

Vulnerability-Based Stratified Random Sampling of 100% of Providers/Catchments/ Eligible Women Patients in Worcester County

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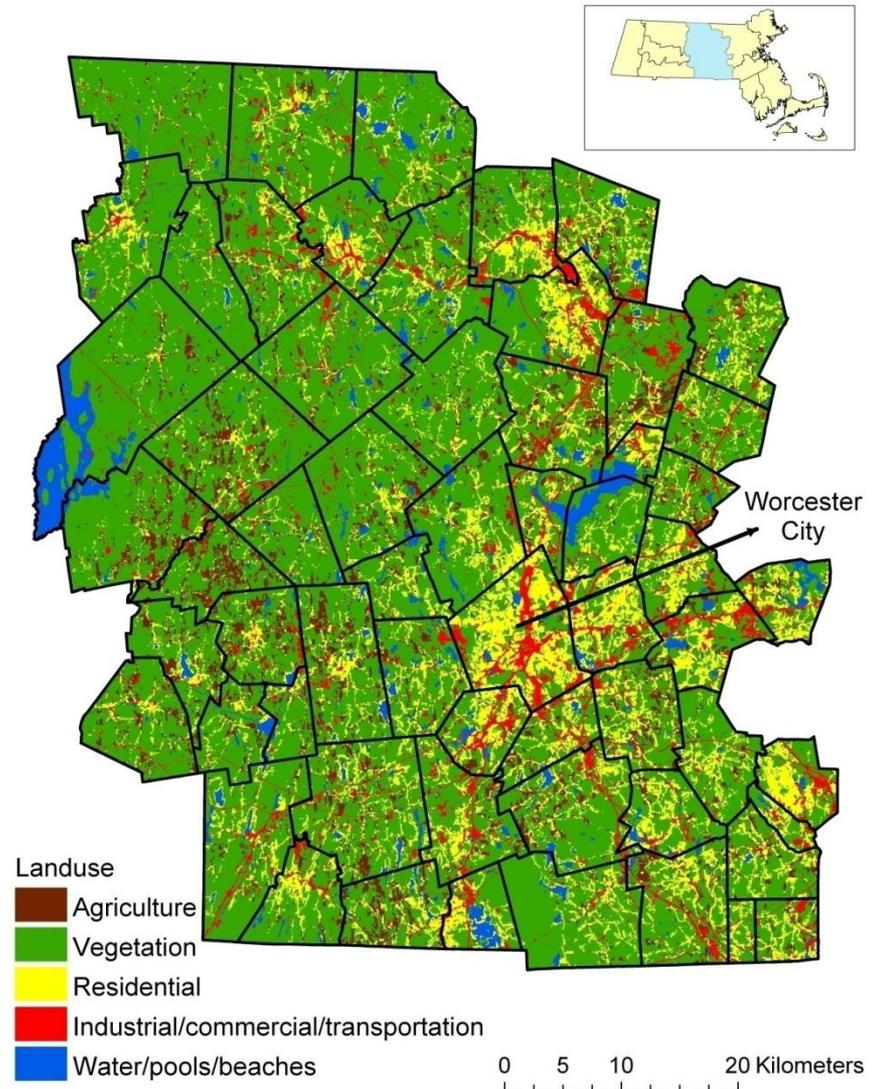
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Context & Concept

Worcester County includes 60 diverse towns where almost 86% of women receive prenatal care from approximately 175 County providers. Our proposed sampling method will use Geographic Information Systems (GIS) to characterize each provider's catchment area using health-relevant social and environmental conditions. We will stratify providers/patients based on those conditions, and draw a random sample for recruitment.



Rationale for PBS

The original strategy for NCS recruitment was household sampling. However, after several trial years and experience, questions were raised regarding the efficiency and cost of the household sampling recruitment methodology and its potential to yield the enrollment of 100,000 live births targeted by the NCS.

The PBS strategy will use a sampling frame that consists of all providers of prenatal and delivery care within the Primary Sampling Units (PSU) (i.e. Worcester County). With PBS, these providers will be used to recruit eligible women for participation in the NCS.

Providers are clinicians delivering pregnancy-related care and include OB/GYNs, family and general practice clinicians, and others including midwives in the county. Thus, all women seeking care from these providers, regardless of location of household, would be eligible for recruitment/enrollment.

