National Collaborating Centre for Environmental Health

Housing and Health

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6th National Community Health Nurses Conference

Markham, ON

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National Collaborating Centre for Environmental Health
Centre de collaboration nationale en santé environnementale

BC Centre for Disease Control
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Road Map

Introduction

EH & Community Health Nurses

Housing Characteristics

Radon, Bed Bugs, Mould, Pesticides

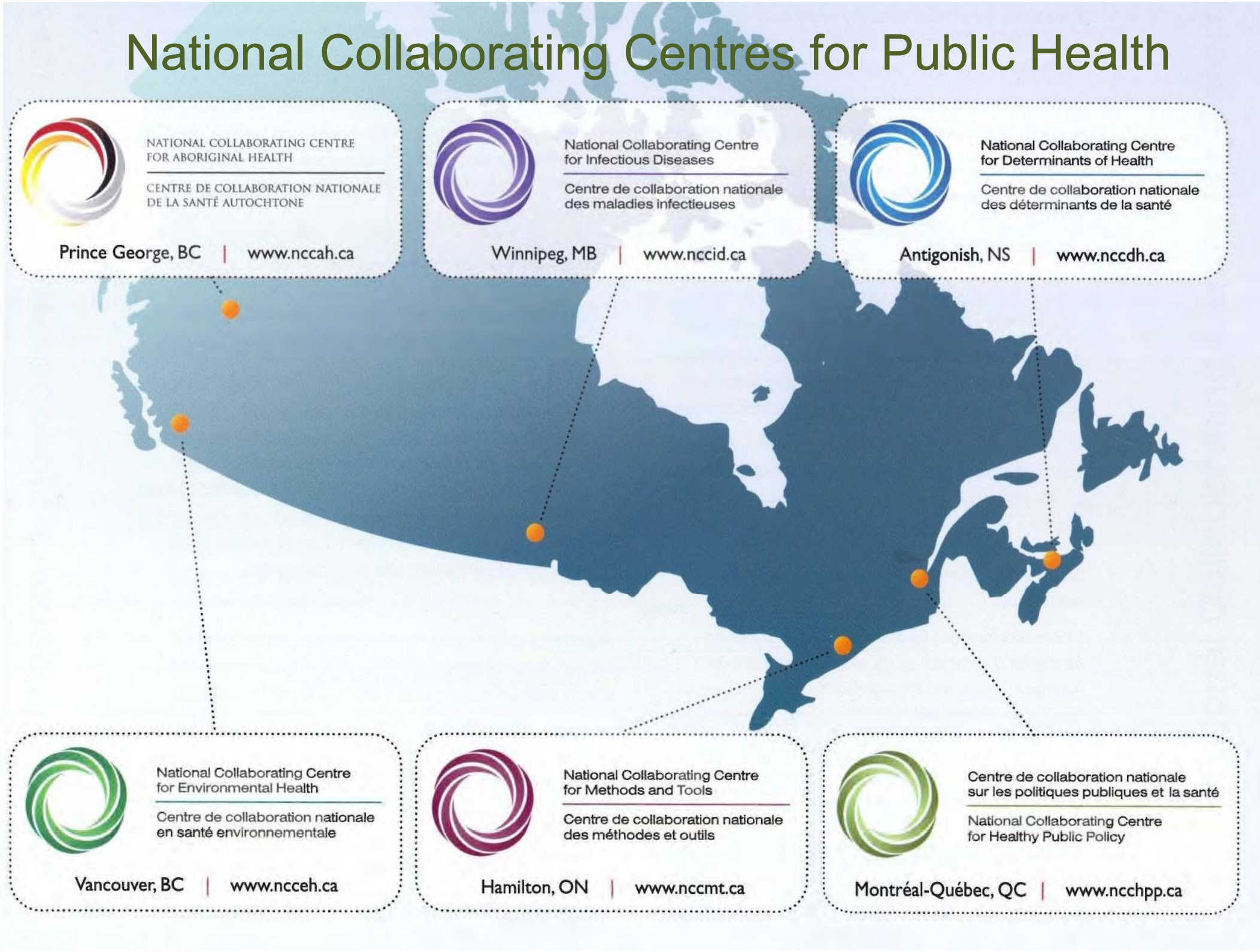
Discussion – experiences/needs/gaps

Background - National Collaborating Centre for Environmental Health (NCCEH)

- Focus on the health risks associated with the physical environment (natural and built) and identify evidence-based interventions to reduce those risks

- Act as a resource for environmental health practitioners and policy-makers across Canada, including EHOs & MHOs, and provincial officials

National Collaborating Centres for Public Health



NCCEH landscape – Project Types

- Environmental Health Needs & Gaps
- Knowledge Translation projects/Evidence reviews
- Comparative review of legislation, regulations
- NCCEH presentations & workshops
- Professional Development

EH and CH Nurses

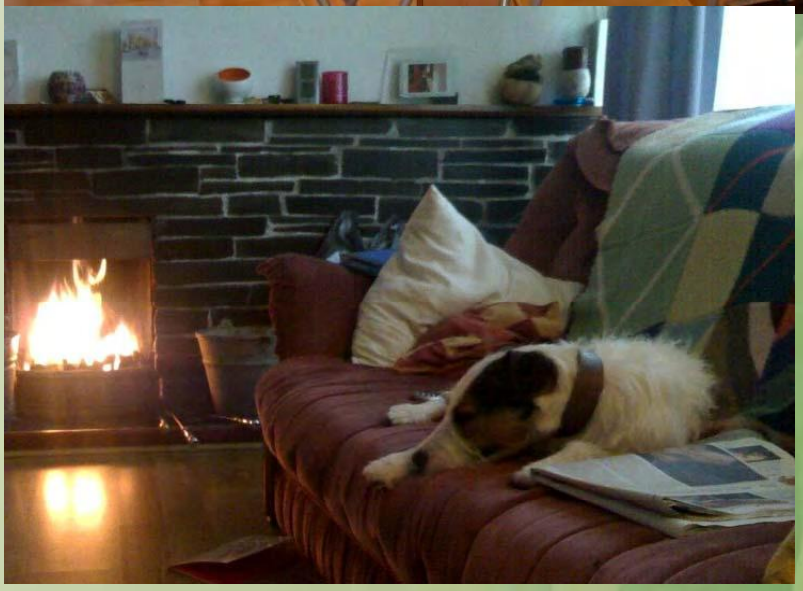
What is meant by environmental health?

