daily activities</li> <li>Increased or thicker phlegm/sputum</li> <li>Using quick relief inhaler/nebulizer more often</li> <li>Sneezing or watery more than usual</li> <li>More coughing than usual</li> <li>I feel like I have a "bad cold"</li> <li>Fear, dizziness and my symptoms wake me up</li> <li>My appetite is not good</li> <li>My medicine is not helping</li> </ul>	<ul style="list-style-type: none"> <li>Continue daily medication</li> <li>Use quick relief inhaler every _____ hours</li> <li>Start an oral corticosteroid (specify name, dose, and duration)</li> <li>Start an antibiotic (specify name, dose, and duration)</li> <li>Use oxygen as prescribed</li> <li>Get plenty of rest</li> <li>Use pursed lip breathing</li> <li>At all times avoid cigarette smoke, second hand smoke*</li> <li>Call provider immediately if symptoms don't improve*</li> </ul>
Red Zone: I am having a life-threatening COPD flare	Actions
<ul style="list-style-type: none"> <li>Sudden decrease of breath when at rest</li> <li>Not able to do any activity because of breathing</li> <li>Not able to sleep because of breathing</li> <li>Fever or shaking chills</li> <li>Feeling confused or very dizzy</li> <li>Other signs</li> <li>Coughing up blood</li> </ul>	<ul style="list-style-type: none"> <li>Call 911 or seek medical care immediately*</li> <li>While getting help, immediately do the following: _____</li> </ul>

\*The American Lung Association recommends that the providers select this action for all patients.

The information contained in this document is for educational use only. It should not be used as a substitute for professional medical advice, diagnosis or treatment. The American Lung Association does not endorse any specific commercial product.

For more information, visit [www.lung.org](http://www.lung.org) or call 1-800-LUNG-USA (1-800-556-6872)

48

<b>Stay Calm</b>	Emotional stress increases heart rate, quickens breathing, makes breathing more difficult and demands more oxygen from the body.
<b>Practice breathing</b>	Practice pursed-lip breathing, diaphragmatic breathing, and conditioning exercises to breathe easier
<b>Use Battery powered lights</b>	Use battery powered lights only, away from open sources of flame
<b>Increase frequency of inhalers</b>	If symptoms worsen, increase the dose or frequency of inhalers or nebulizer or other respiratory medications
<b>Call 911</b>	Call 911, only for an actual or impending life-threatening emergency

49



**POWER OUTAGES OR FLOODS**

- An unopened refrigerator will keep food cold for about 4 hours
- An unopened full freezer will remain frozen for approximately 48 hours

**MOLD AND MILDEW**

- Remove wet items from the house immediately
- Mold worsens asthma

**CLEANING DEBRIS**

- Asthma symptoms manifests within 30-120 minutes after the exposure

**People with chronic respiratory disorders are more susceptible to CO poisoning**

50

50

**Prepare for the fire season**

**BE PREPARED FOR A WILDFIRE**

**Wildfires can ruin homes and cause injuries or death to people and animals.**

**FEMA**  
FEMA V-1013/May 2018

- Know where to find alerts
- Follow the asthma/COPD action plan
- Maintain a 7-10-day supply of medication
- Check the heating, ventilation, and air conditioning (HVAC) system
- Stay indoors with doors and windows closed
- Use a portable air cleaner
- Wear an N-95 mask
- Make an evacuation or relocation plan

51

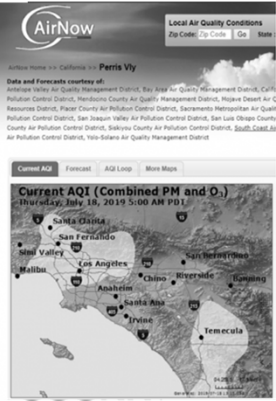
51

## Where to find Air Quality Reports

- AirNow.gov has current and forecast air quality data and maps
- Residents can sign up for email notices about air quality through a free service called EnviroFlash
- Weather forecasts in local news



52



### Current Conditions

**Air Quality Index (AQI)**  
observed at 6:00 PDT

62 **Moderate**

**Health Message:** Unusually sensitive people should consider reducing prolonged or heavy exertion.

*Note: Values above 500 are considered Beyond the AQI. Follow recommendations for the Hazardous category. Additional information on reducing exposure to extremely high levels of particle pollution is available [here](#).*

AQI - Pollutant Details		
Ozone	50	<a href="#">Good</a>
Particles (PM10)	29	<a href="#">Good</a>
Particles (PM2.5)	62	<a href="#">Moderate</a>

53

- Keep smoke out
- Run a/c with the fresh-air intake closed (“recirculate mode”)
- Clean room
- Do not add to indoor air pollution
- Monitor local air quality reports and health warnings
- Avoid ash exposure after wildfire
  - Wear gloves, long-sleeved shirts, long pants, shoes and socks to avoid skin contact
  - Select a respirator that has been tested and approved by NIOSH

54

54

## Stability of biologics at room temperature

Injectable for Asthma	Stability at room temperature
<b>Mepolizumab (NUCALA®)</b>	Unopened carton can be stored outside the refrigerator at up to 86°F (30°C) for up to <b>7 days</b> .
<b>Dupilumab (DUPIXENT®)</b>	Syringes can be stored at <b>room temperature</b> up to 77°F (25°C) up to <b>14 days</b>
<b>Benralizumab (FASENRA®)</b>	May be kept at <b>room temperature</b> between 68°F to 77°F (20°C to 25°C) for a maximum of <b>14 days</b>
<b>Reslizumab (CINQAIR®)</b>	Store diluted solutions at <b>room temperature</b> up to 25°C (77°F), protected from light, for up to <b>16 hours</b>
<b>Omalizumab (XOLAIR®)</b>	Reconstituted vials good for <b>4 hours at room temperature</b>

Stability of Refrigerated medications 2015 (hpsm.org) 55

55

## Question

The expert panel of key opinion leaders within the field of disaster health recommended pharmacists could undertake ----number of roles in a disaster

- a. 13
- b. 23
- c. 43

- Check for open pharmacies <https://rxopen.org>
- Receive care at community health centers  
<https://www.directrelief.org>  
Free prescription drugs and medical supplies for low-income individuals at community health centers of clinics
- Contact Medicare
  - Medicare-insured patients contact the plan to determine the closest network pharmacy that is open.
  - If none are open, Medicare will be able to connect patients with another pharmacy
- Insurance overrides “Refill Too Soon” Edit Override to allow for 30-day supply of medications
- State boards may authorize **Emergency Dispensing of Prescription Medications**

- Must be activated by the federal government
- Only for uninsured patients
- Provides 30-day coverage for prescription medications and DME to those in federally-identified disaster areas
- 72,000 pharmacies enrolled
- Covers vaccines

58

58



## Get involved!

National Disaster Medical System (NDMS)

[publichealthemergency.hhs.gov/ndms/](https://publichealthemergency.hhs.gov/ndms/)

Medical Reserve Corps

<https://mrc.hhs.gov>

Citizen Corps

[www.citizen corps.gov](http://www.citizen corps.gov)

American Red Cross

[www.redcross.org](http://www.redcross.org)

Community Emergency Response Team (CERT), also TEEN CERT

<https://community.fema.gov/PreparednessCommunity/welcome-to-cert>

You Are the Help Until Help Arrives

<https://community.fema.gov/until-help-arrives>

National Voluntary Organizations Active in Disasters

<https://www.nvoad.org/volunteer/>

59

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60