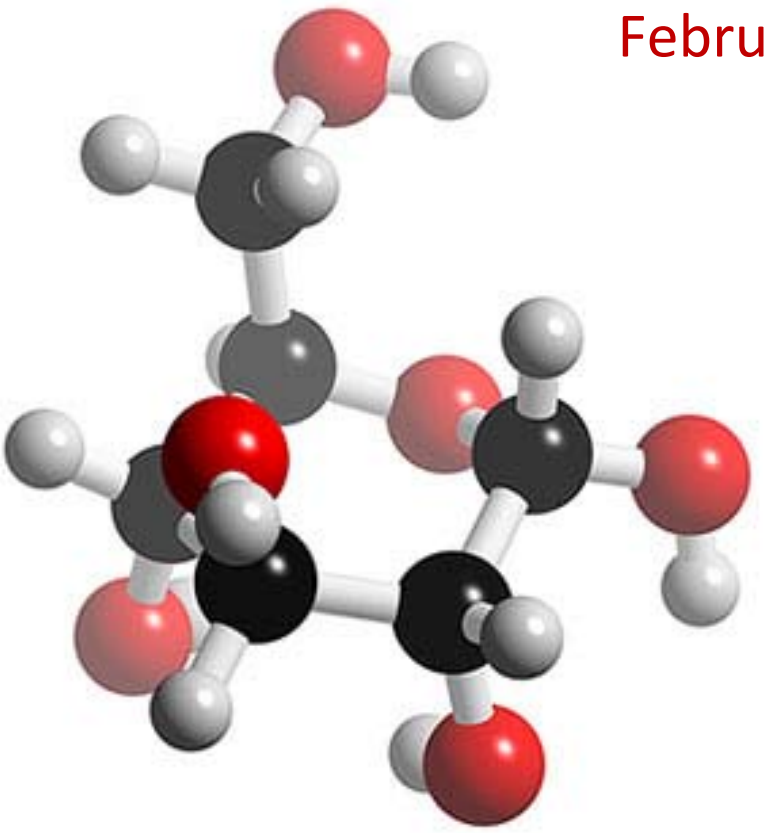
TYPE 1 DIABETES CLUSTER INVESTIGATION: WESTON, WELLESLEY AND NEWTON

February 7, 2012



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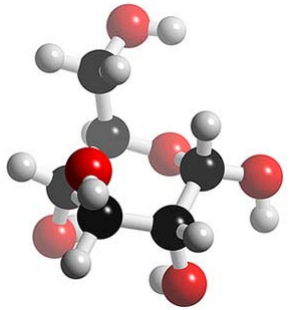
Director, Bureau of Environmental Health
Massachusetts Department of Public Health

Outline



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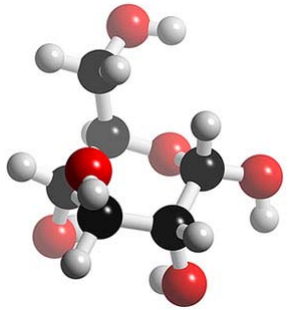
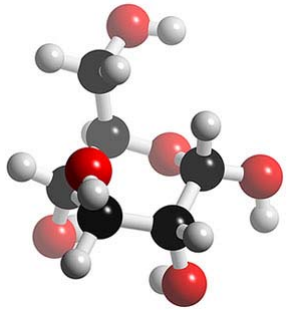
I. Introduction to the Bureau of Environmental Health



Bureau of Environmental Health

- Indoor Air Quality
- Community Sanitation Program
- **Community Assessment Program**
- Food Protection Program
- Environmental Epidemiology Program
- Radiation Control Program
- Environmental Toxicology Program
- Childhood Lead Poisoning and Prevention
- Environmental Health Education And Outreach Program

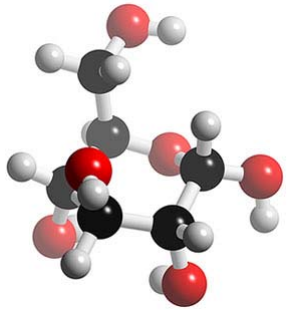
I. Introduction to the Bureau of Environmental Health



How do we evaluate health?

