Creating a GIS Infrastructure to Evaluate Air Quality's Effect on Health Outcomes

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Presenter Disclosures

Rick Krajenta

(1) The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No relationships to disclose

The North American Public Health Institute

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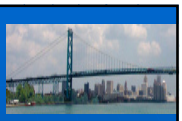
The Detroit - Windsor Community

- Two countries - Canada and the United States - separated by a river, share the Great Lakes environment.
- Similar health issues, different healthcare delivery systems.

The ideal place for the North American Public Health Institute

- An international approach to solving public health problems.
- Detroit and Windsor have similar multicultural populations.
- Detroit and Windsor share the Great Lakes environment, air and water supply.

The ideal place for the North American Public Health Institute



- **Detroit has higher rates for many diseases, severity of disease and mortality.**
- **In Windsor, mortality and morbidity rates are higher than in the rest of the province.**
- **Detroit and Windsor are home to first class hospitals.**

Assemble The Experts

- Henry Ford Health System
  - Epidemiology and Biostatistics.
  - Health Outcomes Derived from Administrative Data.
  - Data/Project Management of Multisite Studies.
- University of Windsor
  - Land Use Regression Modeling.
  - Air Pollution Monitoring.
  - Seasonal Variation of Pollution Levels.

Assemble The Experts

- Wayne State University
  - Toxicology Center
  - School of Nursing
  - Department of Geology
  - Funding For Pilot Work

GeoDHOC Aims
Geospatial Determinants of Health Outcomes Consortium

- Increase spatial resolution as compared to MASN (Michigan Air Sampling Network)
- Health Outcomes added as cohort
  - Personal contact not required
  - Cost Effective
  - Easily Test Different Health Outcomes
- Link Health Data to Pollution Levels

Potential Populations for Research

- Covered lives
  - HMO enrollees
  - Paneled patients
- Contact lives
  - Patients of the health system
    - Primary care patients
    - Specialty care patients
    - Disease or procedure-specific populations
    - Special utilization
      - ED, IPD, …
      - Cancer registry patients

HAP-HFMG Enrollees, Jan06

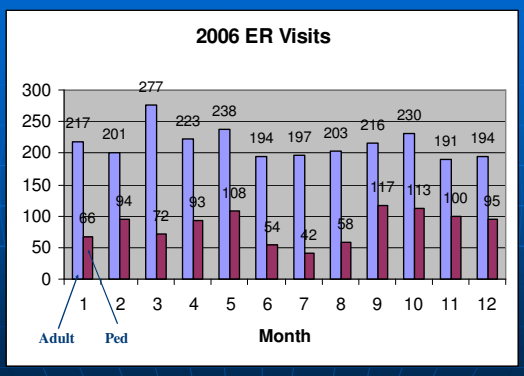
	Females		Males		Total	
Age	#	%	#	%	#	%
0 - 23 mos.	1245	0.5	1209	0.5	2454	0.9
2 - 4	2785	1.1	2901	1.1	5686	2.2
5 - 12	12428	4.8	12873	5.0	25301	9.8
13 - 18	12902	5.0	13251	5.1	26153	10.1
19 - 39	36772	14.2	30050	11.6	66822	25.8
40 - 54	35660	13.8	29929	11.6	65589	25.4
55 - 64	16767	6.5	15599	6.0	32366	12.5
65 - 74	9819	3.8	8331	3.2	18150	7.0
75 +	9299	3.6	6899	2.7	16198	6.3
Total	137677	53.2	121042	46.8	258719	

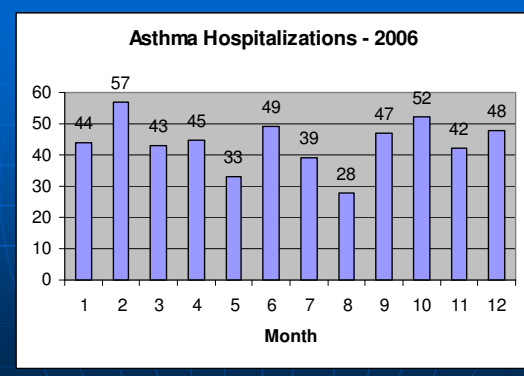
Patient Panels

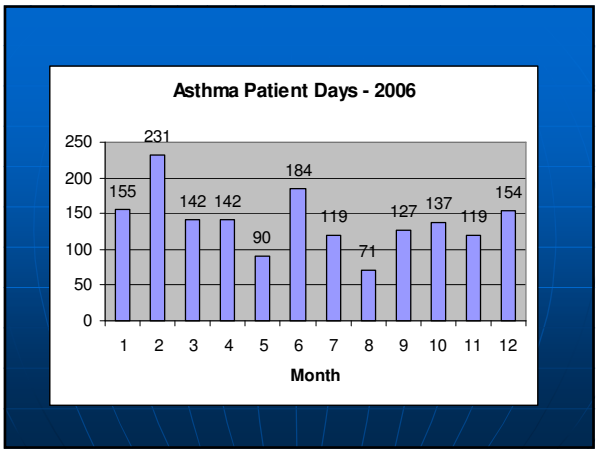
	Females		Males		Total	
Age	#	%	#	%	#	%
0 - 23 mos.	3165	0.6	3135	0.6	6300	1.4
2 - 4	6294	1.3	6661	1.4	12955	2.8
5 - 12	25318	5.4	26350	5.6	51668	11.0
13 - 18	22505	4.8	22638	4.8	45143	9.6
19 - 39	70926	15.1	56917	12.1	127843	27.2
40 - 54	57533	12.3	47531	10.1	105064	22.4
55 - 64	27256	5.8	23793	5.1	51049	10.9
65 - 74	18257	3.9	14535	3.1	32792	7.0
75 +	22227	4.7	14487	3.1	36714	7.8
Total	253451	54.0	216075	46.0	469526	

