Environmental Health in Rural Family Medicine

WONCA Rural: Gramado
Alan Abelsohn
WONCA WP Env
April 2014
Contents

1. Cases: Taking an exposure history
2. Children’s Environmental Health
3. Climate change and health
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How many of you........................??
You assess 14 year-old, Judy, in ER with shortness of breath; worsening of her asthma

PMH: She has had difficult to control asthma; on
  - Fluticasone/ Salmeterol Combination diskus; Salbutamol prn

She is a track athlete, and was training yesterday. She does not smoke, and no-one at home smokes

What are the possible triggers for the worsening of her asthma?
What are the possible environmental triggers for this episode of asthma?

- Compliance
- Infection

Personal exposure history, using CHOPD

- Community
- Housing/Hobbies
- Occupation/School
- Personal
- Diet
Could outdoor air pollution be a trigger that is exacerbating her asthma?

~2-7 fold

Respiratory Effects of Exposure to Diesel Traffic in Persons with Asthma

James McCleanor, M.R.C.P., Paul Cullinan, M.D., Mark J. Nieuwenhuijsen, Ph.D., James Stewart-Evans, M.Sc., Eleni Malliarou, M.Sc., Lars Jarup, Ph.D., Robert Harrington, M.S., Magnus Svartengren, M.D., In-Kyu Han, M.P.H., Pamela Ohman-Strickland, Ph.D., Kian Fan Chung, M.D., and Junfeng Zhang, Ph.D.

<table>
<thead>
<tr>
<th></th>
<th>Oxford St.</th>
<th>Hyde Park</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM2.5</td>
<td>28.3</td>
<td>11.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>UFP</td>
<td>63.7</td>
<td>18.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>elemental carbon</td>
<td>7.5</td>
<td>1.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PM10</td>
<td>125</td>
<td>72</td>
<td>0.03</td>
</tr>
<tr>
<td>NO2</td>
<td>142</td>
<td>21.7</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Respiratory effects of exposure to diesel traffic on persons with asthma
McCreanor NEJM Dec 2007
Could outdoor air pollution be a trigger that is exacerbating her asthma?

AQHI- asthma health care utilization

“each unit increase AQHI is highly and significantly associated with an increase in asthma ED visits”

<table>
<thead>
<tr>
<th>AQHI</th>
<th>Outpatient claims</th>
</tr>
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<tbody>
<tr>
<td>3</td>
<td>2278</td>
</tr>
<tr>
<td>10</td>
<td>3330</td>
</tr>
</tbody>
</table>

To, T. EHP Online Oct2012
What can she, and you as her physician, do about it?

Air Quality Map Updated Hourly

Sao Paulo

health messages

exposure reduction recommendations

• www.cetesb.sp.gov.br
• Also available at AIRNow Web site www.airnow.gov
Ahead of World Cup, Sao Paulo's smog still killing thousands

Smog in Sao Paulo kills more people annually than road accidents, AIDS and breast cancer combined says a recent report. While the city seeks a solution ahead of next year's World Cup, local residents remain frustrated.
Case

- You assess 55 year-old male in ER with atrial fibrillation x 4hrs
- PMH: Hypertension; on HCT 12.5mg od
- He is a track athlete, and was training this morning.
- Is air pollution a possible trigger for his arrhythmia?
Air Pollution-Atrial Fibrillation

![Graph showing percent change in atrial fibrillation rate with respect to PM2.5, black carbon, and NO2 over different time periods (2 hr, 6 hr, 12 hr, 24 hr, 48 hr).]

Link MS. J American Coll Cardiology 2013 62(9)
Exposure history
A clinical tool

What are the possible other environmental triggers for this episode of asthma?