How can environmental health relate to community health nurses?

Examples of lead in drinking water in schools and carbon monoxide in health-care facilities

Characteristics of Good Housing

- Encourage people to cook in their homes?
- Encourage people to use stairs?
- Encourage people to socialize in their homes?
- Encourage pet ownership?
- Encourage going outside?



Good Housing Cont'd

- Prevent poisonings?
- Prevent slips and falls?
- Help reduce transmission of infectious diseases?
- Help reduce long-term exposures to contaminants?

Would these characteristics change depending on the population?

- Seniors
- Disabled
- Children
- Different cultural groups

What problems can arise due to poor housing?

What are characteristics of poor housing?

Poorly-built or maintained building envelopes

- Water intrusion through roof, walls or base (mould) – respiratory and allergic effects
- Pest infestations (ants, rodents) – respiratory and allergic effects
- Radon exposure – lung cancer

Physical factors – heat and cold

- Temperature extremes, affected by poor insulation:
- Heat – *cardiovascular effects, mortality*;
- Cold - *increased susceptibility to respiratory and infectious diseases, mortality*

Poorly Ventilated fuel sources

- Wood smoke (particulates) from woodstoves or fireplaces – *respiratory effects*;
- CO from gas appliances, particularly furnaces - *mortality*

Infrastructure hazards

- Lead from plumbing or paint – *neurological diseases*
- Asbestos – *asbestosis, cancer (mesothelioma)*

Chemical Factors

- Environmental Tobacco Smoke – *cardio-respiratory and allergic effects, poor growth & development, cognitive effects*
- Volatile organic compounds (e.g. attached garages, paint, cleaning products) – *Respiratory and allergic effects, kidney or liver damage, cancer*
- Pesticide use –*neurological effects*

Biological Factors

- Increased relative humidity (mould)
- Plumbing - *Limited access to safe drinking water; Leaking water(mould)*
- Animal antigens – *allergic effects*
- Overcrowding - *Increased transmission of infectious diseases (bacteria, TB)*
- Pest infestations (bed bugs, cockroaches, house dust mites) – *respiratory and allergic effects*

Radon!

Prabjit Barn, Tom Kosatsky

Slides from the BC Lung/BCCDC Radon Workshop | March 2012

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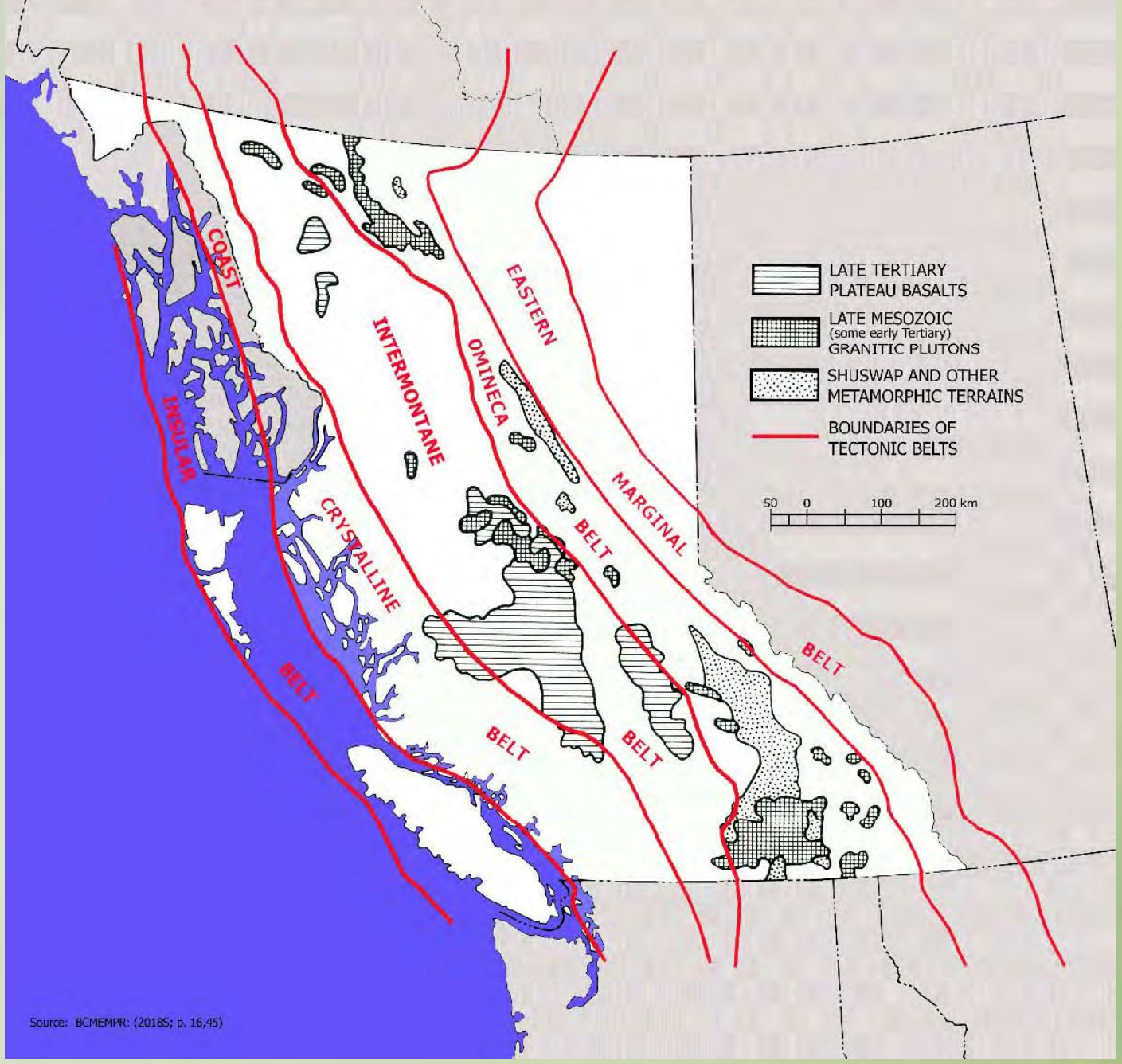
What is Radon ?