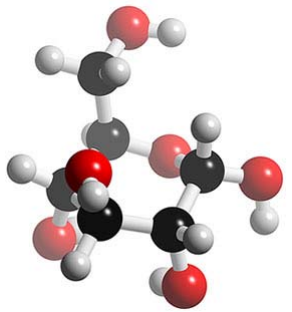
- Assess the potential impact of exposure on the population
- Evaluate disease frequency in the population
- Investigate possible associations between exposure and disease

II. Massachusetts Pediatric Diabetes Surveillance



- Funded through the U.S. Centers for Disease Control and Prevention's Environmental Public Health Tracking program
- Coupled with pediatric asthma surveillance
- Previous verification effort resulted in 97% agreement between school reports and child's medical record
- Mailed survey to 2,100 public and private school nurses/administrative staff
- For 2007-2008 and 2008-2009 response rate >99%

II. Massachusetts Pediatric Diabetes Surveillance



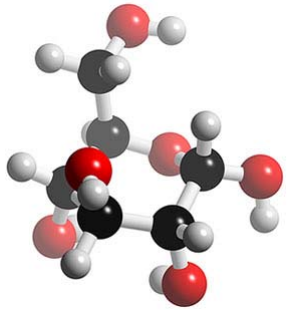
- Counts are provided by type of diabetes (Type 1, Type 2, Unknown Type), race/ethnicity, grade, gender, and community of residence

- Prevalence of Type 1 in MA students in grades K-8 (5-14 years of age) is 2.53 per 1,000 students

- Nationally, the prevalence of Type 1 among individuals 5-14 year of age is 2.12 per 1,000*

*SEARCH for Diabetes in Youth Study

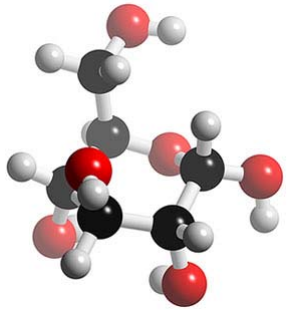
II. Massachusetts Pediatric Diabetes Surveillance



Diabetes in K-8 Students for the 2008-2009 School Year in Massachusetts

- Children with Type 1 diabetes represented 93% of cases (n=1,761)
- Children with Type 2 diabetes = 6% (n=111)
- Unknown type was 1% (n=18)

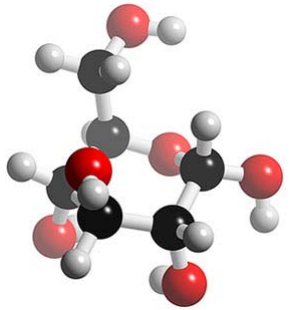
II. Massachusetts Pediatric Diabetes Surveillance



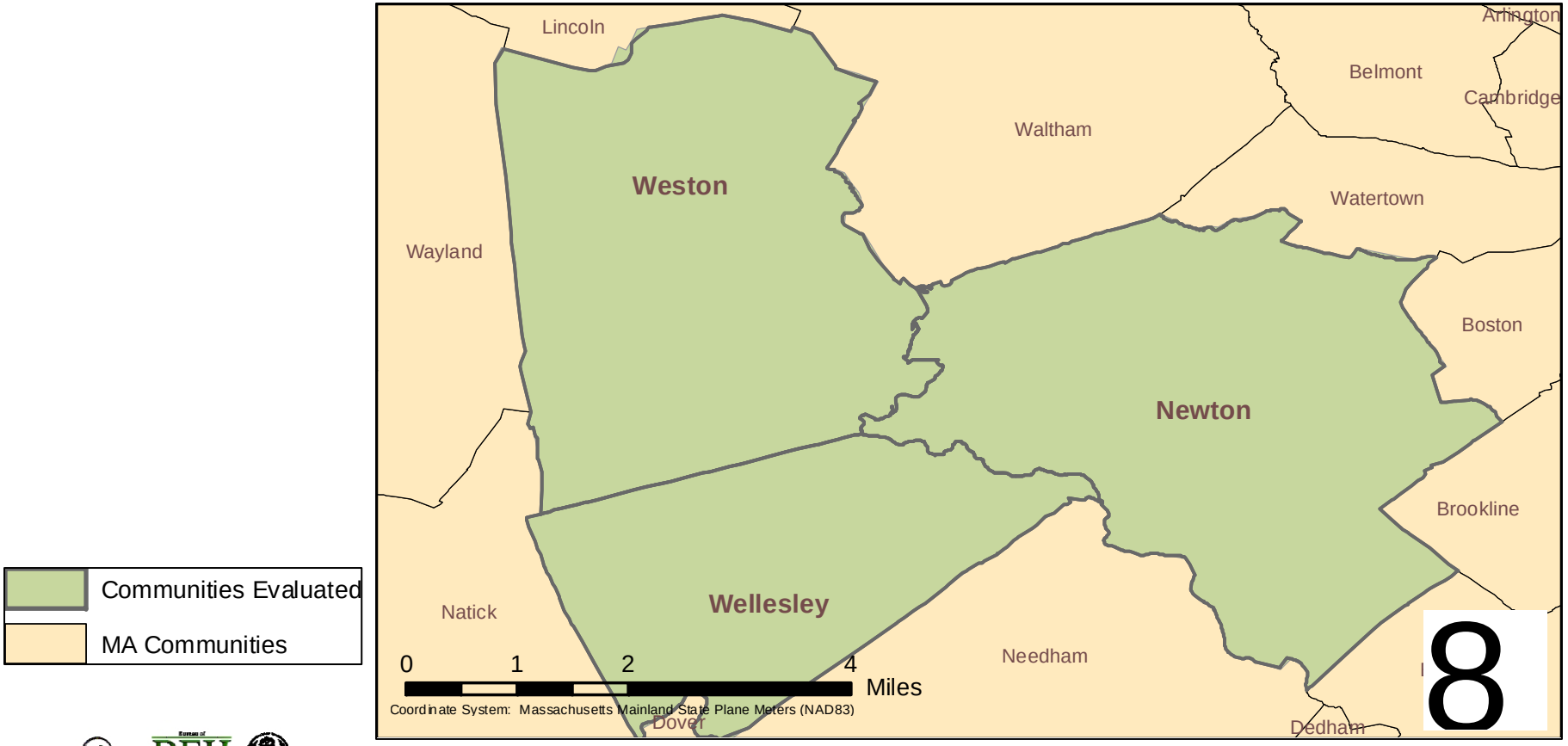
Type 1 Diabetes in K-8 Students for the 2008-2009 School Year in Massachusetts