Previous stratification work

Downs TJ, Ogneva-Himmelberger Y, Aupont O, Wang Y, Raj A, et al. (2010). Vulnerability-based Spatial Sampling Stratification for the National Children's Study-Worcester County, Massachusetts: Capturing Environmental and Socio-Demographic Variability. *Environmental Health Perspectives*
doi:10.1289/ehp.0901315.

Method overview – 1 of 2

We developed a multivariable, vulnerability-based method for spatial sampling combining two descriptive indices: a hazards/stressors exposure index (H), and an adaptability/socio-demographic character index (A).

The variables used at the block-group scale are:

H: population density (proxy for built-environment stress); daily traffic counts (proxy for air pollution); proximity to hazardous waste sites (TRI sites, brownfields).

A: average household income; average education level of head of household; % at or below poverty level; % minority; % using English as a second language.

Advantages

1. Sampling is done in ways that may increase the ability to detect associations between children's health outcomes and socio-ecological environment down the line (NCS primary objective);
2. It uses extant data from US Census, American Community Survey, and elsewhere (e.g. TRI sites);
3. It operates first at the block-group scale (smallest practical scale), then allows for aggregation to each provider's patient catchment area using patient zipcodes; and
4. It samples from 100% of eligible women patients to maximize recruitment.

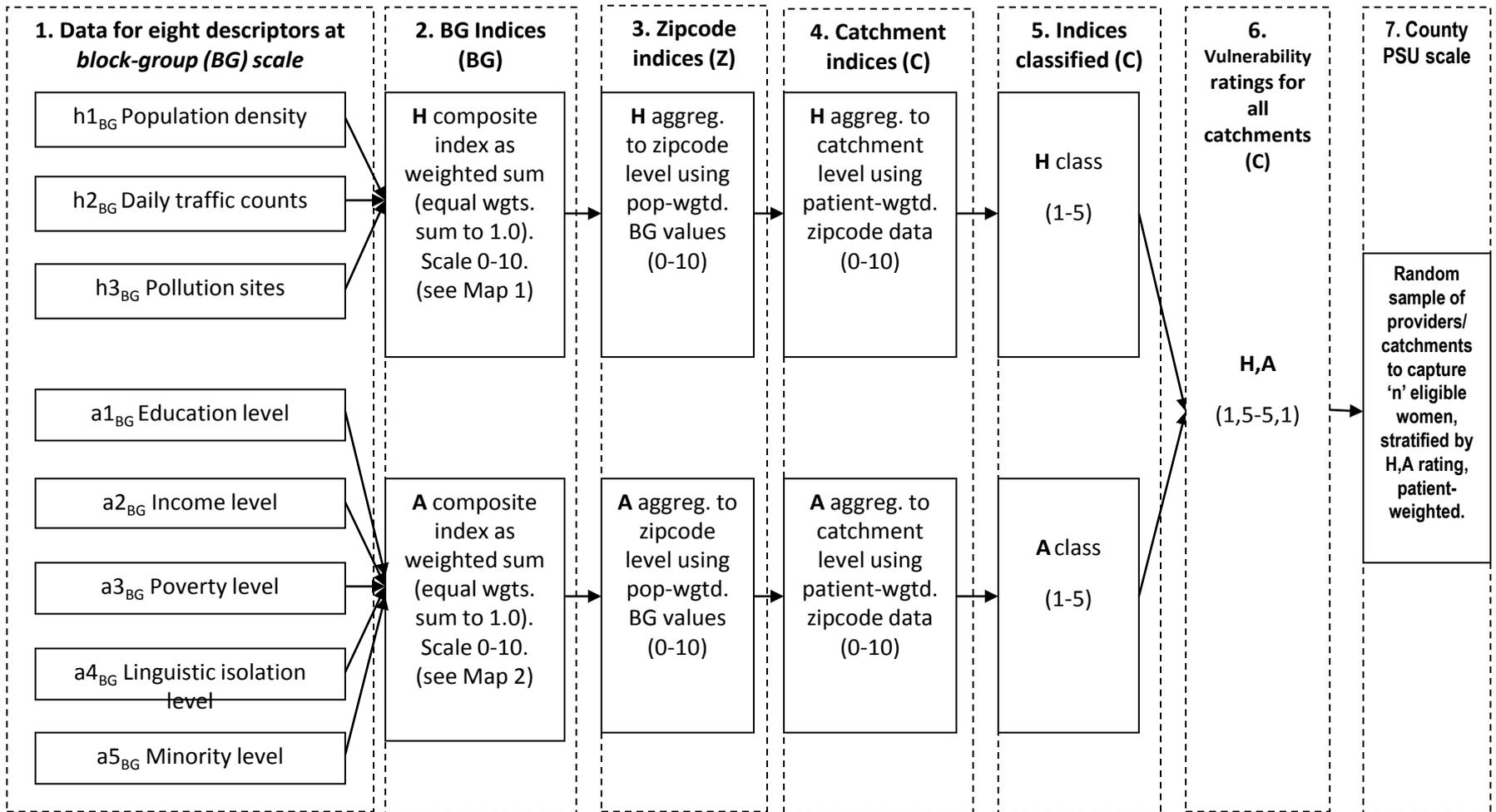
By using annual data from the American Community Survey (ACS), we have the potential to monitor H,A ratings year by year to inform the longitudinal profile of health and context. The approach is also amenable to using indicators of H and A that are locally/regionally relevant, and these will vary from NCS site to NCS site, county to county, as will the health profile.