- Radon is a radioactive noble gas that is colourless, odourless and tasteless.
- Radon is formed by the breakdown of uranium, a natural radioactive material found in soil, rock and groundwater.
- As a gas, radon escapes from the ground into the air.
- Radon is present in the air everywhere in varying concentrations.

Indoors:
Radon can be elevated.

Outdoors:
Radon levels are generally very low.

FAVOURABLE ENVIRONMENTS FOR URANIUM DEPOSITS



Source: BCMEMPR: (2018S; p. 16,45)

Age and Risk of Lung Cancer

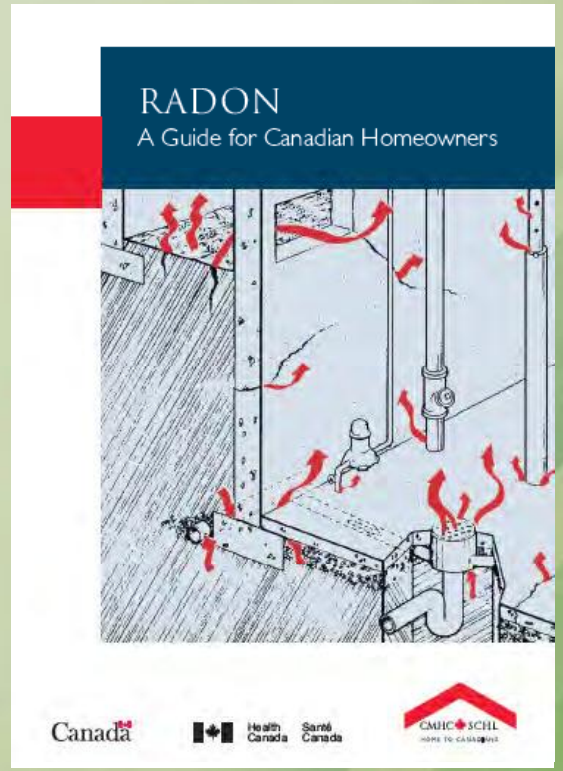
- Only confirmed health risk is increased likelihood of developing lung cancer.
- Risk from radon exposure is long term and depends on:
  1) *concentration of radon,*
  2) *duration of exposure,*
  3) *smoking habits.*
- Although children have been considered to be at greater risk than adults, there is no conclusive current evidence that age at exposure influences cancer risk.
- For a given length of exposure to a given radon level (eg. 10 yrs at 100 Bq/m^3) lung cancer risk is comparable for a 10yr old child, a 30yr old man, or a 60yr old woman.
- However, children have more years to live and thus have more time to develop latent diseases. Because of the long latency period for lung cancer, individuals who receive radon exposures in childhood are more likely to live long enough to develop lung cancer than those exposed in later life.

Radon in Homes and Lung Cancer

Results of pooled analyses in China, Europe and North American.

Pooled analysis	Number of studies included	% increase per 100Bq/m^3	95% CI
Chinese (Lubin et al., 2004)	2	13%	(1.01, 1.36)
European (Darby et al., 2005)	13	8%	(1.03, 1.16)
North American (Krewski et al., 2006)	7	10%	(0.99, 1.26)
European (Darby, 2011)*	5	16%	(1.05, 1.31)

* Results after detailed stratification for smoking history, and allowing for year-to-year variation in measured radon concentration (presented at ICRP Symposium 2011).



Strong direct evidence that radon causes lung cancer in the general population.

