Eviction Risk in Philadelphia

Predicting the 2026 Housing Cliff

Authors: Lingxuan Gao & Xiaoqing Chen

Date: December 8, 2025

Course: MUSA 5080

The Challenge

The Looming Housing Cliff

Context

Philadelphia is approaching a ‘housing cliff’ in 2026 driven by federal policy shocks.

Policy Shock

Stricter NSPIRE standards threaten funding for roughly 1,200 permanent supportive housing units.

The Gap

Historical averages are insufficient in this volatile landscape.

Objective

Method

Develop a ***spatial predictive model*** for Nov 2025 – Nov 2026 and use it in a tiered, safeguarded way.

Policy Impact

Enable **'High Precision Allocation'** of legal aid to the ***most vulnerable census tracts.***

Strategy

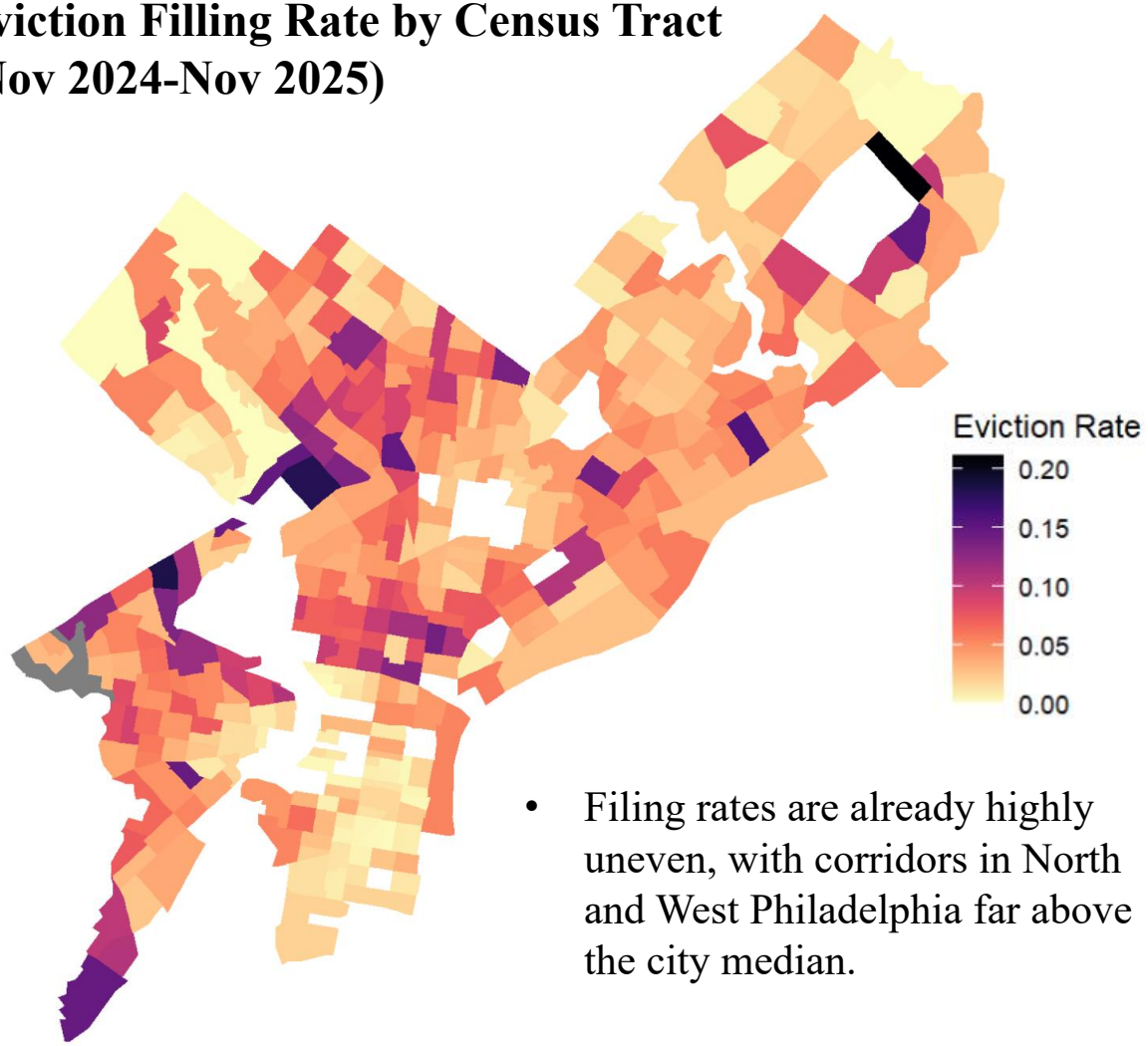
Integrate ***structural distress, spatial context, and demographics.***

- Eviction Lab: Monthly filing counts and landlord hotspot data (2020-2025).
- Demographics (ACS 2022): Poverty rate, Race, Rent burden.
- Structural Distress: L&I Violations (2012-2016 legacy data).
- Real-time Signals: 311 Housing Complaints (2025).
- Spatial Context: Distance to City Hall & Hotspots.