Method overview – 2 of 2

Steps

1. Collect demographic and environmental data and calculate Hazard (H) and Adaptability (A) indices, and H,A ratings blockgroup, zipcode scales.
2. Identify all County/PSU prenatal providers, obtain eligible patients' zipcodes from each provider, map catchment zipcodes w/GIS.
3. Calculate the proportion of patients residing in providers' catchment zipcodes. Generate "weights" to represent contributions of each zipcode to the H, A indices of each provider's catchment. Calculate H,A ratings of providers/catchments
4. Generate random sample of providers/catchments to capture 'n' eligible women, stratified by H,A rating, patient-weighted.

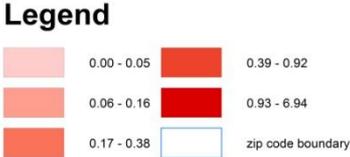
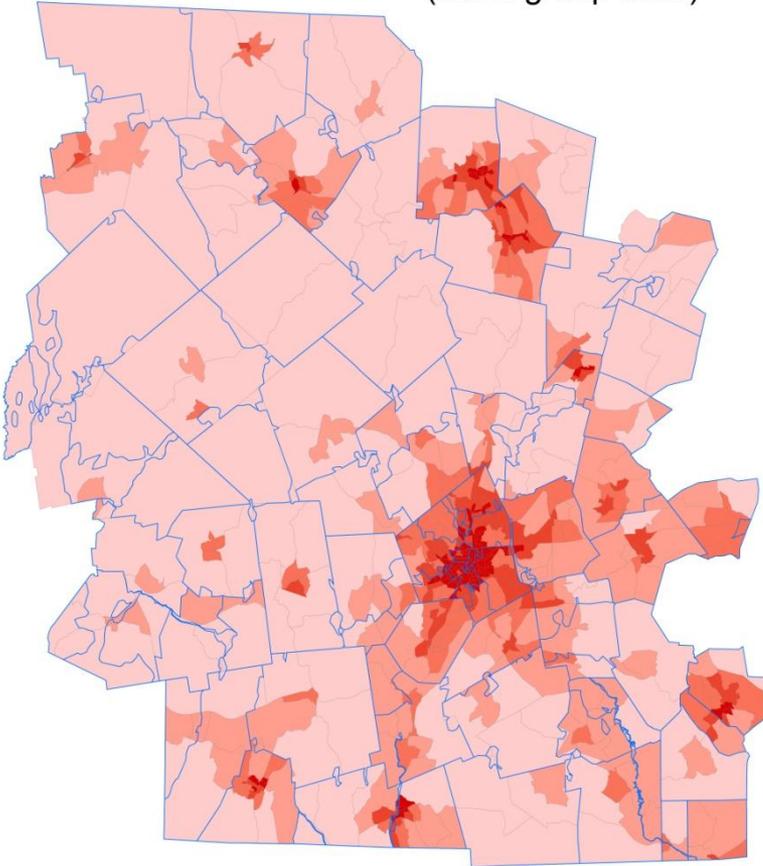
Flowchart of Approach



The resultant H,A vulnerability ratings for all providers/catchments range from worst-case 5,1 (highest stress, lowest adaptability) to best-case 1,5. Measured using 5-year estimates from 2005-2009 American Community Survey data, we will characterize all 175 providers/catchments serving 100% eligible women. We will then generate a patient-weighted random sample of providers/catchments, stratified by H,A rating.