- Although the national prevalence is lower than the MA rate, the methods for determining the rates were very different and could account for some of the difference
- SEARCH estimates are based on a sample of individuals (0-19 years of age) who participate in their study
- MDPH estimates are based on school health information for all children who attend grades K-8 (approximately 5-14 year olds) in public and private schools in MA
- The proportion of non-Hispanic whites is higher in MA (76.1%) than in the U.S. (63.7%); non-Hispanic whites have higher prevalence than other groups

III. MDPH Investigation of Type 1 Diabetes in Weston, Wellesley, and Newton



Selected Massachusetts Communities

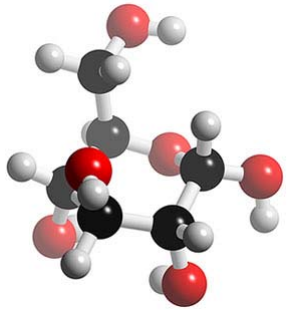


BEH

cg, October 20, 2011

Geographic data supplied by: Massachusetts Executive Office of Environmental Affairs, MassGIS; Geographic Data Technology, Inc.

III. MDPH Investigation of Type 1 Diabetes in Weston, Wellesley and Newton

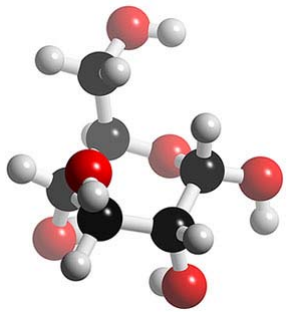


- February 2008, contacted by Ann Marie Kreft
  - Residents concerned that there may be an unusual number of children with type 1 diabetes in Weston, Wellesley and Newton
  - Concern was particular to the area where three communities are contiguous
- Additional concerns focused on the possible relationship to environmental exposure opportunities

IV. MDPH Investigation - Methods

Selected Census Tracts in Weston, Wellesley and Newton Massachusetts

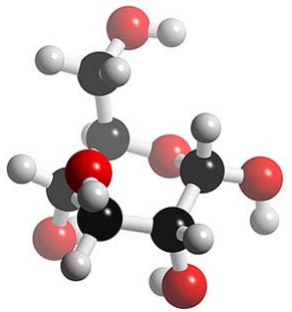
IV. MDPH Investigation - Methods



Environmental Epidemiologic Questions

1. Does the prevalence of type 1 diabetes in these 3 communities or the census tracts of concern differ from the expected prevalence?
2. Does family history play more of a role in the observed prevalence in the 3 communities or the census tracts of concern than would be expected?
   - Five to ten percent of individuals diagnosed with type 1 diabetes have a family history of diabetes (Source: Juvenile Diabetes Research Foundation)
3. Does residential history play a role in the observed prevalence?
4. Does the geographic distribution of residence at diagnosis appear unusual?
5. If there appears to be an excess, are there some shared exposures?
6. Is there a grouping of diagnoses in space or time such that it is plausible that a shared common environmental exposure might have contributed to diagnoses?