Personal exposure history, using CHOPD

- Community
- Housing/Hobbies
- Occupation/School
- Personal
- Diet
Principais locais de exposição, CCLOPD

- Comunidade
- Casa
- Lazer
- Ocupação
- Pessoal
- Dieta
Community Triggers

- Ambient air pollution
- Traffic related air pollution
- Point sources

Smoke
  - Forest fires
  - Crop burning
  - Wood smoke
Housing triggers

Allergens
• House Dust Mite
• Cats
• Cockroach
• Mold/dampness

Particulate Matter
• ETS
• Woodsmoke
• Outdoor air particulates: PM 2.5

Gases
• NO2
• Formaldehyde and VOCs
Case 2

60 year old with chronic cough and loss of weight
– Differential?

What exposures might be related?
– CH2OPD?
Case 2- Ca Lung
CH2OPD

C- Particulates PM2.5
H- Radon; ETS
H  ?
O- Asbestos
P- Smoking
D  ?
What is “ENVIRONMENTAL HEALTH”?

“Environmental health includes both the direct pathological effects of chemicals, radiation and some biological agents, and the effects (often indirect) on health and wellbeing of the broad physical, psychological, social and aesthetic environment which includes housing, urban development, land use and transport.”

- World Health Organization

www.euro.who.int/eprise/main/WHO/Progs/HEP/20030612_1
Multiple Determinants of Health

Source: World Health Organization, undated, from Child Health and the Environment- A Primer
Environment- A forgotten determinant of health?

An estimated 24% of the global disease burden and 23% of all deaths can be attributed to environmental factors

Preventing Disease through Healthy Environments. WHO 2006
http://www.who.int/quantifying_ehimpacts/publications/preventingdisease/enindex.html
Improving the capacity to diagnose, prevent and manage childhood diseases linked to the environment

To understand the special vulnerability of children to environmental exposure
WHO Children’s Environmental Health Modules

Why children
Children are not little adults
Indoor and outdoor air pollution
Chemicals
Lead and Mercury
Pesticides
POPs
Water, Sanitation and Hygiene
Food safety
Global climate change
Noise
Radiation
Injuries
Occupational exposure
Cancer
Respiratory diseases
Paediatric environmental history
Case: 3 year old

Not meeting milestones

Exposure history

CH2OPD
A Success Story: LEAD in Gasoline and Children’s Blood

Institute of Medicine, EPA, 1996
WHO Collaborating Center of CEH
Porto Alegre

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Department of Pediatrics
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Pontifícia Universidade Católica RGS (PUCRS
Porto Alegre, RS – Brazil
rstein@pucrs.br
December 24, 1968
9:35 PM ES
Climate change and health

1. Are you involved in climate change issues in any way; how?

2. Do you think climate change is affecting the health of your patients; how?

3. Do you think climate change will affect the health of your patients; how?
Outline

• The science of climate change

• The health effects of climate change

• Solutions
  • Calculating your Carbon footprint
  • Greening the office
  • Advocate in the community
Climate change is a health issue

• Climate change related to global warming is “the world’s most urgent public health problem” (Stott BMJ 2006)

• Climate change has been called “the defining issue for public health in the 21st century” (Chan 2007)

• Climate change and human survival (BMJ editorial, March 2014)
National Oceanic and Atmospheric Administration:
*Bull. Amer. Meteor. Soc.*, **91** (6), S1-S224.
These indicators all decrease in a warming world.
“Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations”

Very likely = 95%
CO2 Concentrations

Mauna Loa Observatory, Hawaii
Monthly Average Carbon Dioxide Concentration

Data from Scripps CO₂ Program  Last updated February 2006

CO₂ Concentration (ppm)

Year

Source: Scripps Institute of Oceanography
Future scenarios

And tipping points (IPCC 2014)
Health Impacts of Climate Change

• Direct impacts
  – Extreme weather events
  – Temperature related

• Indirect impacts
  – Air pollution related
  – Vector borne and zoonotic diseases
  – Increased scarcity of food and fresh water
  – Rise in sea level
  – Loss of biodiversity
  – Areas becoming uninhabitable
  – Mass human migration, conflict and violence
Extreme Weather Events