Descriptive Insights (Citywide)

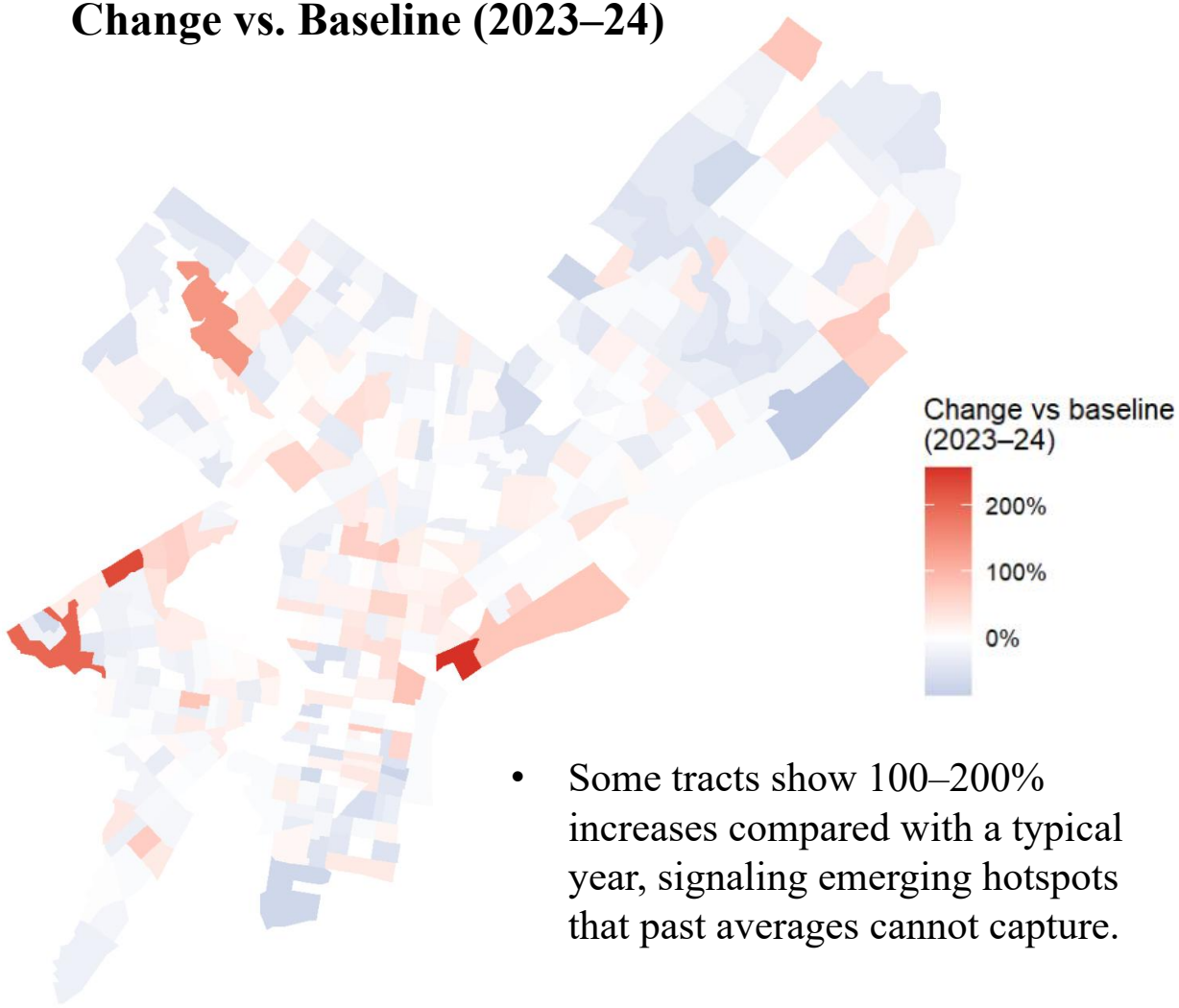
These patterns show that eviction risk is both highly unequal and shifting over time, which motivates building a forward-looking spatial model.

Eviction Filling Rate by Census Tract (Nov 2024-Nov 2025)



- Filing rates are already highly uneven, with corridors in North and West Philadelphia far above the city median.