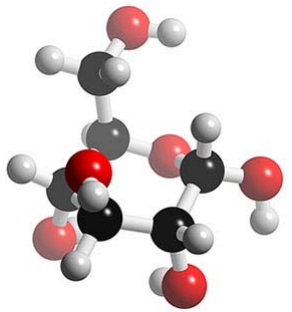
IV. MDPH Investigation - Methods



Data Sources

- In 2007-2008 MDPH began collecting diabetes data from school health records.
  - As with pediatric asthma, data are reported by school nurses and/or administrative staff at public and private schools in Massachusetts.
- Family Educational Rights and Privacy Act of 1974 (20 U.S.C. 1232g)
  - Protects students' privacy for educational records; cannot be released w/o parental consent
  - Applies to all educational institutions that receive funds from U.S. Dept of Education
  - Applies to entire content of the student's record

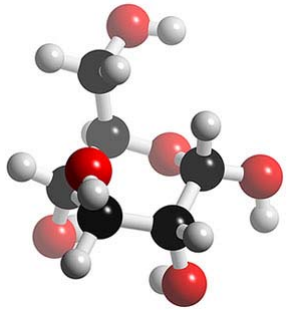
IV. MDPH Investigation - Methods



Data Sources, continued

- To address FERPA barriers, in 2009-2010, MDPH worked with school nurse leaders in the three communities to coordinate mailings to all parents of children (including those beyond DPH's routine K-8 surveillance) diagnosed with type 1 diabetes to obtain consent and gather additional information
- In 2010, MDPH also contacted health care providers to identify all children in the three communities with type 1 diabetes in an effort to capture information about:
  - pre-school age children
  - those attending private schools outside Weston, Wellesley, and Newton

IV. MDPH Investigation - Methods

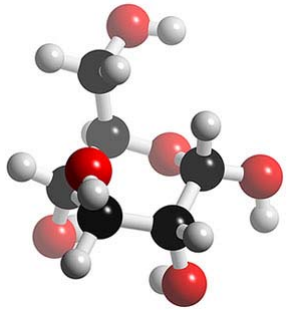


Prevalence Estimates and their Interpretation

- Prevalence estimates are calculated by dividing the number of children with type 1 diabetes in a community by appropriate population data

