EHS Webinar: Wildfire Smoke & Public Health in British Columbia

June 5th, 2014

Vancouver, BC, Canada
Wildfire smoke is an important and growing public health issue

- Wildfire frequency and duration forecasted to increase with climate change
- Estimated annual global mortality from wildfire smoke 339,000
Where there’s fire, there’s smoke

Where there’s no fire, there’s smoke

Photograph by: Ed Kaiser
edmontonjournal.com

http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=78493
Agenda

1. Guidelines for Public Health Decision Making During Wildfire Smoke Events
   - Catherine Elliott

2. BC Asthma Monitoring System
   - Sarah Henderson

3. Questions and Discussion
Guidelines for Public Health Decision Making During Wildfire Smoke Events

EHS Webinar
June 4th, 2014
Vancouver, BC, Canada
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BC Centre for Disease Control
An agency of the Provincial Health Services Authority
1. Consensus Guidelines
2. Preliminary BC Guidance: Practice Pearls
Scope & Considerations

- Wildfire, not planned, not structural
- Informative, not prescriptive
- Must be applied within local & situational context
- Universal and targeted interventions
- Higher resource countries
Process for Guideline Development

Scientific Advisory Committee

- Scope & Key Questions
- Review Evidence
- Consensus Meeting
- Develop Draft Guidelines
- Consultation
- Final Guidelines

June 2014
Wildfire response tools so far

- Evidence reviews
- Guidelines review (July 2014)
- Preliminary BC guidance (July 2014)

http://www.bccdc.ca/healthenv/AirQuality/default.htm
Just the facts: evidence reviews

Key points
Evidence gaps
Considerations

http://www.bccdc.ca/healthenv/AirQuality/default.htm
Wildfire Smoke

Health Effects of Smoke

Smoke Surveillance

Health Surveillance
### Evidence for Interventions

<table>
<thead>
<tr>
<th>Stay indoors</th>
<th>Reduce physical activity</th>
<th>Use a home clean air shelter</th>
<th>Cancel outdoor events</th>
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<tbody>
<tr>
<td>Wear N95 respirator</td>
<td>Provide community clean air shelters</td>
<td>Augment filtration in institutions</td>
<td>Evacuate</td>
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- **Stay indoors**: Minimize exposure to indoor environments as much as possible.
- **Wear N95 respirator**: Enhance personal protection against airborne particles.
- **Reduce physical activity**: Limit strenuous activities that increase respiratory rate.
- **Use a home clean air shelter**: Create a safe environment using air filtration systems.
- **Cancel outdoor events**: Avoid gatherings and activities that require ventilation.
- **Provide community clean air shelters**: Offer temporary spaces with adequate air flow and filtration.
- **Augment filtration in institutions**: Improve indoor air quality in communal spaces.
- **Evacuate**: If necessary, relocate to areas with cleaner air outside of the immediate environment.
Known or suspected to be caused by wildfire smoke

Respiratory:
asthma, COPD
bronchitis, pneumonia

All cause mortality

Cardiovascular
Respiratory:
- asthma, COPD
- bronchitis,
- pneumonia
All cause mortality
Cardiovascular
Birth outcomes

Linked to short-term PM exposure but not yet studied for wildfire smoke:

- Atherosclerosis
- Childhood respiratory disease
- Lung cancer
- Birth outcomes
Populations susceptible to wildfire smoke

- Older adults
- Unborn children
- Populations with pre-existing respiratory disease
- Populations with pre-existing cardiovascular disease
- Populations with lower socio-economic status
Populations susceptible to particulate matter but evidence for wildfire smoke is insufficient

- Children
- Populations with chronic inflammatory diseases (e.g., diabetes, obesity)
- Populations with specific genetic polymorphisms that mediate physiologic response to air pollution
Situational Awareness during wildfire smoke events

Smoke measures:
- Monitored PM (MoE)
- Modeled smoke (BCCDC)
- Predicted smoke (BlueSky)

Health outcomes:
- Medication refills
- Physician visits
- Emergency visits
- Hospital admissions
Interventions

- Stay indoors & reduce physical activity
- Wear N95 respirator
- Use a home clean air shelter
- Cancel outdoor events
- Provide community clean air shelters
- Augment filtration in institutions
- Evacuate
Evidence for Interventions

- Stay indoors
- Reduce physical activity
- Use a home clean air shelter
- Cancel outdoor events
- Wear N95 respirator
- Provide community clean air shelters
- Augment filtration in institutions
- Evacuate
Staying Indoors

Limit infiltration from outdoors
Limit indoor air pollution

Chen 2011. Atmospheric Environment
http://dx.doi.org/10.1016/j.atmosenv.2010.09.048
Staying Indoors: Effective?