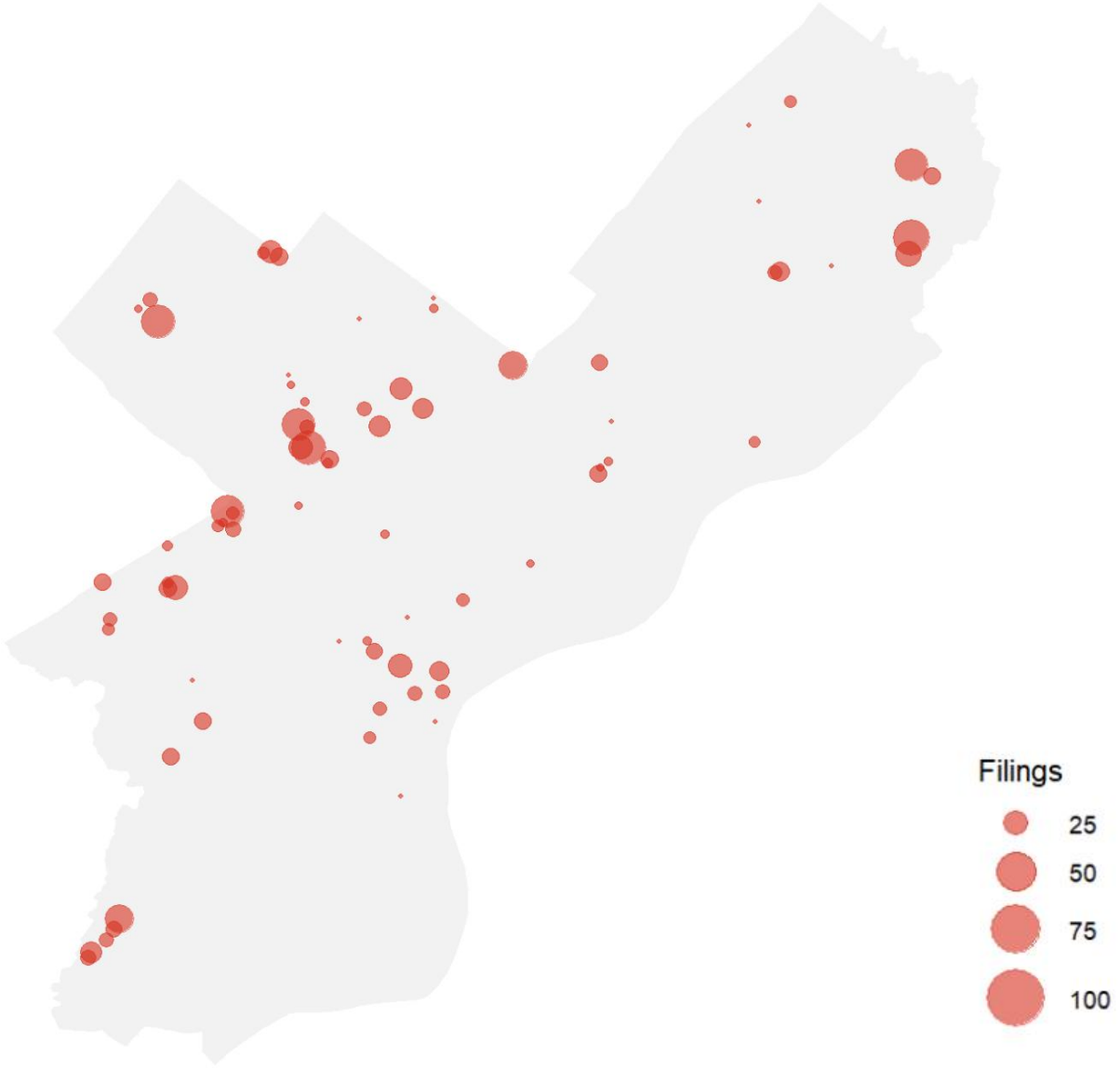
Change vs. Baseline (2023–24)



- Some tracts show 100–200% increases compared with a typical year, signaling emerging hotspots that past averages cannot capture.

Descriptive Insights (Landlords)

Top Eviction-Filing Landlords in Philadelphia



A relatively ***small number of landlords and buildings*** account for ***a large share of filings.***

Our model therefore ***incorporates both neighborhood conditions and landlord hotspot variables*** to guide targeted interventions.

Logistic Regression Modeling

Time Period: Custom 'Eviction Year' (Nov-Nov cycles).

Target: Predicting 'High Risk' tracts (Top 20% based on Pareto Principle).

Models Tested:

