

# XAI-Guided Discovery of Extended Climate-Health Relationships

91% Validation Success • 21-Day Cardiovascular Effects • 5.6M Population Impact

Johannesburg, South Africa • HE2AT Center • DSI Africa Initiative

## XAI DISCOVERY PROCESS

Revolutionary 6-Minute Discovery vs Months Traditional Research

### TRADITIONAL APPROACH

**3-6 MONTHS**

Literature review + hypothesis formation  
Limited to known relationships

1000x FASTER

### XAI APPROACH

**6 MINUTES**

Automated pattern discovery  
Novel relationship identification

### XAI METHODOLOGY STACK

**Random Forest**  
Feature importance

**XGBoost**  
Gradient boosting

**SHAP Values**  
Feature attribution

## VALIDATION SUCCESS RATE

XAI-Generated Hypotheses Statistical Validation



### HYPOTHESIS GENERATION

**124 hypotheses**  
generated automatically  
with biological reasoning

### STATISTICAL VALIDATION FRAMEWORK

**DLNM Analysis**  
Lag-response models

**Correlation Analysis**  
Multiple testing correction

**Bootstrap Validation**  
1000 iterations

**91% of XAI hypotheses validated successfully**

## KEY VALIDATED FINDINGS FROM XAI DISCOVERY

Novel Climate-Health Relationships Confirmed by Statistical Analysis

### 21-DAY BP EFFECTS

**$r = -0.114$**

$p < 10^{-15}$

First in literature

**$n = 4,957$**

Extended cardiovascular adaptation

### IMMEDIATE GLUCOSE

**$r = 0.118-0.131$**

$p < 10^{-6}$

0-3 day peak response

**$n = 2,731$**

Metabolic stress response

### TEMPORAL EXPANSION

**Traditional: 0-7 days**

**Novel: 0-21 days**

**3x expansion**

of temporal window

Previously undetected effects

### POPULATION IMPACT

**5.6M residents**

Johannesburg metropolitan

Climate-vulnerable population

**18,205 participants**

Largest African cohort

## IMPLEMENTATION IMPACT & CLINICAL TRANSLATION

From XAI Discovery to Health Policy & Monitoring Protocols

### CLINICAL MONITORING

Extended 21-day protocols  
System-specific windows  
Preventive interventions  
Evidence-based timing

### POLICY FRAMEWORKS

Environmental justice  
Triple vulnerability analysis  
Intervention prioritization  
Data-driven allocation

### RESEARCH ACCELERATION

6 minutes vs 6 months  
Automated hypothesis generation  
91% validation success  
Replicable methodology

### GLOBAL SCALABILITY

Multi-city implementation  
Transferable frameworks  
Climate-health networks  
International collaboration

### INSTITUTIONAL

HE2AT Center  
DSI Africa  
IBM Research Africa  
Multi-institutional