



## Testing predictive validity

Remember that this method for testing predictive validity is not the only possible technique. Be innovative and explore different empirical methods that suit your needs the best.

### [You can test the RTM with existing outcome event data, or wait for new data]

- 1) Convert "raster risk terrain map" to "vector risk terrain map" using "Convert Raster Cells to Vector Polygon Grid" tool in the RTM Toolset
- 2) Add presence/absence of outcome event to each cell in the "vector risk terrain map" using "Add and Populate AnyEvents Field " tool in the RTM Toolset
  - a) Clear All Selected Features
- 3) If necessary for your study area, clip the vector risk terrain map to "intersect" with streets using "Clip Vector Grid to Streets" tool in the RTM Toolset (to exclude all places where outcome events cannot occur due to geocoding of the data)
- 4) Export attribute table of "Clipped vector risk terrain map" as a dBASE (.DBF IV)
- 5) Open attribute table of "Clipped vector risk terrain map" in statistical software, such as EpiInfo
  - a) Do logistic regression

#### i) Sample Results from EpiInfo (Significance is usually measured when the P-Value is less than 0.05):

Unconditional Logistic Regression							
Term	Odds Ratio	95% C.I.	Coefficient	S. E.	Z-Statistic	P-Value	
RISKVALUE	2.2561	1.6294 3.1240	0.8137	0.1661	4.8999	0.0000	
CONSTANT	*	*	-6.8054	0.4851	-14.0282	0.0000	
Convergence:		Converged					
Iterations:		6					
Final -2*Log-Likelihood:		260.1501					
Cases included:		3975					
Test	Statistic	D.F.	P-Value				
Score	25.9356	1	0.0000				
Likelihood Ratio	22.7217	1	0.0000				

## Weighting risk map layers

There are several reasonable ways to empirically weight risk map layers. The most appropriate method will depend on a variety of things, including the design of your risk terrain model (e.g., binary valued or ordinal scale). Be innovative and explore different and more advanced statistical methods that suit your needs.

### [Weight risk map layers with existing outcome event data]

Weighting requires a vector grid, such as a blank grid of cells (i.e., the same size cells as you intend to use for your risk terrain map)

#### 1. First, use "RSI Calculation" tool to calculate Relative Spatial Influence (RSI) for each risk map layer.

- View results in the selection tab of the Table of Contents (e.g., Gangs: 11/434).
- Divide the number of shootings by the number of street-intersected cells to get a RSI value
  - For example, see Table 1 (below)

Oper'zed Spatial Influence of	# of P1 Shootings	# of All Cells	# of Street-Intersected Cells	RSI = Shootings per Cell	Risk Factor's Weight
Gang	(11)	735	(434)	(.025)	$0.025/0.010 = 2.5$
Infra	(20)	2088	(1074)	(.019)	1.9
Drug	13	744	438	.030	3.0
School	12	2402	1229	.010	1
Bus Stop	28	5644	2759	.010	1

#### The "RSI Calculation" tool replaces the following steps:

- 1) Create a new Vector Risk Terrain Map that excludes all places that cannot have an outcome event (e.g. include only street-intersected cells if crimes are geocoded only to streets; Use "Clip vector grid to streets" tool.
- 2) Convert reclassified raster risk map layer to point features.
- 3) For the (converted) map of point features, select by attributes all points that have a "risky" value (e.g., Grid\_Code = 1)
- 4) Select by location all cells from the (Street-Intersected) Vector Risk Terrain Map that intersect with the selected points from the risk map layer. While these cells are selected, "Select by Location" outcome events that intersect with the selected cells. Record two things: 1) the number of street-intersected cells that are selected (e.g., 1074) and 2) the number of outcome events that are selected (e.g., 20).
- 5) Divide the number of outcome events by the number of street-intersected cells to get a "Relative Spatial Influence (RSI)" value.
- 6) Repeat Steps 3-5 for each risk map layer.

#### 2. Weights Calculation

- Calculate weights for each risk map layer by dividing the RSI value of each risk map layer by the smallest RSI value.

#### 3. Produce Weighted Risk Terrain Map in a GIS

- In ArcMap, have the reclassified raster risk map layers depicting the operationalized spatial influence of each criminogenic feature in the Table of Contents.
- Calculate a "Weighted Risk Terrain Map" using the "Weighted Sum" Tool to add the reclassified risk map layers together; Assign weights to each risk map layer accordingly.
  - Clip the resulting Weighted Risk Terrain Map to study extent and set the symbology accordingly
- (Optional) See the steps above under "Testing Predictive Validity" to test the predictive validity of the Weighted Risk Terrain Map

## Selecting/Validating Risk Map Layers

[Select/validate risk map layers with existing outcome event data]

The goal is to identify places that are the highest risk according to the operationalized risk map layers AND the places that have outcome events present.

**Begin with a blank grid of cells (i.e., the same size cells as you intend to use for your risk terrain map)**

**Prepare tabular data for Chi-squared tests**

1. **Add/Populate "AnyEvent" Field using the "Add and Populate AnyEvents Field" tool to note the presence or absence of outcome events in each cell**

**The "Add and Populate AnyEvents Field" tool replaces the following steps:**

- 1) Open the attribute table of the "Vector grid" (e.g., created using the "Create Blank Vector Grid of Study Area" tool in the RTM Toolset) and add a new field to note whether the cell is host to any outcome events.
- 2) "Select by location" all cells of the "Vector Grid" map that intersects with the "outcome events"
- 3) Open the attribute table of the "Vector Grid" while these cells are selected. Right click on the column heading of the respective new "AnyEvent" field > Field Calculator > "1".

2. **Add/Populate "RiskFactor" Field using the "Specify Risky Places" tool in the RTM Toolset to note whether each cell is operationalized as risky for each risk factor.**

**The "Specify Risky Places" tool replaces the following steps:**

- 1) Open the attribute table of the "Vector Grid" and add a new field to note whether the cell is located at a risky area for the risk factor.
- 2) Convert the reclassified raster risk map layer to point features.
- 3) For the (converted) map of point features, select by attributes all points that have a "risky" value (e.g., Grid\_Code = 1)
- 4) Select by location all cells of the "Vector Grid" that intersects with the selected points from each of the individual risk map layers.
- 5) Open the attribute table of the "Vector Grid" while these cells are selected. Right click on the column heading of the respective risk factor > Field Calculator > "1".
- 6) Repeat these steps for each risk map layer.

3. **Create a new "Vector Grid" map that excludes all places that cannot (technically) have an outcome event (e.g., include only street-intersected cells if crime incidents are geocoded only to streets).**

4. **Export the attribute table of the (Street-intersected) vector grid as a dBASE (DBF IV) file.**

- Import DBF file into a statistical software package, such as EpiInfo.
- Run Chi-Squared test for each risk factor on the "AnyEvent" variable.
  - i) Only include statistically significant risk factors in your risk terrain model
  - ii) Exclude or re-operationalize (and test again) risk factors that are not significant