

The Summer of Smoke: ecosocial and health impacts of a record wildfire season in the Northwest Territories, Canada

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Government of NWT

Introduction

- Trauma, injury associated with direct human-wildfire interactions
- Increased risk of respiratory morbidity and overall mortality in populations exposed to wildfire smoke
- Indigenous populations especially vulnerable
 - Disproportionately affected by evacuation orders in Canada
 - Elevated risk of hospitalization for cardiac and respiratory problems in Australia
 - Implications for food and nutritional security



**Fires and smoke outside of Yellowknife
(summer 2014) www.myyellowknifenow.com**



Introduction

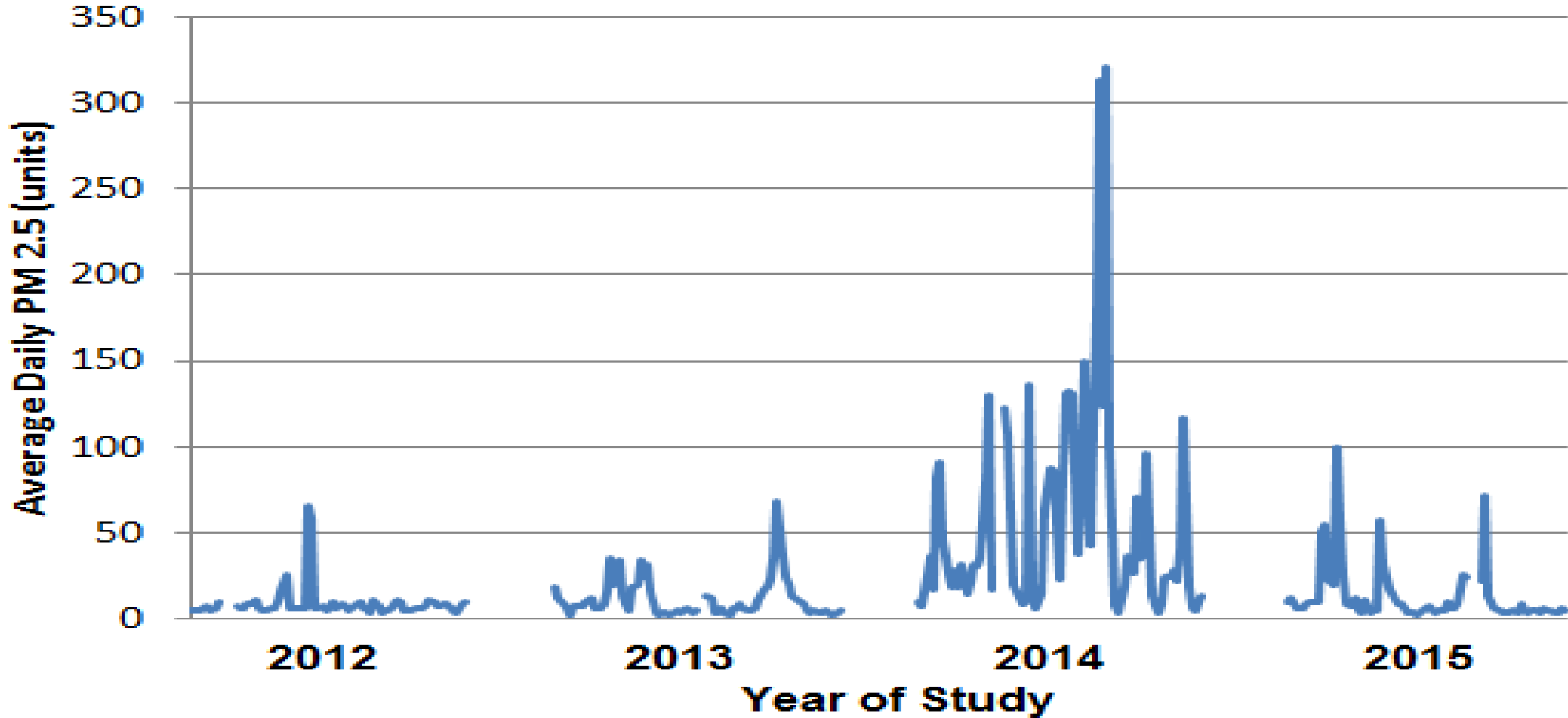
- Summer 2014 (June – August)
- 35,000 km² of forest burned
- \$56.1 million CAD (\$43.4 million USD) in fire fighting costs
 - Budget ~ \$7 million CAD
- Community of Kakisa underwent voluntary evacuation
- Increased incidence of emergency room visits for respiratory problems
- Mental and emotional health impacts



Map of the Northwest Territories, Canada



24-hour mean PM2.5 from Yellowknife Air Quality Station During the Study Period



Quantitative Methods

- **Poisson regression to examine the relationship of 24-hour mean PM2.5 levels with cardiorespiratory hospital encounters from June 15 – August 31 2012-2015.**
 - Is there an association between PM2.5 levels and hospitals encounters in this population?
- **Compared health system utilization between 2014 and the average of 2012 and 2013 (with 2015 as a comparator year)**
 - Did anything unique happen in terms of health system utilization in 2014?