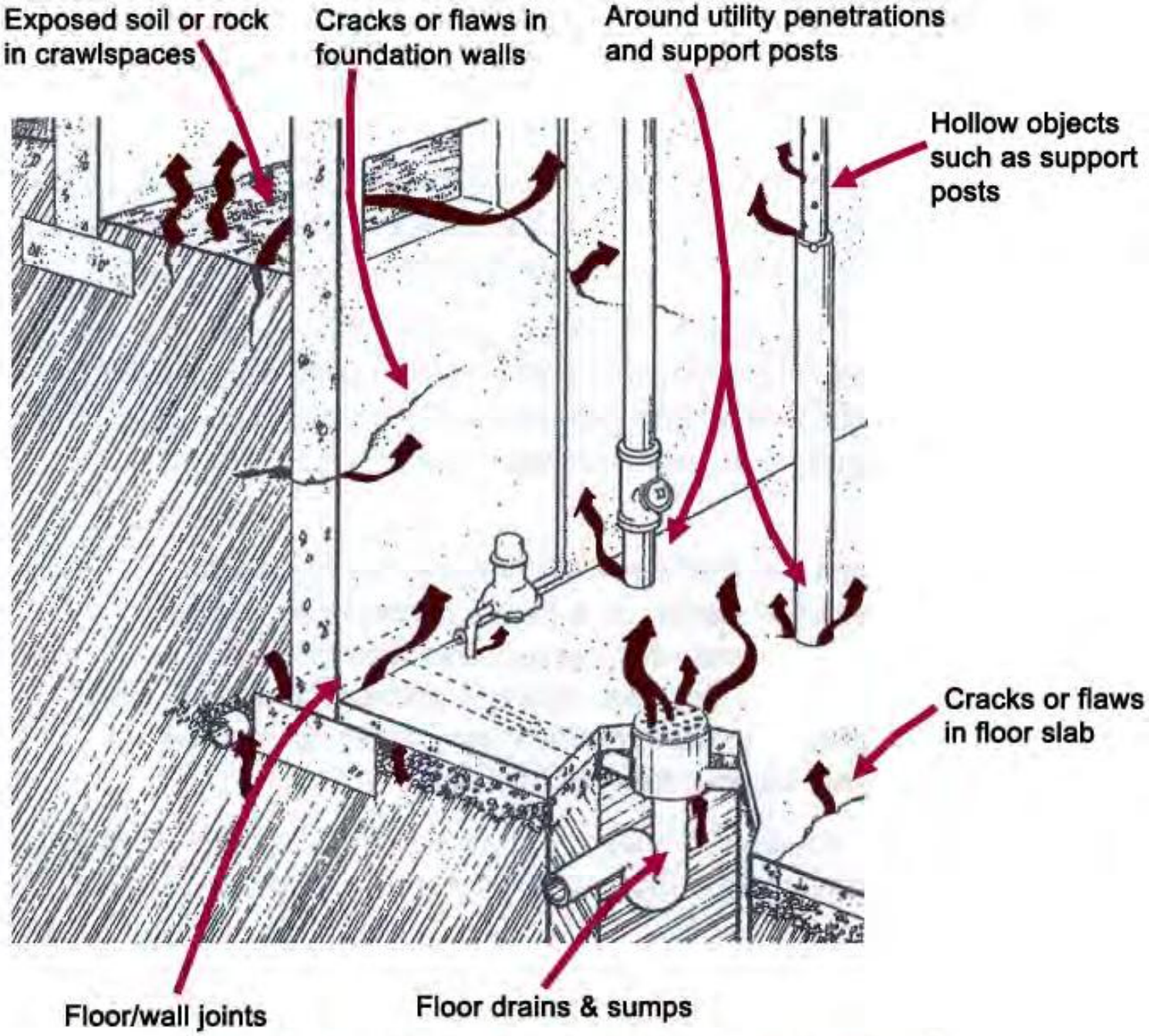
The only way to **know** is to measure…

<200 Bq/m^3	Below Health Canada guideline
200 – 600 Bq/m^3	Fix within **2** years
>600 Bq/m^3	Fix within **1** year

Population Radon Risk Assessment

- In 2011 there were 20,600 deaths from lung cancer in Canada
(11,300 in men and 9,300 in women)
  - 16% of 20,600 => 3261 (1805 in men, 1456 in women)
  - More than **3000** lung cancer deaths are due to residential radon exposure in 2011.

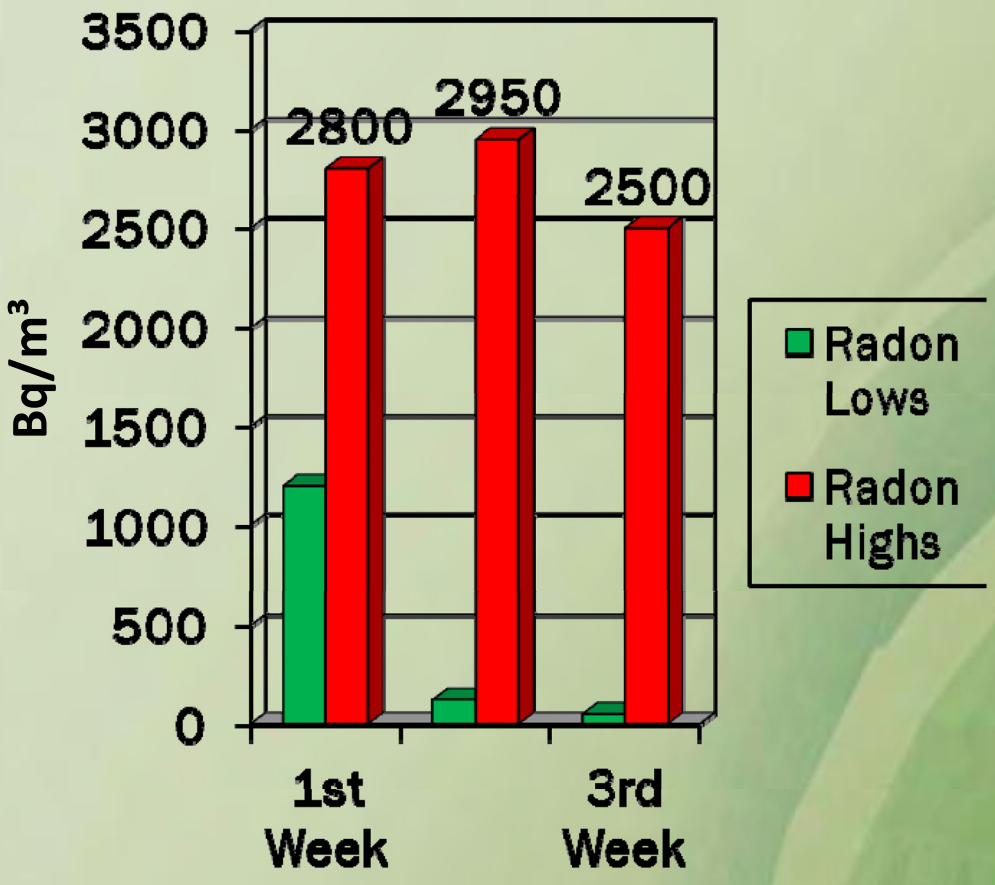
The majority of radon-induced lung cancers are caused by low and moderate radon concentrations rather than by high radon concentrations, because only a few people are exposed to high indoor radon concentrations.



Typical radon entry routes in poured concrete foundation walls and floors

Radon Indoors: CONCENTRATION VARIABILITY

- **Hourly variation**
- **Daily variation**
- **Seasonal variation**
- **Test location**
- **Building ventilation rate**
- **Atmospheric conditions**



Methods of Mitigation

- Sub slab de-pressurization
- Sub-membrane de-pressurization
- Sump de-pressurization
- Block wall de-pressurization
- Increase of ventilation
- Aeration (radon in water)
- Carbon absorption (radon in water)
- Radon resistant new construction

Radon Resistant Construction

- Building Codes in Washington State in 5 high radon counties require radon resistant construction in new homes.
- Small incremental costs for installation compared to Canada National Standard and provides mitigation when installed.

