Child Safety: Vulnerability Analysis of Baltimore, MD

Introduction

The environment in which children grow up has an enormous impact on the way their lives turn out. The urban environment can create obstacles to success for children, as there are a plethora of different community risk factors that children can be exposed to.

Baltimore, a coastal city with high poverty and crime rates, has long been a difficult place for children to grow up. This project uses GIS to analyze different community risk factors and community protective factors that can make children more or less vulnerable to different risks in Baltimore based on spatial information.

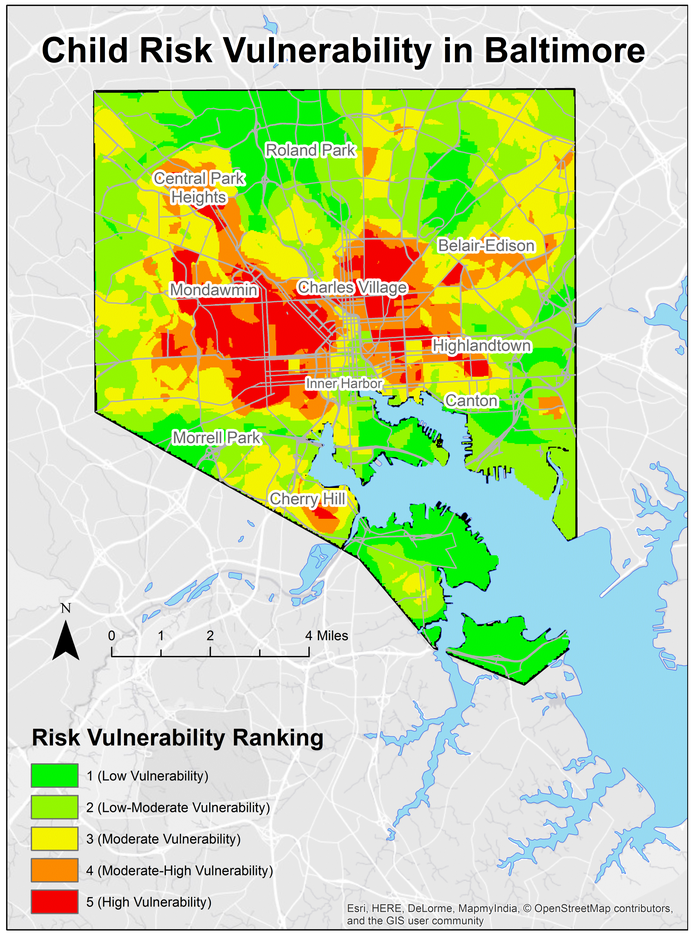
Methods

This analysis starts by identifying four different risk factors and two different protective factors that can alter vulnerability of children in Baltimore. The risk factors are 1.) Violent crime 2.) Liquor stores 3.) Unemployment 4.) Poverty, while the protective factors are 1.) Police stations and 2.) Schools. The four risk factors are variables that negatively affect children, and the two protective factors positively affect children. Publicly available data was used to the extent possible to simulate the factors that can have an impact on children. The prevalence of these six factors in Baltimore was used to determine child vulnerability.

A density analysis was performed for three different variables citywide: liquor stores, violent crime, and schools. These three analyses illustrated the areas of highest density for each variable across Baltimore. A density raster was created using data from the Baltimore city open data site, which highlights areas where there is high or low density of these three variables.

Next, a proximity analysis was performed for police stations, which calculated the distance to police stations for residents of different parts of the city using the Euclidean Distance tool in ArcMap. Then, census tract data for both unemployment rate and poverty rate were converted to raster form in order to use analysis tools within ArcMap to analyze the data. The six maps created through these different data sets were then reclassified on a 1-5 scale, with 1 representing areas of low vulnerability for children and Baltimore and 5 representing areas of high vulnerability.

Finally, the six reclassified datasets were combined into one final reclassification, again on a 1-5 scale. This total reclassification created a total risk vulnerability map of Baltimore, illustrating areas of highest and lowest vulnerability to child risk factors within the city boundaries. The table below this map shows the number of children within each vulnerability ranking based on census tract data.



Vulnerability Ranking	Number of Children
1	10,299
2	32,462
3	35,362
4	27,182
5	26,451

Results

Overall, Baltimore trends toward safer neighborhoods closer to the perimeter of the city, but towards Baltimore center, there is a much higher vulnerability to the risk factors identified in this study. While there are both police stations and schools close to the areas identified as most vulnerable, they don't completely protect children from the risks presented by the prevalence of liquor stores, violent crime, unemployment and poverty in these areas.

Limitations

Finding data is one of the biggest obstacles in using GIS to identify areas of vulnerability to child risk factors. In this analysis, challenges occurred when converting liquor store locations into data points that could be used in ArcMap, rendering the list of liquor store locations incomplete. Additionally, census tract data from 2015 was available, yet violent crime data from the same year was not, so 2014 data was used from violent crime. Analysis was only performed within the boundaries of Baltimore city.

Cartographer: Rory Ziomek May 2017 TUFTS UEP 232

Projection: NAD 1983 State Plane Maryland FIPS 1900 Feet

Data Sources: 2010 Census Tract Data, 2015 Census Tract Data, Baltimore Open Data, ESRI Data Maps

Other Sources: [1]Hoh, Rachel (2016). Production Gone Sour: Pesticide Exposure and Cranberry Bogs in Plymouth, County, MA. *Tufts Student GIS Expo Explorer.*

[2]Sohoni, D., and Saporito, S. (2009). Mapping School Segregation: Using GIS to Explore Racial Segregation between Schools and Their Corresponding Attendance Areas. *American Journal of Education*, 115: 4, 569-600. Retrieved from http://www.journals.uchicago.edu/doi/abs/10.1086/599782. [3]Kaiser, R., Spiegel, P., Henderson, A., and Gerber, M., (May 29, 2003). The Application of Geographic Information Systems and Global Positioning Systems in Humanitarian Emergencies: Lessons Learned, Programme Implications and Future Research. *Disasters*, volume 27, issue 2, pages 127-140. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/14677717.00224/abstract. [4]Yu, Xiang (2015). Key Fac-