Preventing Lead Poisoning in Chicago

Joe Brew (Univ. of Florida), Alex Loewi (Carnegie Mellon), Subhabrata Majumdar (Univ. of Minnesota), Andrew Reece (Harvard)
Mentor: Eric Rozier (Univ. of Miami)

The problem

From 1995 to 2013, 298,675 Chicago children (29% of those tested) were poisoned by lead (blood lead level [BLL] >5 micrograms per deciliter). Though the incidence of lead poisoning has declined drastically (fewer than 3% in 2013), the consequences for those sickened are severe and life-long. Lead poisoning is associated with intellectual disability, systemic organ malfunction, aggression, and in severe cases, death.

The data

We had four principal data sources:
1. 20 years of BLL tests
2. CDPH inspections data
3. Cook County assessor data
4. 2010 census

The task

The principal pathway of childhood exposure to lead is through the home. Upon notification of a poisoned child, the Chicago Department of Public Health (CDPH) inspects that child’s home for lead hazards. Our team was assigned the task of helping CDPH go from a reactive to a proactive system in which homes predicted to be a potential source of exposure would be inspected before a child falls ill.

Current system

Child tests positive for lead poisoning
CDPH performs home inspection
If present, lead hazard is remediated
Child’s health improves

Our goal

House is predicted to be a source of lead
CDPH performs home inspection
If present, lead hazard is remediated
Child never gets sick

Improvements

Modeling brings the number of “high-risk” (probability of lead poisoning greater than 0.5) buildings targeted for inspection down from 200,000 to approximately 42,000. But that number still remains too high for feasibility. Our next step is to incorporate birth data so that we can target only homes with a child at the age of greatest risk (approximately 2 years old). Doing so is expected to bring our number of “high-risk” homes down to fewer than 500 (Fig. 3).

Exposure Prevention: Estimating Life Trajectories

Current medical practice is to act only once a child has exhibited a level of lead in the blood that is considered dangerous. We found canonical trajectories by imputing tract-level trajectories, then using spectral clustering to pick out exemplars. These suggest a trajectory can be predicted very early in life, allowing for preventative interventions. This work is leading us to consider policy recommendations for child lead testing that differ quite dramatically from the current practice.

The Tool

We have built an interactive, web-based application to assist the CDPH inspections team in prioritizing which buildings to visit, as well as to understand the history of those buildings.