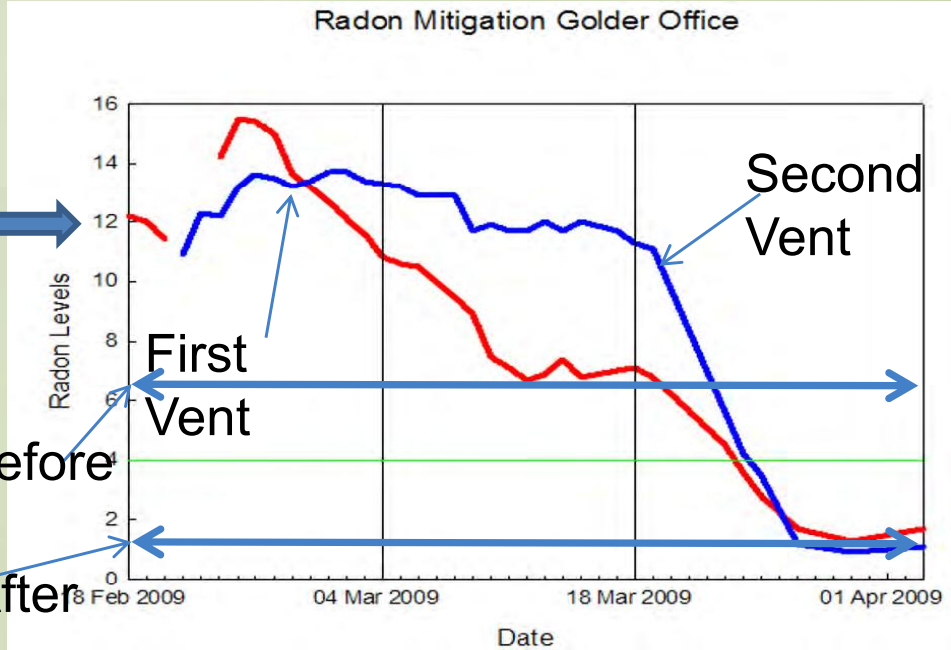
- **Can individual Communities develop such requirements by local by laws?**

Radon in existing homes

- Home owner must pay
- Costs range from few hundred to few thousand dollars
- Cost is a major barrier to mitigation
- Other barriers include:
  - almost impossible to directly connect the disease to radon
  - Lack of immediate threat
  - concern about the potential impact on property values

Mitigation is Possible!

Castlegar Office Now!!



Dana Schmidt's Home Before

Dana Schmidt's Home After

How can community health nurses get involved?

- Promote radon testing and mitigation in daycares and school basements, and in your community
- Another good reason to stop smoking
- Help residents find supports for testing and mitigation
- Others?

Bed Bugs

T Kosatsky, D Fong, M Shum, R Ayre, E Comack, T Stuart, S Perron, S Beaudet

Introduction

- Infestations increasing
- Size of an apple seed (6-7 mm)
- Feed on blood of mammals (mainly humans)
- Light, reddish brown
- Hide and lay eggs in crevices, mattresses, baseboards, etc.
- Attracted to CO_2, heat, aggregation pheromones, and human sweat

Re-emergence

- Early half of 20th Century – quite common
- Decline of infestations since1940s
  - DDT
  - Organophosphates, carbamates
  - Preventative and non-specific application
- DDT and OPs banned
- Non-specific application discouraged
- Pyrethroids became most common
  - No residual, resistance

Health Effects

- No documented transmission of disease
- Allergic reactions and hypertrophic scarring
- Mental health effects
- Acute and possibly chronic effects from pesticide exposure

Bed bugs as vectors for disease transmission

- Bloodborne pathogens of interest
  - HIV
    - Unsuccessful transmission through artificial membrane
    - No viral replication in bed bug, or detected in secretions
  - HCV
    - RNA has not been successfully isolated from bed bugs
  - HBV
    - Antigens and DNA isolated from bed bugs feeding on virus-laden blood.
    - Detected in feces, but not salivary glands
- MRSA and VRE has been recovered from bed bugs in infested dwellings of three hospitalized patients in BC

Physical Health Impacts

- Allergic reactions, hypertrophic scarring, hives, lesions
  - Salivary proteins may sensitive individuals to further bites
- Systemic health effects (rare, individuals with underlying health conditions)
  - Reports of anaemia, asthma, anaphylaxis
- *Drug reactions, infections, allergens, and bites by other insects may cause similar skin reactions*

Mental Health Impacts

- Surveys of online anecdotal postings
  - symptoms relating to posttraumatic stress disorder are often cited
- Case-reports of vulnerable individuals (e.g., with previous or current mental health disorders) experiencing worsening states:
  - Depression
  - Loss of appetite
  - Insomnia
  - Social isolation
  - Suicidal thoughts
  - Hypervigilance

Insecticide Exposure

- Acute health effects
  - Neurologic, respiratory, cardiovascular, gastrointestinal, ocular, death
  - US report identified 111 cases of illness associated with pesticide exposure during bed bug treatments in 3 states from 2003-2010
    - one fatality (case had underlying health conditions)
- Chronic health effects
  - Limited evidence
  - Cancer, developmental effects

Prevention

- Eliminate entry points and harbourage sites
  - Building maintenance
  - Sealing cracks/crevices
  - Clutter removal
- Prevent ingress and migration
  - Second-hand items, luggage (guidelines, inspection)
  - Isolation of bed and furniture
  - Moat-style interceptors, monitoring devices
  - Encasements

Identification

- Clinical signs of bed bug bites
  - Some individuals are asymptomatic
- Inspection by qualified person (e.g., pest control professional, entomologist)
  - Live/dead bugs, molted skins, fecal deposits, blood stains, odours
- Identify harbourage sites
  - Canine detection units
  - Clutter removal
  - vacuuming
- Estimate population
  - Moat-style interceptors, monitoring devices

Treatment

- Carried out by qualified person
- Assess extent of infestation, implement specific controls in a safe manner
- Preparation
- Non-chemical treatment
- Chemical treatment
- Ongoing monitoring and prevention

Public Health Management

- Many PH departments do not consider a health hazard
  - Not documented to transmit disease
  - Toronto - PH frontline and involved
  - Montreal, Winnipeg, Vancouver – second line, support role to City
  - How about your city?

How can community health nurses get involved?

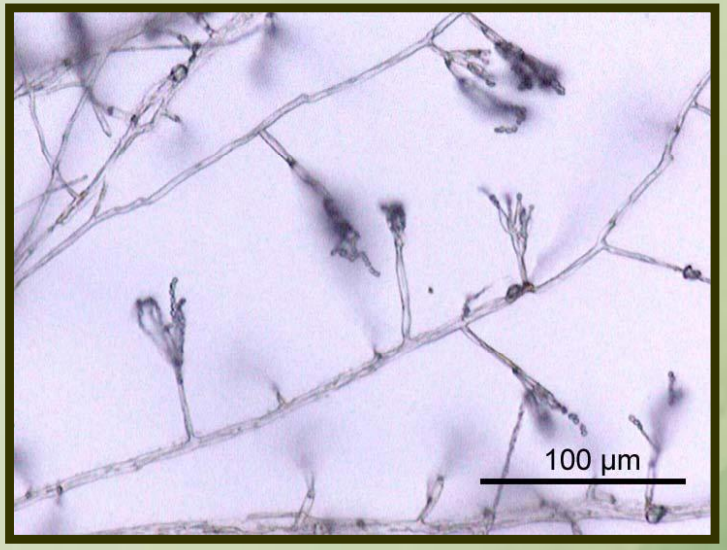
- Recognize bites
- Recognize signs of infestation
- Help occupants find supports, inform appropriate authorities
- Others?