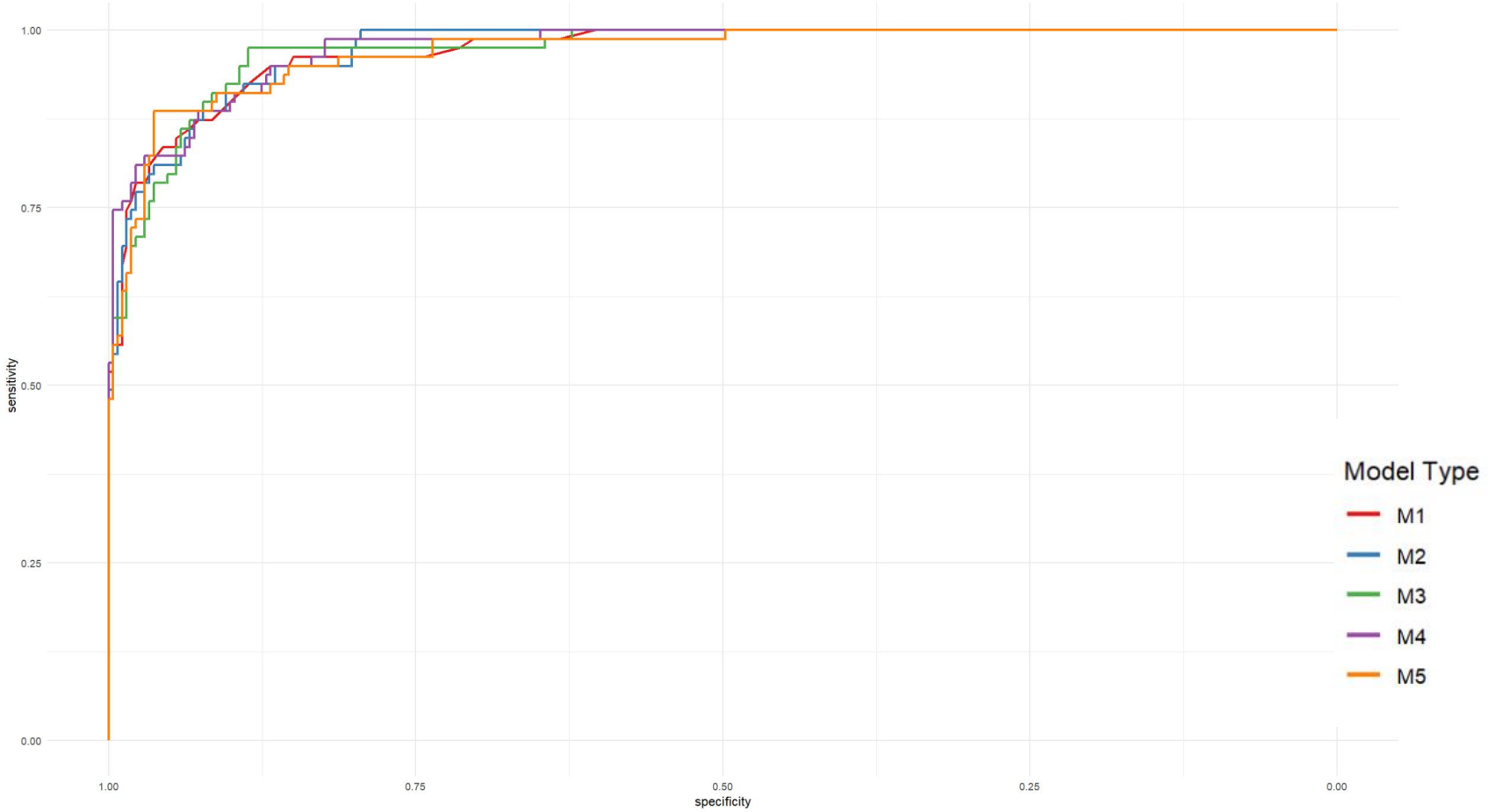
- M1: Inertia (History only)
    - lag_mean_monthly
- M2: History + Demographics
    - lag_mean_monthly / pov_rate / renter_share / med_rent
- M3: History + Built Environment
    - lag_mean_monthly / hist_vio_per_1k / hotspot_fillings / housing 311_per_1k
- M4: History + Spatial Context
    - lag_mean_monthly / dist_center_km / dist_hotspot_km / neighborhood_cluster
- M5: Full Integrated Model
    - all above

Results

Model Performance:

M5 (Full Integrated Model) delivers 94.3% accuracy (AUC ≈ 0.97) – added complexity improves signal, not noise.

ROC Curve Comparison： Full Model (M5) chosen as champion.