- 95% Confidence Intervals (CI) are calculated

IV. MDPH Investigation - Methods

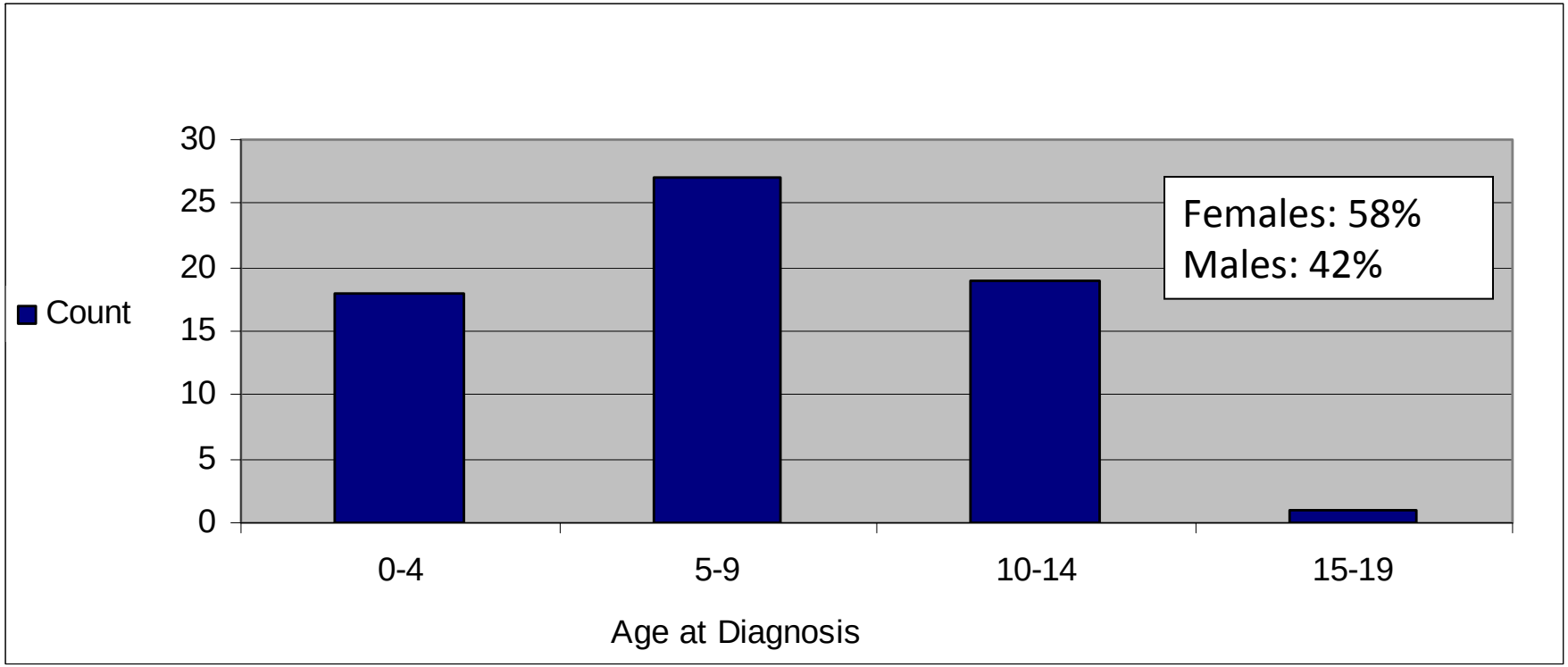


Consent Form

- Residential History
- Family History
- Insulin dependency
- Age at diagnosis

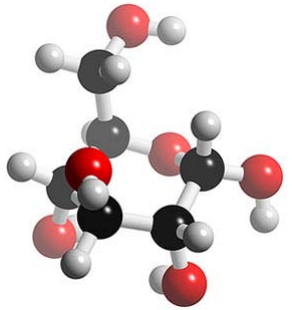
V. MDPH Investigation - Results

Participant Information from Consent Forms



Note: The literature suggests the ratio of males to females is generally equal, with slightly higher prevalence in males.

V. MDPH Investigation – National Comparison Results



Prevalence Estimates of Type 1 Diabetes in Children/Adolescents Ages 0-19 Years in Weston, Wellesley and Newton as of December 31, 2009

	Prevalence[1]	95% CI
Newton	1.69-3.62	1.11-4.68
Wellesley	2.98-3.58	1.93-5.11
Weston	3.66-4.50	1.95-7.31

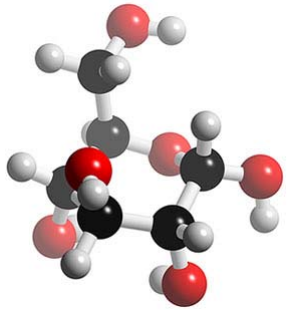
SEARCH

2.00 (1.94-2.06)

[1] Diagnoses per 1,000 individuals 0-19 years of age

- *No statistically significant difference seen in community prevalence estimates compared to national prevalence.*
- *Lower bound of range represents results from consent forms and upper bound represents results from the provider response.*

V. MDPH Investigation – State Comparison Results

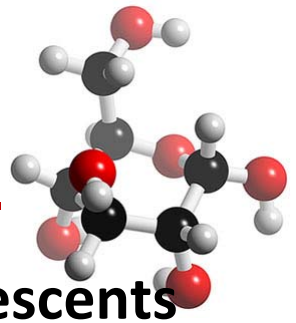


Prevalence Estimates of Type 1 Diabetes in Children/Adolescents 5-14 Years in Weston, Wellesley and Newton as of December 31, 2009

	Prevalence	95% CI
Newton	2.27-3.71	1.37-5.27
Wellesley	2.53-3.44	1.26-5.68
Weston	3.83-4.45	1.53-8.45
Statewide	2.53	2.41-2.65

- *No statistically significant difference seen in community prevalence estimates compared to statewide prevalence.*
- *These data represent a range of prevalence from 3 sources: consent forms, EPHT and provider response.*

V. MDPH Investigation - Results



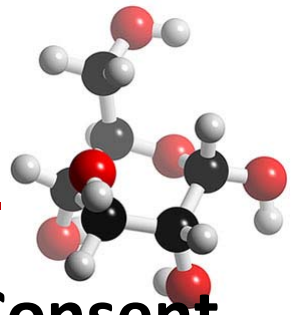
Prevalence Estimates of Type 1 Diabetes in Children/Adolescents Ages 0-19 Years in Selected Census Tracts in Weston, Wellesley, and Newton as of December 31, 2009

	Census Tract	Count	Prevalence	95% CI
Newton	3747	*	*	0.02-6.04
Newton	3748	*	*	0.02-4.83
Wellesley	4042.01	*	*	4.03-18.39
Wellesley	4043.01	*	*	3.86-14.81
Weston	3672	*	*	2.43-9.31
	All 5 Combined	30	4.88	3.29-6.96
National	SEARCH Study			
		4045	2.00	1.94-2.06

*Due to the small numbers, counts and prevalence estimates are not reported to protect individuals' privacy.

- *Prevalence in 3 census tracts of Weston and Wellesley is statistically significantly higher than national prevalence.*
- *Prevalence in 2 census tracts in Newton is not statistically significantly different from national prevalence.*

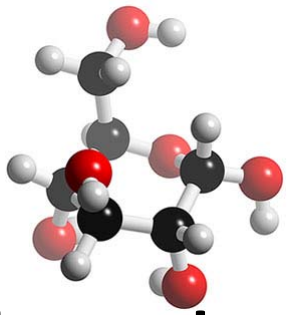
V. MDPH Investigation - Results



Residential and Family History Information from Consent Forms for 3 Communities

- 85% of children/adolescents diagnosed with type 1 diabetes resided in Weston, Wellesley, and Newton at the time of diagnosis
- 21 of 65 (32%) reported a family history of diabetes
  - Of those 8 individuals with a parent previously diagnosed with type 1 diabetes, 7 are fathers
  - The risk of type 1 diabetes by age 20 in the offspring of fathers with type 1 diabetes is about 3 times the risk in the offspring of mothers with type 1 diabetes.