Limit infiltration from outdoors
Limit indoor air pollution

Can reduce indoor particulate matter
Limited evidence of reduction in children's asthma symptoms

Chen 2011. Atmospheric Environment
http://dx.doi.org/10.1016/j.atmosenv.2010.09.048
Home Clean Air Shelter

Limit infiltration from outdoors
Limit indoor air pollution
Clean indoor air (existing central air, HEPA, electrostatic precipitator)
Home Clean Air Shelter: Effective?

Limit infiltration from outdoors
Limit indoor air pollution
Clean indoor air (existing central air, HEPA, electrostatic precipitator)

Reduces indoor particulate matter
Limited evidence of reduction in respiratory symptoms & cardiovascular health
Community Clean Air Shelter

Limit infiltration from outdoors
Limit indoor air pollution
Clean indoor air: existing or augmented

No Specific Evidence for CCAS:
Similar effects as home clean air shelter depending on level of air cleaning
Canceling outdoor events

Effective only if people seek cleaner air

No evaluation studies

Consider other options:
- Modified event
- Informed participation
N95 Respirator
(Mask)

Widely available and inexpensive
Must be fit tested & trained
N95 Respirator: Effective?

Widely available and inexpensive

Fit-testers in occupational settings

10-fold reduction in inhaled particulate matter

No evaluation of efficacy or effectiveness
Augmenting filtration in institutions

HVAC Systems:

MERV 3-8: Residential systems
MERV 8-15: Many hospitals

Chen 2011. Atmospheric Environment
http://dx.doi.org/10.1016/j.atmosenv.2010.09.048
Augmenting filtration in institutions

MERV 3-8: Residential systems
MERV 8-15: Many hospitals

Approaches:
- Augment filtration
- Set up clean air shelters (rooms)

Ventilation engineer is critical to planning augmented filtration.
Evacuation

Potential benefits:
Reduce smoke exposure and associated health effects

Potential harms:
Disruption of daily activities, social support systems, economy, health care.
Smoke exposure during/after evacuation
Limited evidence of increased anxiety, exacerbation of mental illness
Planning a Response (BC)

Populations at risk*

Susceptible populations

General population

Health & Environmental Surveillance

Health
- Asthma

Smoke
- Monitored
- Modeled
- Predicted

Other threats
- Heat
- Fire

Preparedness

Sensitive Populations

Vulnerable populations

General population

Readiness to respond
- Clean Air Shelters
- N95 respirators
- Institutions

Communications plan

Response

Interventions for:
- Sensitive individuals
- Vulnerable populations
- General population
- Institutions

Communications plan

*Populations at risk include susceptible individuals and vulnerable populations.
Summary

• Number of interventions
• Challenge is deciding appropriate interventions for the situation
• BCCDC tools & expertise
Questions

Catherine Elliott

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Overview

• 2010 fire season
• 2011 foundational research
• 2012 pilot BCAMS
• 2013 updates to BCAMS
• 2014 updates to BCAMS
Summer of 2010 was the worst season on record.
From 2003 fires: smoke associated with asthma-related **physician visits** in Kelowna
From 2010 fires: smoke associated with salbutamol dispensations in Williams Lake
Salbutamol dispensations in fire-affected populations
Salbutamol dispensations in non-fire-affected populations

Elliott et al. Environmental Health 2013: 12
BCAMS cover page gives summary of activity for each HA
Salbutamol dispensations used in 2012 pilot of BCAMS WEEKLY

Limitations:
- 7-day averaging
- Non-intuitive alerting algorithm
- PM data for only 36 of 89 local health areas
- 1-week data lag
Monitor PM

Remote sensing aerosol

Remote sensing fire

Remote sensing smoke

Venting index

Empirical PM model developed
Combining multiple data sources allows daily population-weighted estimates for all LHAs.
2013 refinements to BCAMS, still using salbutamol dispersions WEEKLY

Improvements:
• PHIDO alerting
• Empirical model estimates included
• BlueSky forecasts included
• Still 1-week data lag
2014 BCAMS based on physician visits at the HSDA level, run WEEKLY or DAILY when needed.
Use of physician visits decreases spatial resolution, increases timeliness

April 23rd
LHA maps of estimated PM$_{2.5}$ concentration provided whenever unusual or rare physician visits observed, to help highlight impacted areas.
Discussion

1. What are your information needs when managing wildfires smoke events?
2. How can coordinate better pre-season and during wildfire smoke events?
3. How can we better evaluate our response to wildfire smoke events?