Mould

M Shum and C. Palaty

What is mould?

- Eukaryotic, microscopic, spore-bearing (except yeasts)
- Separate phylogeny from plants and animals
- Grows in mat of intertwined filaments (hyphae)
- Relies on dead or decaying organic matter



What does mould need to grow?

- Food (organic matter)
- Right temperature (preferably 18-32ºC)
- Water

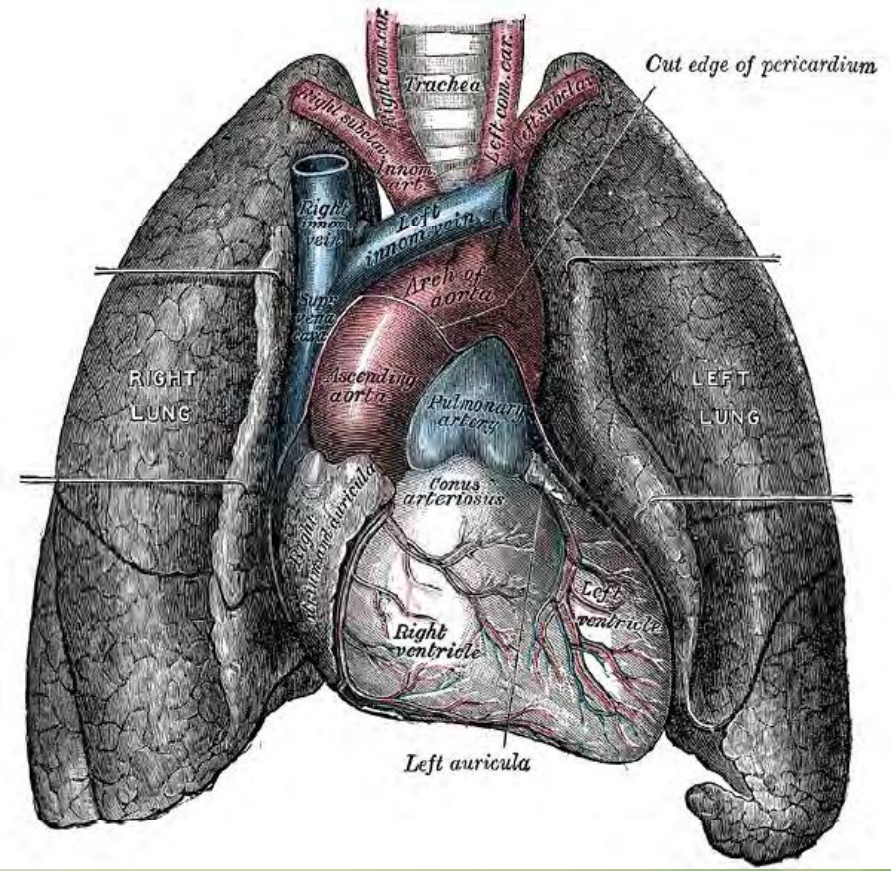
Only component in indoors that can be controlled is water

What are the components of concern?

- Mycotoxins
- Spores
- Structural components
- Volatile organic compounds

How can I get exposed?

- Ingestion
- Dermal contact
- Inhalation



What are they types of ascribed health effects?

- Systemic fungal infections
- Allergic reactions
- Irritant/non-allergic reactions
- Toxic effects

Ascribed Health Effects

Range of health effects blamed on mould exposure:

- Lower, upper respiratory effects
- Asthma
- Respiratory tract disorders
- Pulmonary hemorrhage
- Neurological, reproductive, immune effects
- Cancer

Mould (Dampness) and Health Effects – Syntheses of Evidence

- Palaty and Shum, 2009. Health Effects of Mould in Indoor Environments. NCCEH
- Fisk et al., 2010 – Metaanalysis of respiratory infections and bronchitis
- Mendell et al., 2011 – Systematic review of respiratory and allergic effects of damp & mould