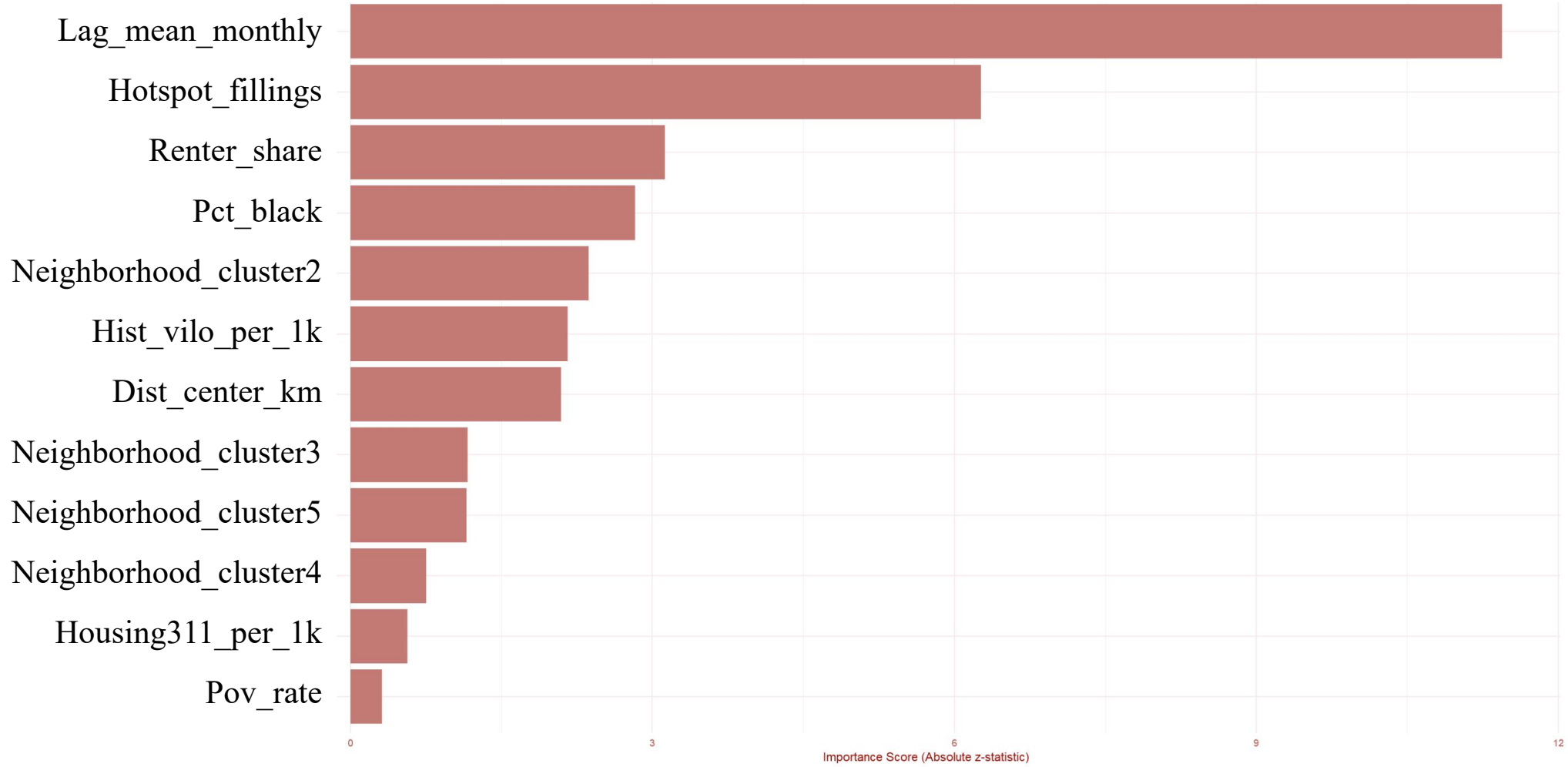
Model Comparison Table

Model	AUC	Accuracy	AIC
M1: Inertia	0.971	0.929	707.873
M2: Demographics	0.974	0.912	661.983
M3: Built Env	0.971	0.920	638.294
M4: Spatial	0.975	0.920	676.184
M5: Full	**0.969**	**0.943**	**609.176**

Results

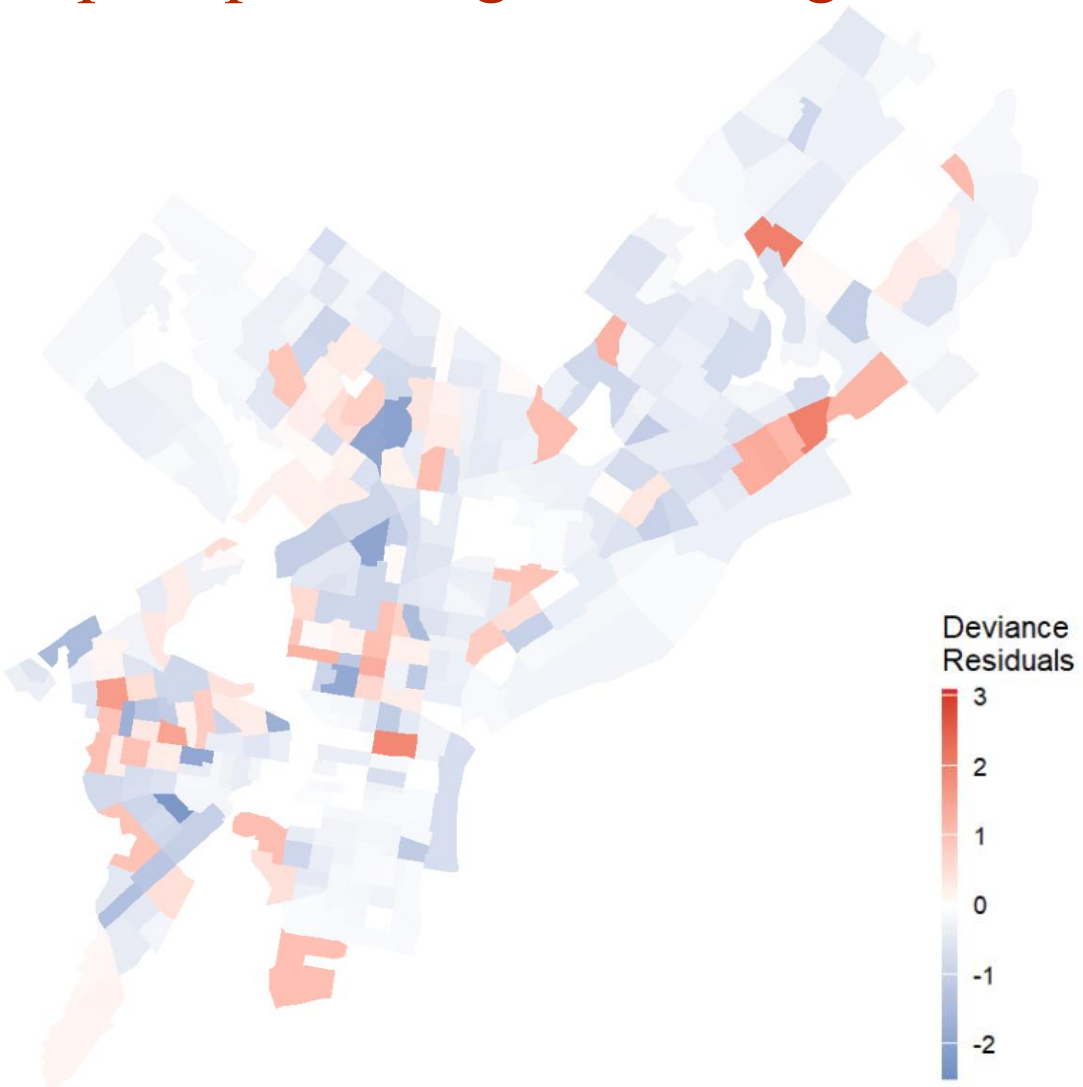
Drivers: Risk is dominated by historical inertia and landlord hotspots, amplified in **renter- and Black-majority neighborhoods**.