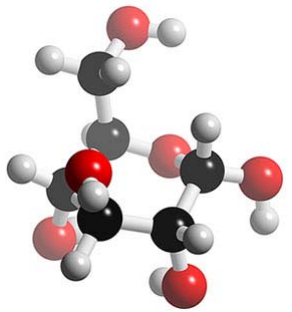
V. MDPH Investigation - Results



Residential and Family History Information from Consent Forms for 5 Census Tracts

- 87% of children/adolescents diagnosed with type 1 diabetes resided in Weston, Wellesley, and Newton at the time of diagnosis
- 11 of 30 (37%) reported a family history of diabetes
  - 2 of 11 have a parent previously diagnosed with type 1 diabetes

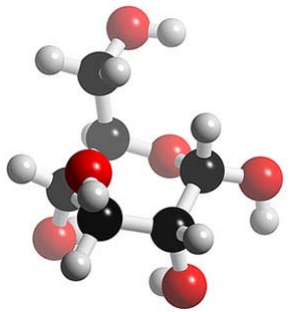
V. MDPH Investigation - Results



Geographic Distribution of Residence

- Mapped address information reported on the consent forms using a GIS
  - Current address was mapped for the children/adolescents who reside in one of the three communities
  - Address at the time of diagnosis was mapped for those individuals who lived in one of the three communities at the time of their diagnosis.
- The spatial pattern of address at diagnosis did not reveal any unusual patterns thus far

VI. MDPH Investigation - Discussion



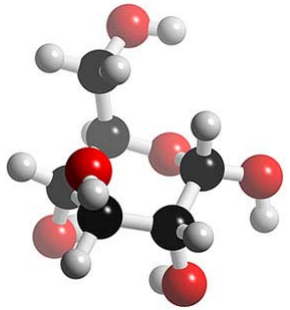
Risk Factors for Diabetes

- Type 1 diabetes is thought to be autoimmune in nature; for that reason environmental factors are also thought to play a role. Genetic factors and a family history are also thought to play a role in the development of Type 1

- Type 2 diabetes also has some suggested environmental risk factors including persistent organic pollutants (e.g. PCBs)

- Recognized risk factors for Type 2 diabetes include family history, obesity, physical inactivity, race/ethnicity and others

VI. MDPH Investigation - Discussion

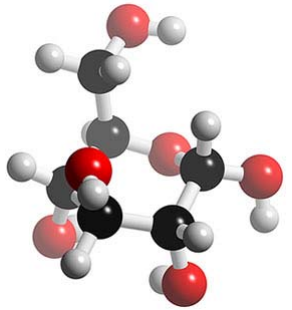


Potential Environmental Risk Factors Associated with Type 1 Diabetes*

Class	Specific agent
Viruses	Enteroviruses Rubella (congenital) Coxsackie B Rotaviruses
Nutritional	Cow's milk and cow's milk-based infant formula Gluten Exposure to Bafilomycin A1 Nitrates (N-nitroso compounds) Vitamin D Deficiency
Life-style / Other	Exposure to b-cell toxins (e.g. the rat poison, Vacor) Smoking (Family members, indoors) Older maternal age Birth order Infant Growth Birth weight Stressful life events

*Based on Table 2 from Zvi Laron's Interplay Between Heredity and Environment in the Recent Explosion of Type 1 Childhood Diabetes Mellitus

VI. MDPH Investigation - Discussion

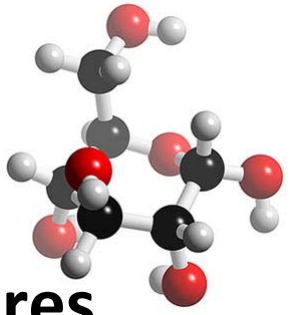


Other Current Areas of Environmental Research and Type 1 Diabetes

- Exposure to ozone, sulfates, and particulate air pollution
  - One study in California has shown an association between estimates of exposure to air pollution and type 1 diabetes; authors recommend further research

- Exposure to persistent organic pollutants
  - Several studies have been conducted each with major limitations (e.g. cross-sectional design unable to report whether diabetes or higher PCB levels came first)