Summary of Evidence for Health Effects from Indoor Mould (Dampness) Exposure

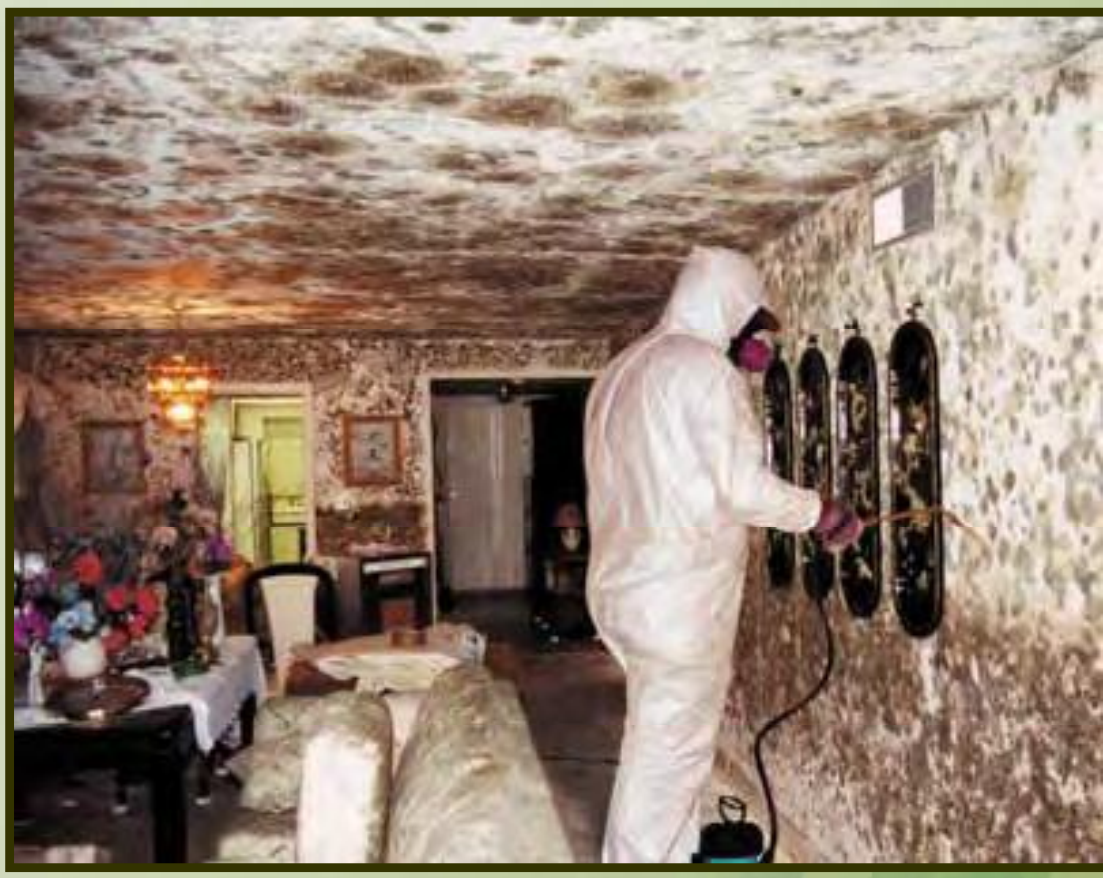
- Causal relationship
  - None
- Sufficient evidence for association
  - Asthma exacerbation (strongly suggestive of causation)
  - Asthma development
  - Upper respiratory symptoms (i.e., sore throat, conjunctivitis, allergic rhinitis, nasal symptoms)
  - Cough, wheeze, dyspnea
  - Hypersensitivity pneumonitis in susceptible people
  - Respiratory infections
  - Eczema

Summary of Evidence Cont'd

- Limited or suggestive evidence for association
  - Common cold
  - Allergy/atopy
- Inadequate or insufficient evidence for association
  - Other respiratory disease not mentioned above
  - GI tract problems
  - Skin symptoms
  - Non-occupational inhalation fevers
  - Neuropsychiatric symptoms
  - Cancer
  - Rheumatologic and other immune diseases
  - Reproductive effects
  - Acute idiopathic pulmonary hemorrhage in infants
  - Altered lung function

How do you know if you have a mould problem?

- Visual inspection most important
  - Signs of water intrusion
  - Building envelope
  - Sometimes not visual
- Testing can supplement



AIHA “Green Book” – Recognition, Evaluation, and Control of Indoor Mold (2008)

Exposure Assessment

- Indoor mould not directly related to exposure or health effects
  - Mould not the only possible contributor to a health effect (eg., dampness)
  - Different components of mould can be harmful
  - Exposure determined by more than just the quantity of mould present
  - Exposure can occur anywhere
  - Individual susceptibility is a major factor

Visual Inspection

Sealant Problems

Water in the ground has seeped through the concrete walls of the basement

Improper Grading

High Occupancy

High Humidity

Testing

- Surface – tape, culture, bulk (material)
- Dust – vacuum, tape
- Air sampling
  - Total spore (onto a slide for microscopy)
  - Culturable (onto agar for culture and speciation)
  - DNA (polymerase chain reaction)
- Destructive

Removal of wallboard, cabinetry, carpeting, baseboards

Limitations of Testing

- Snapshot in time
- Doesn’t inform of actual exposure
- Not well-standardized or validated
- Difficult to interpret
  - Most compare indoors with outdoors
  - Johnson et al., 2008 shows that when 30 sets of air sample datasets were sent to 18 IAQ professionals, inconsistent conclusions
  - No prior history or other information provided
- Testing not that useful by itself

What do you do if you have a mould problem?

- Remove source of water
- Remove/replace porous, semiporous materials
- Clean hard surfaces
- Many guidelines
  - NYCDOH, 1993, 2000
  - Health Canada, 1995
  - ACGIH, 1999
  - US EPA, 2001
  - AIHA, 2001

How can community health nurses get involved?

- During visits observe mould, water intrusion, condensation, exterior issues
- Observe recurring respiratory effects, asthma exacerbation of occupants
- Photograph signs of water or mould? Or encourage occupants to do so?
- Support occupants in contacting appropriate individuals to investigate
- Others?

Residential Pesticide Exposure

M Shum, E Van-Balen, H Ward, C Bos

Introduction to Pesticides

- Broad range of chemicals used to control or kill unwanted organisms
  - Insecticides
  - Rodenticides
  - Herbicides (eg. 2,4 D for weeds)
  - Fungicides

Health Effects

- Pesticides vary in toxicity
- Some associated with health effects, such as cancer, reproductive effects, and asthma.
- Children are particularly vulnerable to exposure and health effects
  - Systematic review (Turner et al., 2010) showed association with maternal and childhood insecticide exposure with childhood leukemia

How can people be exposed? Where? When? To What?

Possible Non-Occupational Exposure Sources

Community

- Parks, playgrounds, fields, lawns
- Drinking water treatment
- Swimming pools, ornamental ponds
- Community gardens
- Drift from neighbourhood and aerial spraying

Household sources

- Diet
- Indoor pesticide applications
- Track-in on shoes, clothes
- Dust
- Wood protecting agents, external door, window stripping
- Lice, fleas, and ticks treatment
- Insect repellants
- Cosmetic control of weeds and insects on lawns
- Outdoor pets

Routes of Exposure

- Residential pesticide use
  - Ingestion (hand-to-mouth)
  - Inhalation (only during and shortly after spraying)
  - Dermal
- Diet
  - Ingestion (food or water)
- Parks, fields, recreational pools
  - Ingestion
  - Dermal
- Take-home/track-in
  - Ingestion
  - Limited dermal and inhalation
- Lice treatment
  - Dermal
  - Inhalation
- Fleas/ticks shampoo for pets
  - Dermal
  - Limited inhalation (during application)
  - Ingestion (after petting)

How can we reduce residential pesticide exposure?