Asthma Events at HFHS - 2006

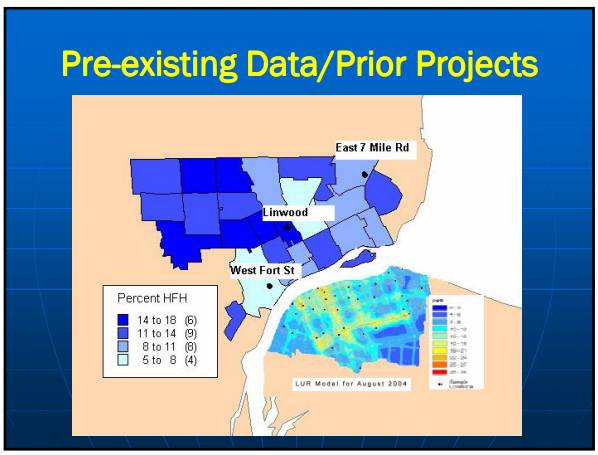
- ER Encounters
  - 3,593 in 2,486 pts
    - 2,581 adult
    - 1,012 peds
    - Peaks
      - March – May
      - Sept & Oct
  - 1 pt had 30 ER visits (co-dx with schizophrenia)
- 527 admissions
  - 5 Peds, 18 pt days
  - 522 adults, 1,653 pt days



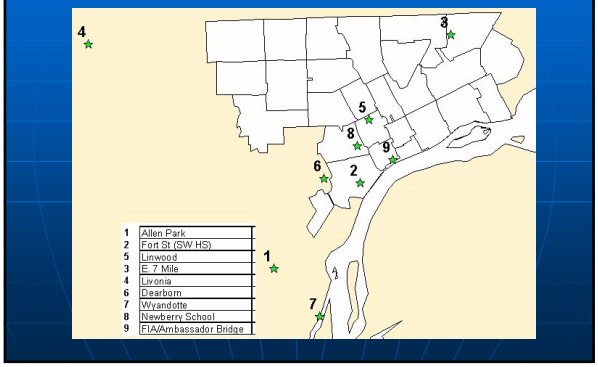




Pre-existing Data/Prior Projects



MASN Sites



MASN - 7 Mile Road NO2

9/6/08 16:00	2
9/6/08 17:00	3
9/6/08 18:00	5
9/6/08 19:00	15
9/6/08 20:00	25
9/6/08 21:00	28
9/6/08 22:00	29
9/6/08 23:00	26
9/7/08 0:00	20
9/7/08 1:00	25

Air Pollution Compliance Levels

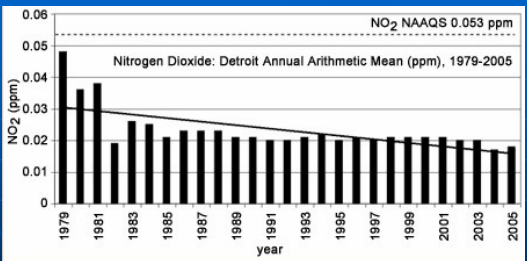
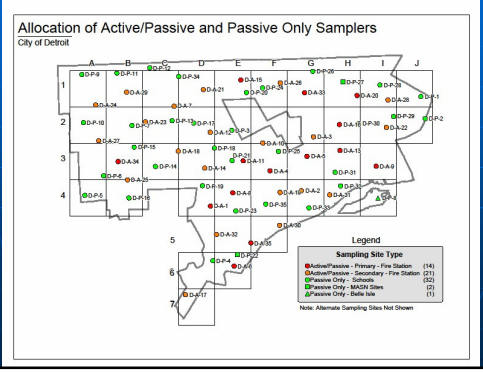
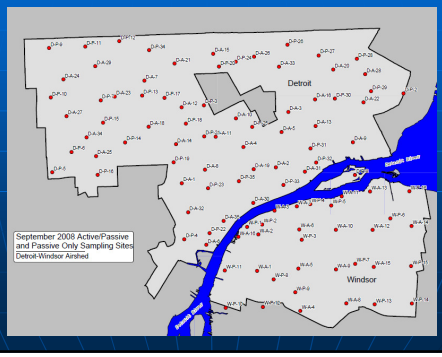


Figure 3. The annual average (ppm) of nitrogen dioxide in Detroit, 1979-2005. Compliance is met when the annual average concentration does not exceed 0.053 ppm.