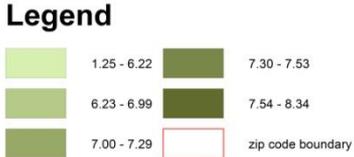
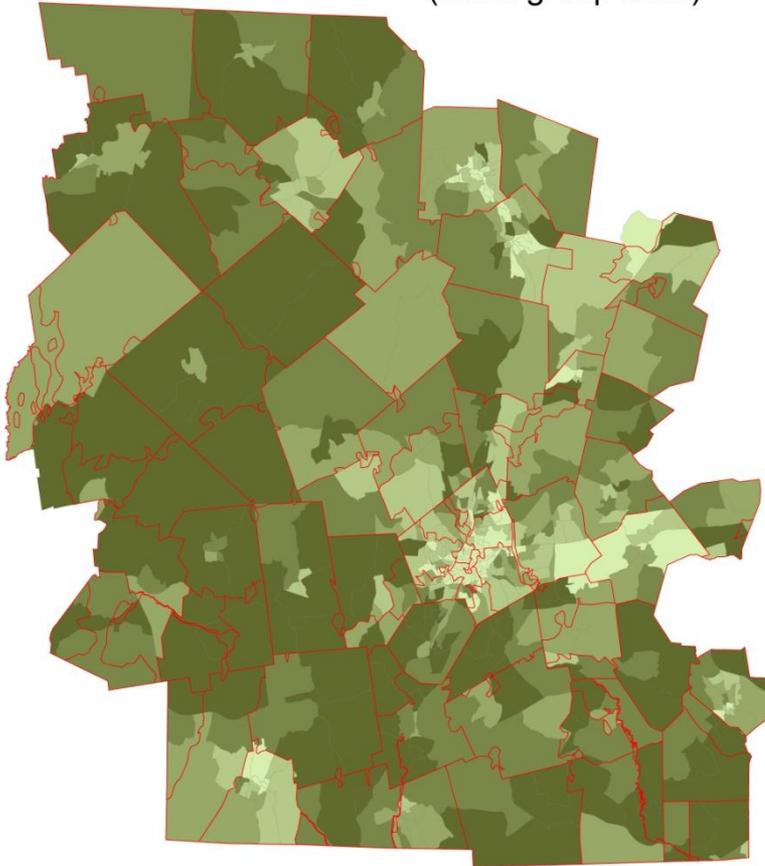
Map 1. Hazard index (H) by blockgroup, zipcode

Hazard index for Worcester County
(block group level)