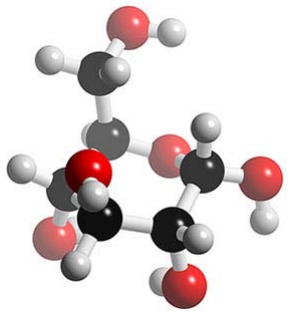
VI. MDPH Investigation - Discussion



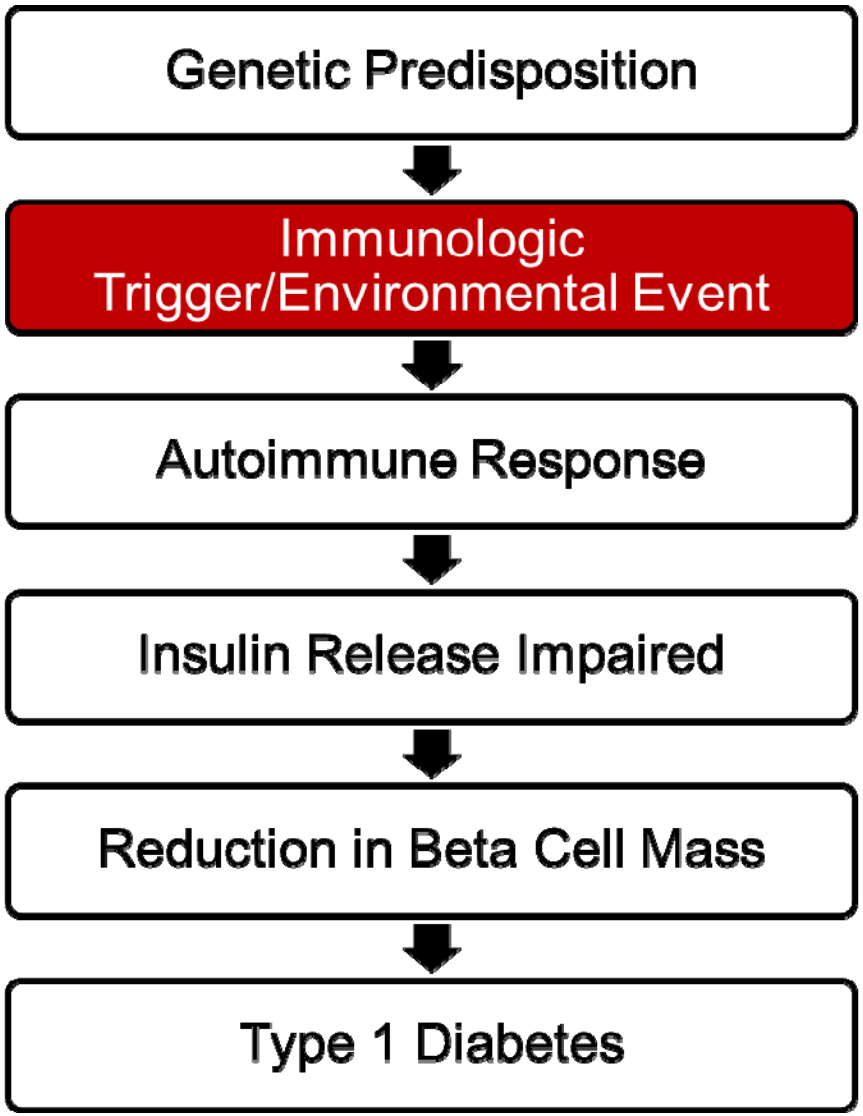
Autoimmune Diseases and Environmental Exposures

- Literature suggests that petroleum distillates (products, such as diesel fuel created from processing crude oil), mercury, silica and chlorinated hydrocarbons may be associated with lupus and other undifferentiated connective tissue diseases

VI. MDPH Investigation - Discussion

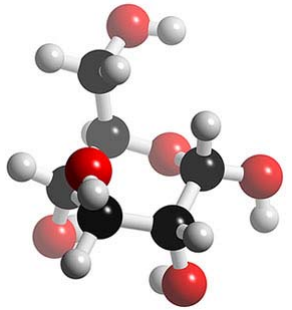


The Development of Type 1 Diabetes*



*Adapted from Figure 338-6 in Diabetes Mellitus in Harrison's Principles of Internal Medicine, 17th Edition (2008)

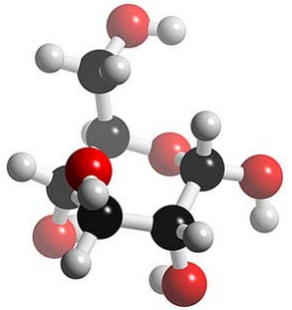
VII. MDPH Investigation - Conclusions



Prevalence

- The prevalence in the three communities is not statistically significantly different from the national prevalence estimates (SEARCH) or statewide prevalence estimates
- Prevalence estimates for three census tracts in Weston and Wellesley (3672, 4042.01, and 4043.01) are statistically significantly higher than the national prevalence estimate. This is not true for the Newton census tracts of 3747 and 3748.