Feature Importance: What drives Eviction Risk? (Based on M5)



Validation & Robustness

The model is both **accurate and geographically robust**, while the residual map helps us flag a few neighborhoods for closer review.



Map of Model Error (Residuals): Where is M5 failing?

Red = underestimation (missed risk)
Blue = overestimation (false alarm)

Spatial Cross-Validation

- ***AUC ≈ 0.91*** even when we hide entire neighborhood clusters, showing the model ***generalizes well to new areas***.

Spatial Autocorrelation

- ***Moran's I of residuals = 0.115 (low but significant)*** – the model explains most spatial patterns, with only ***small local clusters of error***.

Bias Check

- Red and blue pockets are scattered rather than city-wide, indicating ***no systematic over- or under-prediction*** for any large region.

Limitation

Reporting Bias in 311 Complaints

Reporting bias in 311 complaints – ***fewer reports in vulnerable areas*** may hide serious, unreported housing problems.

- Our model uses 311 complaints as a proxy for housing distress. But tenants in the most vulnerable neighborhoods may be less likely to report violations (for example, due to fear of landlord retaliation).
- As a result, "quiet" areas in the data may still be suffering from severe, unreported neglect.

Census-Tract Scale, Not Individual Properties

Predictions are at tract level, not property level

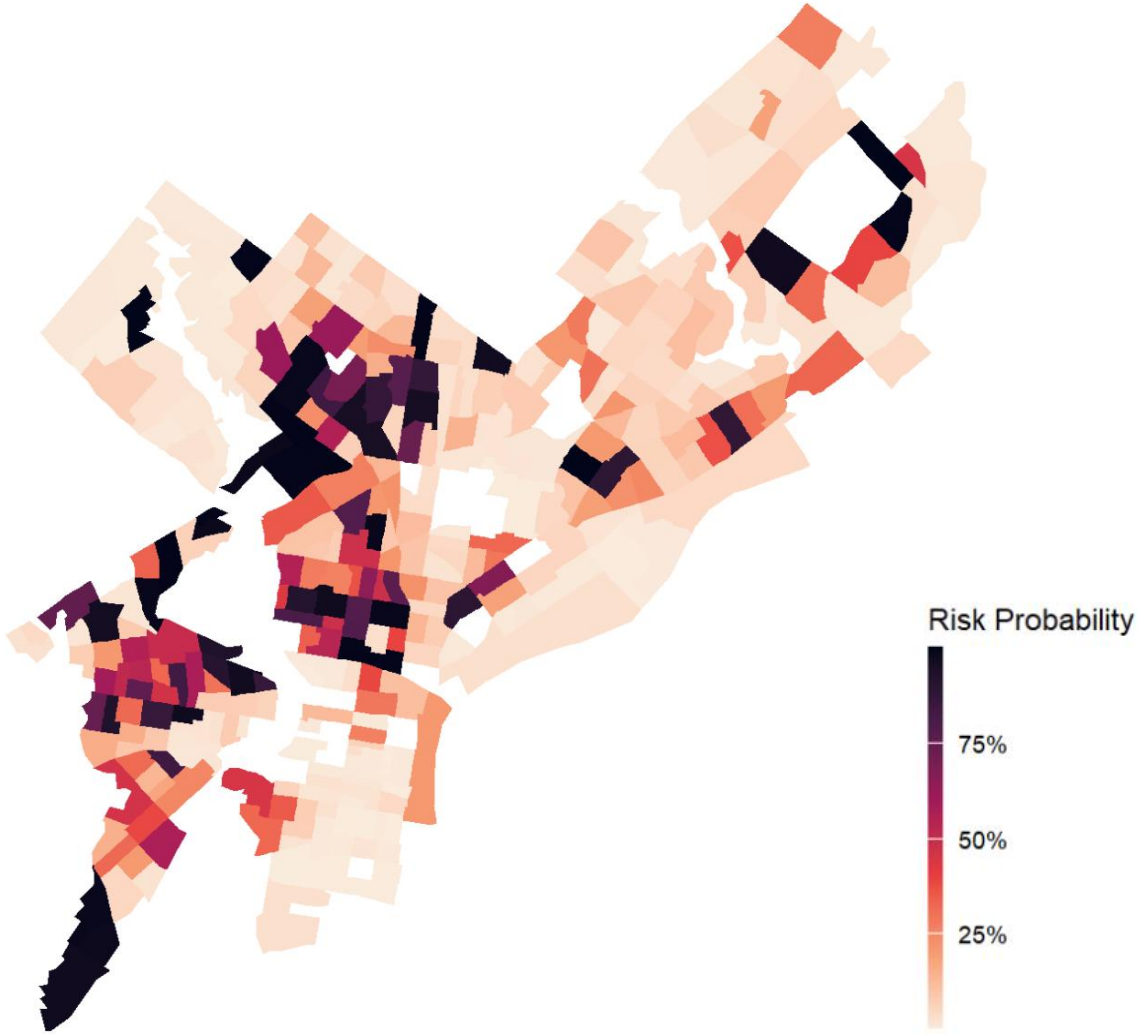
– ***a "high-risk" tract still requires property-level verification*** before allocating expensive resources.