Vulnerability
Drought in Australia

Trend in annual rainfall 1960-2009 (mm per decade)
The French Heat Wave 2003 Daily Mortality in Paris

Graphique n°1 : Nombre de décès journaliers à Paris et températures minimales et maximales entre le 25 juin et le 19 août 2003
Health Impacts of Climate Change

• Direct impacts
  – Temperature related
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  – Mass human migration, conflict and violence
• Can you identify this rash?
Lyme Disease

• Localized or disseminated
  – Erythema Migrans (up to 1 month)
• Later
  – Neurologic, cardiac (weeks to months)
  – Arthritis, encephalopathy, polyneuropathy
Potential Spread of Lyme Disease
Malaria in Zimbabwe 2000

Baseline

Ebi et al. 2005
Health Impacts of Climate Change

• Direct impacts
  – Temperature related
  – Extreme weather events
• Indirect impacts
  – Air pollution related
  – Vector borne and zoonotic diseases
  – Increased scarcity of food and fresh water
  – Rise in sea level
  – Loss of biodiversity
  – Areas becoming uninhabitable
  – Mass human migration, conflict and violence
  – (IPCC 2014)
Many low carbon policies good for health

Case studies in four sectors responsible for large emissions of greenhouse gases (GHGs) showed major health benefits

<table>
<thead>
<tr>
<th>Sector</th>
<th>Health benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household energy</td>
<td>Outdoor/ Indoor air</td>
</tr>
<tr>
<td>Transportation</td>
<td>Air pollution; active transportation ^exercise</td>
</tr>
<tr>
<td>Food production./ agriculture</td>
<td>Eat lower on the food chain</td>
</tr>
<tr>
<td>Electricity generation</td>
<td>Air pollution</td>
</tr>
</tbody>
</table>
So what can we as health professionals do?
So what can we as health professionals do?

- Calculate your Carbon footprint
- Greening healthcare
- Promote active transportation
- Advocacy as medical/health organisations/alliances
WONCA Working Party Env Health

eBook
Climate change
Workers Health (with ICOH)
Radiation from Medical Investigations (with WHO)
Children’s Environmental Health (with WHO)
Contents

1. Cases: Taking an exposure history
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Obrigada!

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Saúde Infantil e o Ambiente: Construindo Capacitação entre Médicos em Ontario
Objetivos de Aprendizado

- Listar maneiras pelas quais os riscos ambientais são diferentes para crianças do que para adultos
- Ilustrar as vulnerabilidades aumentadas e únicas da criança em relação à ameaças ambientais
- Entender a relação entre a criança e o ambiente – começando antes da concepção e continuando por todo o desenvolvimento
- Propor ações de prevenção e remediação
Área Emergente da Saúde Ambiental

- Extensas novas evidências sobre questões de saúde ambiental e crianças na literatura científica.

- Reconhecimento de que Saúde Ambiental diz respeito à crianças e que isso deve ser avaliado e cuidado imediatamente.
Rotas de Exposição

Source of contamination
- Air
- Soil/dust
- Water
- Food
- Consumer products

Environmental media
- Air
- Soil/dust
- Water
- Food/breast milk
- Consumer products
- In utero

Route of exposure
- Inhalation
- Dermal contact
- Ingestion
- Inhalation
- Ingestion
- Dermal contact
- Inhalation (volatile waterborne contaminants, e.g., Chloroform)
- Ingestion
- Ingestion
- Inhalation
- Dermal contact
- Maternal ingestion
- Maternal inhalation
- Maternal dermal contact

Receptor person or population at point of exposure
Principais Fontes de Poluentes

- Água
- Ar
- Comida
- Produtos de Consumo
- Solo / pó
- Leite Materno

Photo Credit: CPCHE
Tipos de Exposição

Aguda
- Exposição por um curto período de tempo (ex. 24 horas)
- Única: única ou exclusiva
- Repetida: multiplas exposições; acumulação potencial