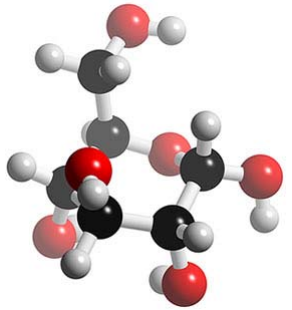
VII. MDPH Investigation - Conclusions



Family History

- It appears that family history of type 1 diabetes may have played more of a role in the prevalence of type 1 diabetes in Weston, Wellesley, and Newton as well as in the five census tracts, than in the general population
  - 5-10% of individuals with type 1 diabetes are expected to have a family history
    - 32% reported family history in the 3 communities
    - 37% reported family history in the 5 census tracts

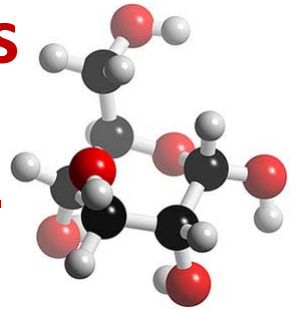
VII. MDPH Investigation - Conclusions



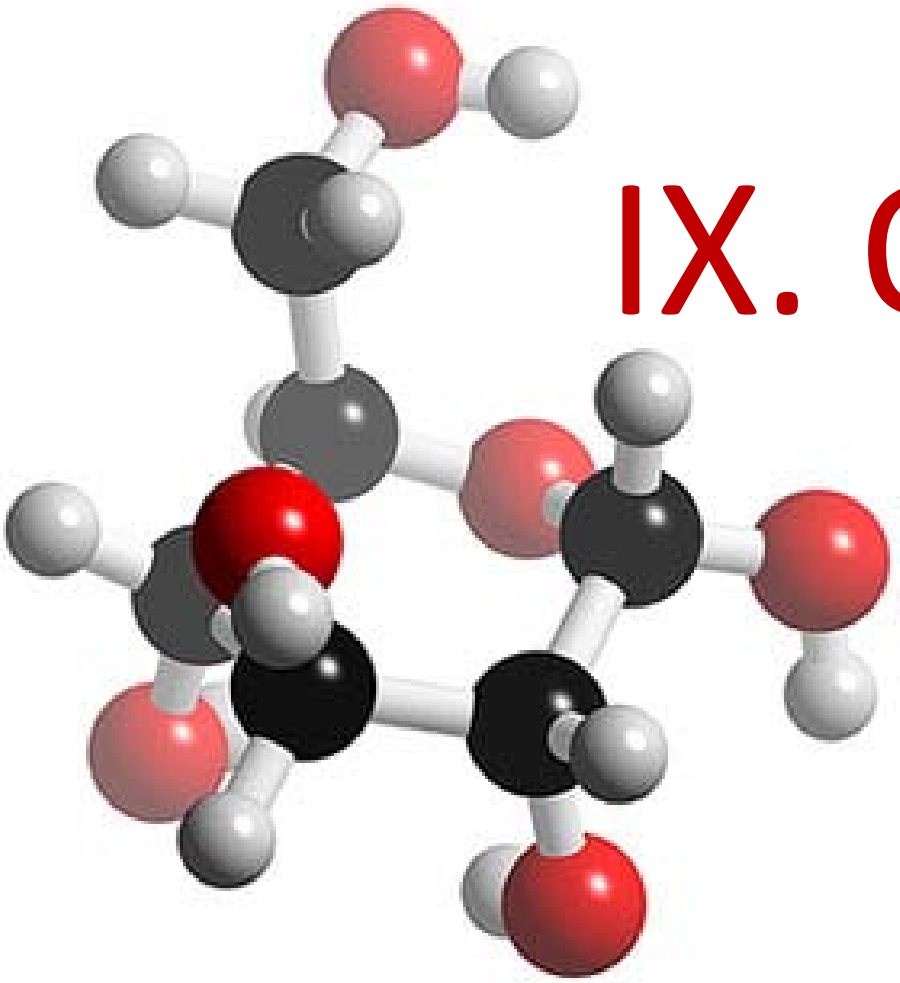
Residential History

- 85% of the children/adolescents resided in Weston, Wellesley or Newton at the time of their diagnosis. Within the five census tracts in Weston and Wellesley, 87% resided in their census tract at the time of their diagnosis.

VIII. MDPH Investigation – Recommendations for Next Steps



- Complete the review of environmental sites in the three census tracts in Wellesley and Weston (3672, 4042.01, and 4043.01)
  - Particular attention will be paid to any patterns that may emerge suggesting that children who may already be at higher risk of developing type 1 diabetes share more common factors including opportunities for environmental exposure(s).
- Evaluate statewide variability in the prevalence of type 1 diabetes using EPHT data (for grades K – 8) to identify areas with greater than and less than expected prevalence.
- The findings from this report coupled with the findings from the environmental site reviews will direct further follow-up investigative efforts.



IX. Questions?