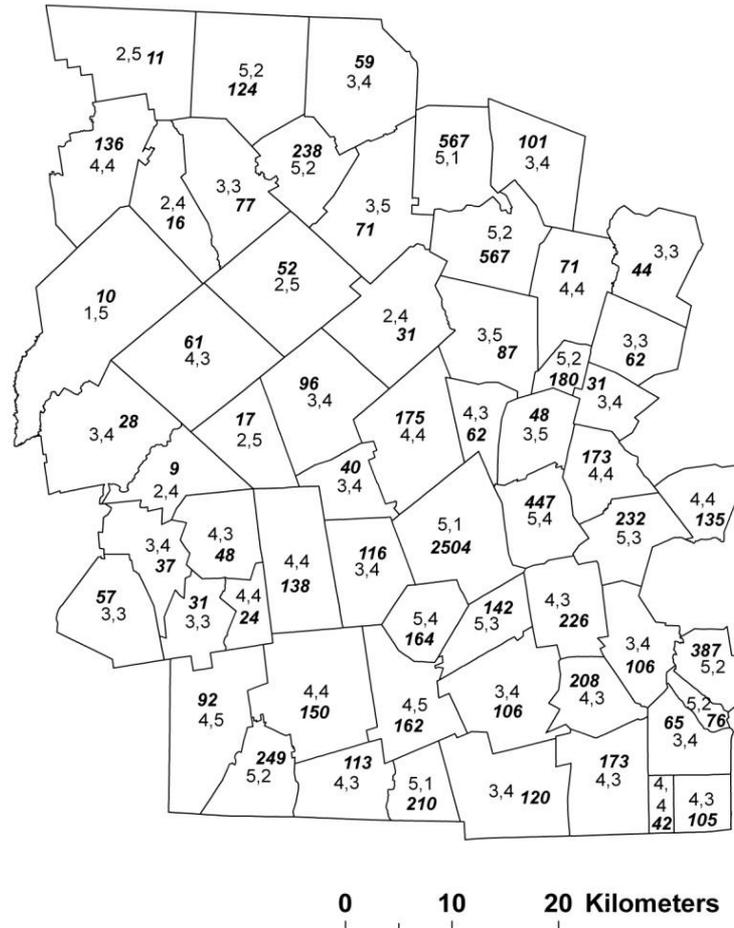


Map 2. Adaptability index (A) by blockgroup, zipcode

Adaptability index for Worcester County
(block group level)

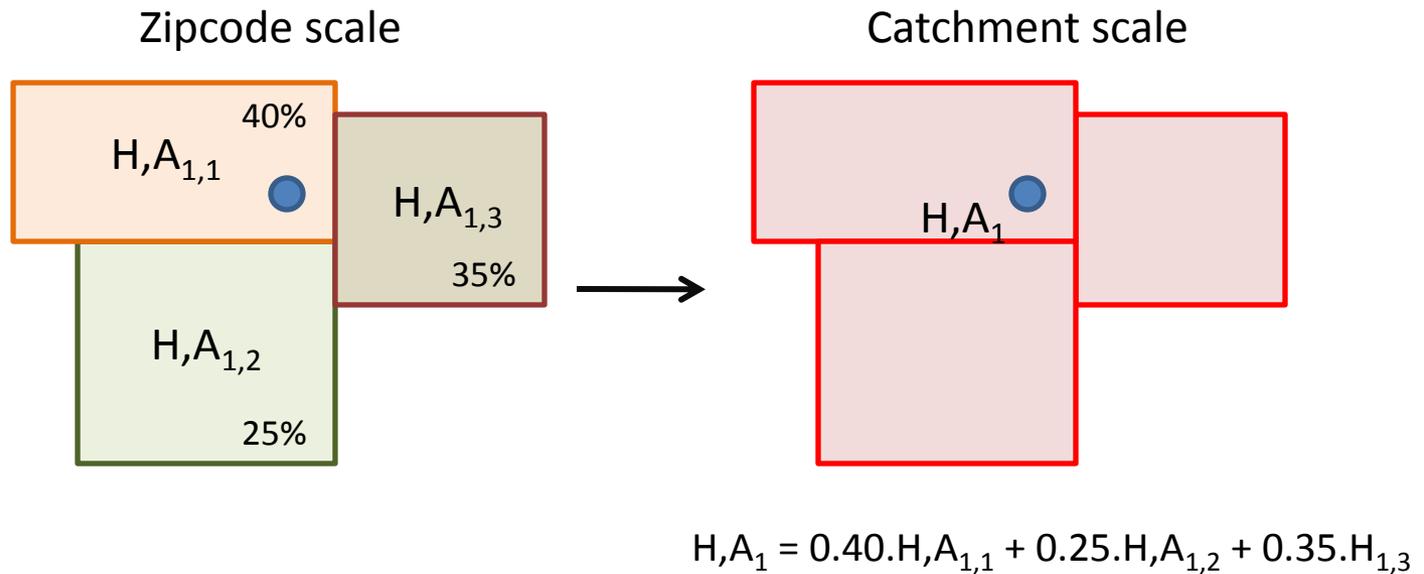


H,A ratings by town



Downs et al, 2010

H,A aggregation zipcode (Z) to catchment (C)



Key:

H,A_{catchment#,zipcode#}

xx% - % patients in zipcode

● Provider location

Sampling frame for patient-weighted random sampling of 'n' women stratified by H,A rating

	H,A rating																								
Providers (% total patients)	1, 5	1, 4	1, 3	1, 4	1, 5	2, 5	2, 4	2, 3	2, 4	2, 5	3, 5	3, 4	3, 3	3, 4	3, 5	4, 5	4, 4	4, 3	4, 4	4, 5	5, 5	5, 4	5, 3	5, 4	5, 5
P1 %									• 2.3																
.																									
P175 %																				• 0.6					
Total % by bin	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Total elig. patients	100%																								

Thank you for your kind attention