- Our predictions operate at the census tract level. A "high-risk" label for a tract does not mean every building or household in that tract is at equal risk.
- Expensive interventions should be verified and prioritized at the property level with local partners to avoid wasting resources on stable buildings.

Forecast for 2026

Eviction risk in the housing-cliff year remains highly concentrated:

a relatively small share of neighborhoods will bear most of the pressure, making them the natural priority for high-precision legal aid and rental assistance.



Eviction Risk Probability (Nov 2025 - Nov 2026)

Darker/Red areas indicate >80% probability of high eviction activity

Scale of Risk

- The model forecasts ***71 census tracts as high risk*** for 2026, representing ***about 20% of all neighborhoods*** in Philadelphia.

Geographic Pattern

- High-risk tracts form ***continuous corridors in North and West Philadelphia***, rather than being scattered randomly across the city.

Model Confidence

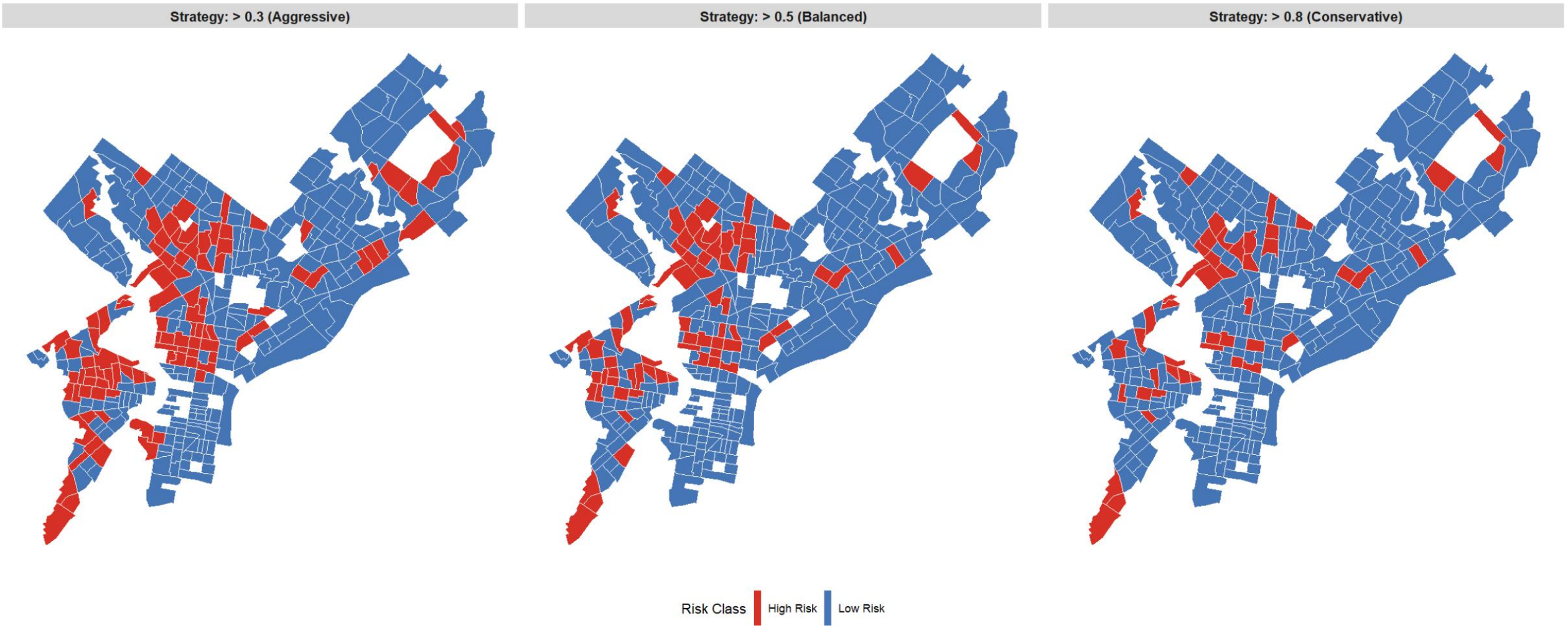
- In the darkest areas, predicted probabilities exceed ***75–80%***, signaling near-certainty of intense eviction activity if nothing changes.

Strategy

Targeting Strategies for 2026: Coverage vs. Precision

Lower thresholds cast a wide safety net but require more resources;
Higher thresholds focus only on the most extreme hotspots with maximum precision.

Policy Trade-offs: How Does the ‘High Risk’ Threshold Change Our Target Areas?



Strategy

Priority Neighborhoods for High-Precision Aid (2026)

Under the conservative (>0.8) threshold, these five census tracts show near-certain eviction risk and should be first in line for intensive legal and rental support.

Top 5 Highest-Risk Census Tracts (2026 Forecast)

Geoid	Predicted Risk	2025 Avg. Filings	Poverty Rate
42101021800	0.9999700	12.500	14.8%
42101036100	0.9999043	11.583	4.8%
42101030100	0.9998525	13.833	44.2%
42101012100	0.9989267	10.333	16.9%
42101023900	0.9988449	9.000	10.0%

- This table lists the census tracts with the highest predicted eviction risk, showing their risk probability, 2025 average filing rate, and poverty rate to justify why these neighborhoods should be prioritized for intensive support.