Mitigation Strategies

- Live with weeds
- Prevent pests (eg., integrated pest management)
- Protect applicator from exposure
- Prevent take-home and track-in
- Clean surfaces regularly

Effectiveness of Mitigation Strategies

- IPM – 4 studies* showed control of cockroach infestations without sprays
- Occupational literature suggests during and after application that the following can be effective
  - Wearing personal protective equipment
  - Removal and washing of protective clothing

*Brenner et al., 2003, Campbell et al., 1999, Kass et al., 2009, Williams et al., 2006

Effectiveness of Mitigation Strategies

- Experimental studies of track-in of herbicides showed effectiveness of
  - Taking off shoes
  - Using entry mats
  - Limiting activity of pets and children on recently sprayed lawns/gardens

Ref: Nishioka et al., 1996, 1999, 2001

Effectiveness of Cleaning

- Pesticides can accumulate in dust
- More volatile substances remain in air and can deposit on surfaces
- Bulk of residues found in carpet fibres, binding, padding
- Assumption that cleaning dust would reduce exposure (no direct evidence)
- From easiest to clean to least: bare floors, flat and level loop carpet, short plush carpet, deep plush carpets

MAIN MESSAGES FOR THE PUBLIC

Safe use of pesticides (when necessary)

- Read and follow label. In Grey et al., 2005, less than half understood everything on label; fewer wore gloves
- Ensure pregnant women and children are not in the area during spraying (>8 hours)
- Wear personal protective equipment(PPE)
- Remove PPE before entering home
- Treat pets for ticks/fleas outdoors, if possible, or in ventilated area

Reduce Take-home Exposure

- Remove PPE before entering home
- Use entry mats
- Remove shoes
- Wash hands
- In laundry, separate clothing used in spray application
- Close windows during outdoor spraying
- Keep pets and children away from recently sprayed lawns/gardens

Cleaning

- Replace carpeting with bare floors
- For bare floors, use wet mop or vacuum
- For carpeting and upholstery, vacuum regularly and steam-clean

How Can Community Health Nurses Get Involved?

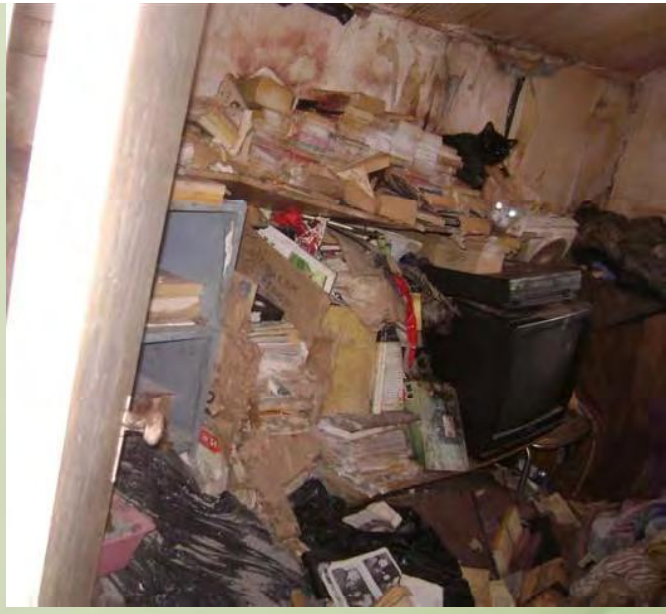
- Observe pesticide use or signs of pest infestations
- Educate residents, especially with young children or pets
- Help occupants find supports for pest problems
- Other?

Discussion

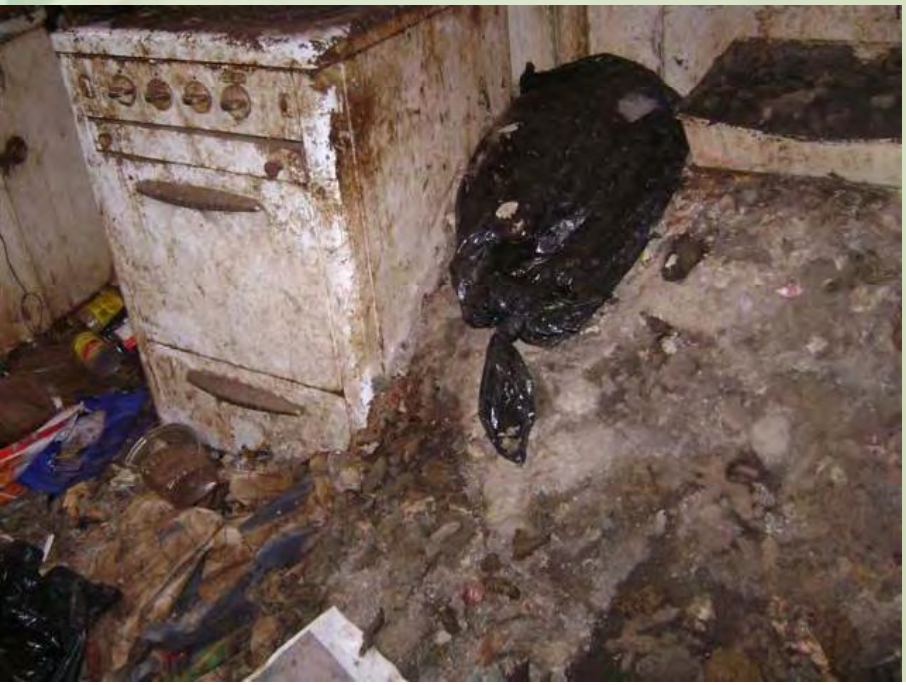
Experiences, Needs, Gaps

Discussion

- How many of you are currently involved in housing-related health issues?
- What opportunities are there for your involvement in housing-related health issues?
- What are the challenges to your involvement?
- Would you share a success story with the group about your role as a community health nurse in dealing with a health -related housing issue?



Although some of the damage was caused by the leaking roof most of the stains and dirt are from cat feces and accumulating “stuff”



Recluse Case Study questions: submitted by Heather Jessup-Falcioni

- **Proposition**: Images of challenging housing circumstances communicate information by evoking health care provider perceptions, thoughts and practices in relation to their role. Images provide a stimulus for thinking-on-action.
- Describe what you see and express the significance about the visual content and comment about the implications of the phenomena to the community health nursing role.
- Describe approaches for intervening in such circumstances (by-laws, access to other agencies).
- Describe, at a community level, what are feasible recommendations to maintain housing for precariously housed people.

Thank You

Questions?

Comments?

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