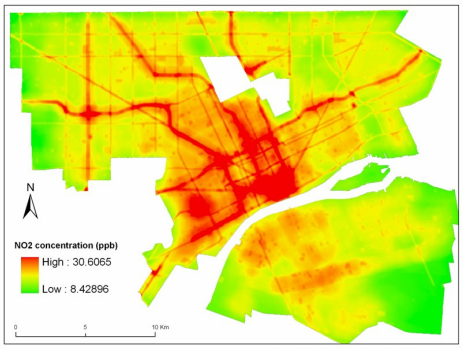
Optimal Sample Distribution



Final Sampler Allocation

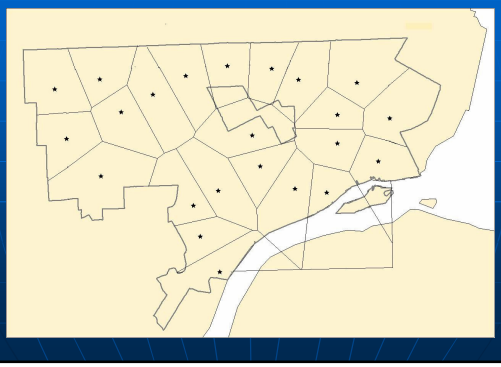


NO_2 Land Use Regression Model Of Detroit-Windsor Region (Preliminary Results)



Model Generated By: H. Zeng and A. Grgicak-Mannion
Great Lakes Institute for Environmental Research, University of Windsor

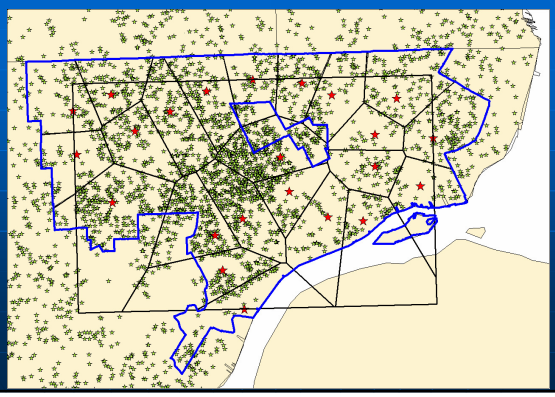
Create Voronoi Polygons - PMs



Voronoi Polygons

- All locations within polygon are closer to the included point than any other.
- Useful to assign point values to a region.
- Test for association to asthma events on direct values at sampler location.

Add Asthma Events



Next Directons

- Does LUR Model Correlate stronger to Health Outcomes.
- Test for Associations to other Health Outcomes. ie. Cardiovascular
- Test Air Dispersion Models to Account for Meteorology.
- Sampling Repeated in June 2009 with modifications.

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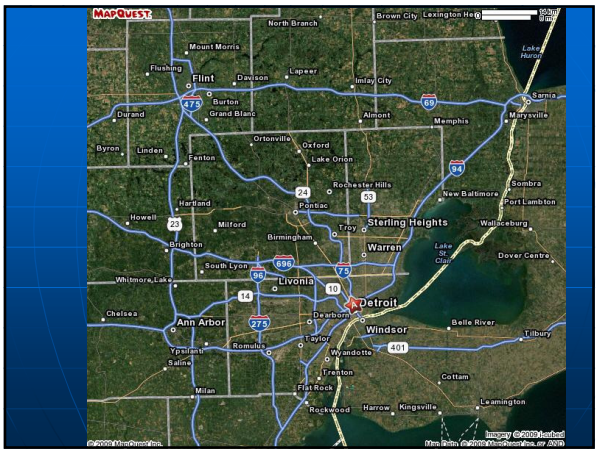
Acknowledgements:

- The authors would like to acknowledge all members of the GeoDHOC group: Shannon M. Molaroni, Lawrence D. Lemke, Wayne State University, Department of Geology; Iris Xu, University of Windsor, Dept. of Civil and Environmental Engineering: Hongyu You, Health Canada and Paul Villeneuve.
- Project supported by: (1) Research Enhancement Program Clinical Translational Science in Urban Health, Wayne State Univ., 2008-2009; (2) Health Canada (air sampling planning, equipment, personnel and sample analysis); (3) University of Windsor and Wayne State University (student assistants). We would also like to thank the Detroit Fire Department and Enwin Utilities.

Thank-You

Questions??


MAPQUEST
North Branch
Brown City
Lexington
Mount Morris
Flushing
Flint
Davison
Lapeer
Imlay City
Lake Huron
Sarnia
Burton
Grand Blanc
Almont
Memphis
Marysville
Durand
Byron
Linden
Fenton
Ortonville
Oxford
Lake Orion
Rochester Hills
New Baltimore
Sombra
Port Lambton
Hartland
Howell
Pontiac
Troy
Sterling Heights
Wallaceburg
Milford
Brighton
Birmingham
Warren
Dover Centre
South Lyon
Whitmore Lake
Livonia
Detroit
Chelsea
Ann Arbor
Dearborn
Windsor
Belle River
Tilbury
Taylor
Romulus
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