Recommendations

Tiered Intervention

Combines “narrow & deep” and “wide & light” support, maximizing impact of limited funds and reducing false positives.

Strategy A – High Precision (≥ 80% probability)

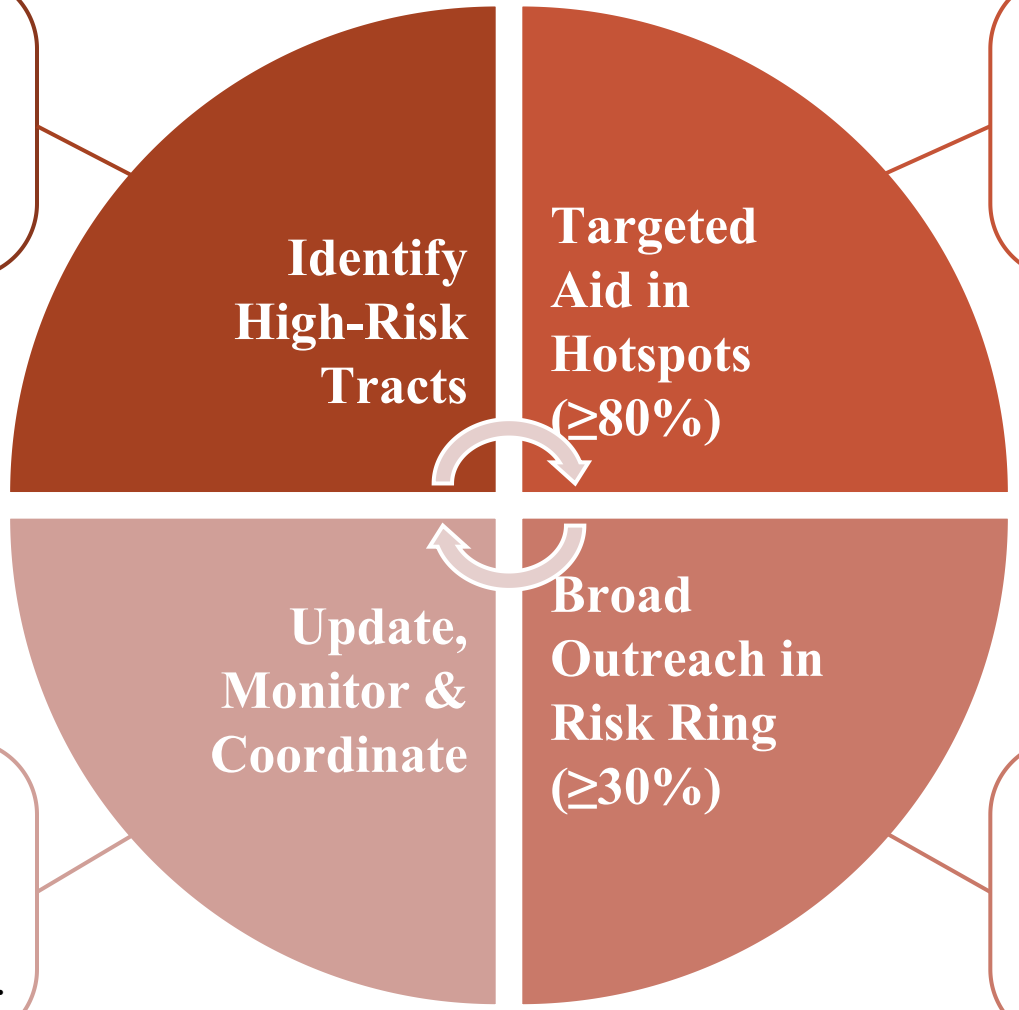
- **Target:** Small set of extreme hotspots.
- **Action:** Direct rent relief, full legal representation, intensive case management.
- **Note:** Verify needs **at the property/household level** with local partners before committing these high-cost resources.

Strategy B – Aggressive Outreach (≥ 30% probability)

- **Target:** Wider ring of at-risk neighborhoods around the hotspots.
- **Action:** Low-cost interventions – flyers, text alerts, know-your-rights workshops, landlord engagement.
- **Note:** Use this tier to reach areas where **311 distress may be under-reported**, and monitor for emerging hotspots to feed back into the model.

Recommendations

- Use the model to define the 71 priority tracts and the wider at-risk ring for 2026.



- Concentrate expensive tools—rent relief, full legal defense, case management—in the highest-risk tracts.

- Refresh the model annually, track outcomes, and align budgets through a cross-agency housing cliff taskforce.

- Deploy low-cost interventions—flyers, SMS alerts, workshops, landlord engagement—across the wider at-risk neighborhoods.

Summary

The 2026 housing cliff will be highly concentrated, with roughly one-fifth of Philadelphia's census tracts—primarily in North and West Philadelphia—bearing most of the eviction pressure.

Model 5 gives the City a validated, spatial roadmap, accurately identifying where risk will be highest and remaining robust under spatial cross-validation and bias checks.

We recommend adopting a tiered response, starting with immediate high-precision targeting of the 71 highest-risk tracts for intensive support, complemented by low-cost outreach across the broader at-risk ring.

Thanks for your time