Crônica ou de longo-prazo
- Exposição contínua ou repetida (ex. Acima de 24 horas, por meses ou semanas)
- Exposições de baixa dose

Aguda dentro de crônica (“Acute on chronic”)
- Exposição aguda sobre uma exposição crônica do mesmo agente

"Hit and run“
- Exposição aguda causando efeitos tardios uma vez que o agente tóxico não está mais presente.
Preocuvações Atuais com a Saúde Humana Relacionadas a Contaminantes Ambientais

- Câncer
- Dano herdado
- Defeitos de nascimento
- Dano reprodutivo
- Efeitos no desenvolvimento e no comportamento
- Dano ao sistema imune
- Efeitos nos sistemas respiratório e circulatório
- Infecções virais e bacterianas
Exposição ao longo da vida: Carga sobre o corpo

Água Potável
Ambiente doméstico
Solo: pele
Solo: ingestão
Comida “Normal”
Aleitamento Materno
Intrauterina
Exposição ocupacional

Nasc.  6 m  1 a.  5 a.  16 a.  45 a.  65 a.
Crianças não são adultos pequenos

- Fisiologia do desenvolvimento dinâmica
- Maior expectativa de vida
- Politicamente fracos
- Exposições exclusivas e diversas
Exposições exclusivas e diversas

Transplacentária

Lições de fármacos:
• Talidomida
• Dietilbestrol (DES)

Vários produtos químicos atravessam a placenta
• Chumbo
• Mercúrio
• PCBs (Bifenil Policlorados)
• Drogas de abuso: álcool, metadona
• Radiação

Photo Credit: CPCHE
Janelas do Desenvolvimento

Schematic illustration of the sensitive or critical periods in human development. Red denotes highly sensitive periods; yellow indicates stages that are less sensitive to teratogens.

Aleitamento Materno

• O leite materno é a nutrição mais completa e segura para lactentes

• Mães devem tentar evitar exposições tóxicas a:
  ✓ DDT, DDE, PCBs, Dioxinas
  ✓ Mercúrio
  ✓ PBDEs

• O leite materno pode servir de marcador para contaminação ambiental
Exposições Exclusivas e Diversas

Comportamento Exploratório

• Mão para boca
• Objeto para boca
Exposições Exclusivas e Diversas

Estatura e zonas de respiração

*Photo Courtesy: WHO*
Exposições Exclusivas e Diversas

Tamanho e Superfície Corporal
Exposições Exclusivas e Diversas

Crianças / Adolescentes Não Reconhecem Perigo

- Crianças que não caminham não conseguem se afastar do perigo
- Crianças não-alfabetizadas não conseguem ler avisos e sinais
- Pre-adolescentes / adolescentes podem assumir riscos não razoáveis por imaturidade cognitiva e comportamentos de risco
Exposições Exclusivas e Diversas

MAIS VULNERÁVEIS

Xenobióticos são processados de maneira diferente por um corpo imaturo

- Aumento do consumo de energia, água e oxigênio em estado anabólico
- Absorção
- Biotransformação
- Distribuição
- Eliminação
- Janelas Críticas do Desenvolvimento

Photo Courtesy: WHO
Ambiente Complexo da Criança

RISCOS
- Físicos
- Químicos
- Biológicos

MEIO
- Água – Ar – Comida – Solo – Objetos

SUSCETIBILIDADES
- Janelas Críticas/momento
- Idade
- Estado nutricional
- Pobreza

LOCAIS
- Rural/urbano
- Casa
- Escola
- Playground
- Campo / Gramado
- Rua
- Trabalho

ATIVIDADES
- Aprendizado, Brincar, comer, Beber, Dormir, Respiração, Fumo
- Praticar esportes, Jogar, « Testar », Escavar

DESFECHOS - EFEITOS
- bom ou ruim?
  - Órgãos
  - Sistemas
  - Funções
  - Desenvolvimento
  - Sobrevivência

Photo credit: US NIEHS CERHR logo