Quantitative Results

- During 2012-2015, a 10 $\mu\text{g}/\text{m}^3$ increase in PM2.5 was associated with an increase in ER visits for asthma (11%) and pneumonia (6%).
 - Asthma consistent across subgroups of age, sex, and ethnicity
 - Pneumonia driven by cases in <5 years, males, and Inuit population
- In 2014 (compared to 2012/13):
 - 48% increase in dispensed salbutamol
 - Significantly more clinic visits for asthma, pneumonia, cough
 - Double ER visits for asthma; 57% increase in ER visits for pneumonia
 - All measures subsequently decreased in 2015



Qualitative Methods

- Co-development of semi-structured interview guide
- Purposive sampling to allow for inclusion of diverse backgrounds and experiences
- 30 interviews conducted using video recording
- Thematic analysis of transcripts



Screen shot from community documentary

Qualitative Results

- **Key themes:**
 1. **Consequences for mental and emotional wellbeing**
 2. **Consequences for physical activity and wellbeing**
 3. **Separation from the land and traditional activities**
 4. **Adaptation and resilience**
 5. **Situating the summer of smoke within broader environmental change**



CBC North



Mental and Emotional Wellbeing

- **Uncertainty, fear, sadness, anxiety, anger**
 - **Prominent in Kakisa (underwent voluntary evacuation)**
- **Isolation**
 - **Neighbours**
 - **Communities**
 - **Land and traditional activities**



CBC North



Mental and Emotional Wellbeing

“Well, it took a toll on me because being stressed out from the fires and never knowing when we had to leave to be evacuated we didn't know if we were going to come home to a community or to our houses. We didn't know nothing. We didn't know what to expect. **Not knowing what lies around the corner there.** So it was really stressful....It was draining. It was really draining because you don't know what's in store for us when we got back home”

(female participant from Kakisa).



Physical Activity and Wellbeing

- Time spent indoors
 - Lethargy
 - Conscious decrease in outdoor exercise
 - Connection to mental health
- Irritants from smoke
 - Headaches
 - Shortness of breath
 - Eye irritation
- Respiratory problems
 - Prominent among those with pre-existing conditions



CBC North



Separation from the land and traditional activities

- The 'lost summer'
- Implications for physical activity
- Implications for mental and emotional wellbeing
- Implications for food and nutritional security



CBC North



Separation from the land and traditional activities

“It was like we didn’t have a summer, for me, because, usually we get outside, we do things on the water...we enjoy being in the North. We enjoy being outside. We enjoy the environment. We enjoy cooking. Everything that’s outside, we enjoy, and, I feel like I lost that...that impacts you emotionally and mentally”

(female participant from Yellowknife).



Conclusions

- **Comprehensive planning and education**
 - Prior, during, and following wildfire events
- **Implications for health resource allocation**
- **Improved risk communication**
 - Smoke forecasting
- **Inclusive of local values, traditions, connection to land**



Title screen from community documentary



Acknowledgements

Research Team

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Climate Change and Health Adaptation in Northern
First Nation and Inuit Communities



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Adaptation and Resilience

- **Fire proofing homes prior to wildfire season**
- **Opening of indoor recreation centres**
- **Community concern and support**



Broader Environmental Change

- The 'new norm'
- Connection to other observable changes
 - Decreases in wildlife, vegetation
 - Melting permafrost



Canadian Geographic



Table 1-24-hour mean PM_{2.5} and PM₁₀ from June 15-Aug 31

	Median PM _{2.5} (Q1,Q3)* µg/m ³	Maximum PM _{2.5} µg/m ³	% of days with PM _{2.5} ≥ 25 µg/m ³	Median PM ₁₀ (Q1,Q3) µg/m ³
2012	6.2 (5.6, 8.9)	65.7	4 (3 days)	13.3 (9.5, 17.9)
2013	6.7 (4.4, 14.5)	67.6	9 (7 days)	12.6 (8.4, 22.0)
2014	30.8 (16.2, 85.0)	320.3	55 (43 days)	43.8 (26.5, 100.7)
2015	6.4 (4.6, 11.5)	99.6	12 (9 days)	14.9 (10.3, 28.8)

*Q1- first quartile; Q3- third quartile



Adjusted risk of cardiorespiratory emergency room visits and hospital inpatient stays per $10\mu\text{g}/\text{m}^3$ increase in 2-day averaged 24-hour mean $\text{PM}_{2.5}$. All models adjusted for age, sex, ethnicity, day of week, humidity and temperature.

Outcome	Incidence Rate Ratio (95% confidence interval)
Cardiovascular Basket ¹	0.98 (0.96, 0.99)
Respiratory Basket ¹	1.03 (1.01, 1.05)
Asthma¹	
ALL	1.11 (1.07, 1.14)
Male	1.12 (1.08, 1.17)
Female	1.07 (1.03, 1.12)
Inuit	1.11 (1.04, 1.19)
Dene	1.09 (1.00, 1.19)
Non-Indigenous	1.10 (1.06, 1.15)
Age <5 years	0.99 (0.73, 1.35)
Age 5-19 years	1.07 (1.01, 1.14)
Age 20-39 years	1.09 (1.04, 1.14)
Age 40-59 years	1.12 (1.07, 1.18)
Age 60+ years	1.11 (0.96, 1.30)



Pneumonia¹	
ALL	1.06 (1.02, 1.10)
Male	1.09 (1.04, 1.14)
Female	1.00 (0.92, 1.08)
Inuit	1.10 (1.06, 1.16)
Dene	NE (not estimable)
Non-Indigenous	0.97 (0.87, 1.09)
Age <5 years	1.13 (1.06, 1.20)
Age 5-19 years	1.09 (0.99, 1.19)
Age 20-39 years	0.95 (0.78, 1.14)
Age 40-59 years	0.96 (0.84, 1.10)
Age 60+ years	1.06 (0.99, 1.14)
¹ International Statistical Classification of Diseases and Related Health Problems, 10 th Revision, Canada (ICD-10-CA) Codes All cardiac (I00-I52); All respiratory (J00-J99); Asthma (J45-J46); Pneumonia (J12-J18)	

