NIST Technical Note 2028

Community Risk Ratings for the FireCARES System

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Abstract

The FireCARES (Community Assessment Response Evaluation System) project is a web-based tool intended to help fire departments effectively match resources to community risk. Among other things, the analysis includes estimates of the community risk and estimates of effectiveness of response. This report documents the estimation of the community risk for fires, fire injuries, fire deaths, and emergency medical services calls. The community risk for fires is broken out by low- medium- and high-hazard properties as defined in NFPA Standard 1710.

Key words

Fire Risk; FireCARES; Fire; Injury; Death; EMS

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Abbreviations:

ACS:	American Community Survey
BRFSS:	Behavioral Risk Factor Surveillance System
CDC:	(US) Centers for Disease Control
EMS	Emergency Medical Services
FireCARES:	Community Assessment Response Evaluation System
GLM:	Generalized Linear Model
LASSO:	Least Absolute Shrinkage and Selection Operator
NFIRS	National Fire Incident Reporting System
NHIS:	National Health Interview Survey
NFPA	National Fire Protection Association
RMS	Root Mean Square
RMSE	Root Mean Square Error

1. Introduction

The FireCARES project (www.firecares.org) is a web-based tool intended to help fire departments effectively match resources to community risk. Among other things, the analysis includes estimates of the community risk and estimates of effectiveness of response. This report describes the estimation of the community risk.

A literature review of the factors affecting death and injury in fires is in [1]. They found that the factors affecting the likelihood of death and injury in fires include age (and in particular, being older or very young), race (specifically black or American-Indian or Eskimo) gender, older homes, mobile homes, rentals, the lack of a smoke detector, and the use of alcohol and tobacco. For example, living in a low-income household or area is associated with a higher risk of injury in fire. The use of space heaters was associated with increased risk of death in fire.

As far as I am aware, no one has attempted to estimate the spatial risk for fire, injury or death, or emergency medical services (EMS) calls at the community-level.

This report is organized as follows: Section 2 describes the data used and the general approach to estimating community risk. Section 3 describes the analysis of community fire risk for low-hazard properties. Section 4 describes the analysis of community fire risk for medium-hazard properties. Section 5 describes the analysis of community fire risk for high-hazard properties. Section 6 describes the analysis of community “risk” for EMS calls. Section 7 concludes.

2. General Approach

2.1. Data

Data were from a number of different sources. The main data on fires and EMS calls were from the National Fire Incident Reporting System (NFIRS) [2]. NFIRS is a reporting system used by fire departments nationwide to report on their activities. The system is maintained by the US Department of Homeland Security through the United States Fire Administration and is designed to capture all activities engaged in by a fire department, including fires, EMS and community outreach. The system is voluntary at the national level, so not all departments use the system or contribute data to it. Data is obtainable from the United State Fire Administration. Department information was from the National Fire Department registry maintained by the US Fire Administration [3].

The NFIRS system records the time, date, and street address of all incidents, the type of the incident (e.g., fire, EMS call, hazardous materials incident, service call, etc.), property use, equipment and personnel on the call, number type and severity of casualties, actions take, and a host of other data. For fires specifically, NFIRS collects information on the size of the fire, room of origin, heat source, item first ignited, human and other factors contributing to ignition, presence and effectiveness of detectors and automatic suppression equipment among other data. Note, that this data is generated through firefighter data entry. The quality of this information is directly dependent on firefighters accurately entering data.

Fires and EMS calls were geocoded as part of the FireCARES project. Street addresses entered into NFIRS are not always validated, so geocoding was not 100 % effective. Geocoding percentage varied from department to department.

Department size classifications used in this work are shown in Table 1. Size classification is based on the classifications contained in the National Fire Protection Association (NFPA) Standard 1710 [2].

Demographic data was at the census tract level and was from the US Census' American Community Survey (ACS). "The [ACS] is a nationwide survey designed to provide communities with reliable and timely social, economic, housing, and demographic data every year…. The ACS has an annual sample size of about 3.5 million addresses…. Data are pooled across a calendar year to produce estimates for that year. As a result, ACS estimates reflect data that have been collected over a period of time rather than for a single point in time…. [2]" This work uses the ACS 5-year estimates which are based on data pooled over a 5-year period.

Table 1: Size groups for departments

Size Group	Population Protected Minimum	Maximum
0	0	2499
1	2500	4999
2	5000	9999
3	10 000	24 999
4	25 000	49 999
5	50 000	99 999
6	100 000	249 999
7	250 000	499 999
8	500 000	999 999
9	1 000 000	no max

Health information used in EMS estimation is from the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS "is the nation's premier system of health-related telephone surveys that collect state data about U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services…. The BRFSS completes more than 400 000 adult interviews each year, making it the largest continuously conducted health survey system in the world. [3]" It is conducted by the 50 US States and compiled by US Centers for Disease Control (CDC).

As used in this report, the BFRSS data was drawn from two intermediate sources. County-level summaries of the BRFSS data were obtained from Robert Woods Johnson Foundation at

www.countyhealthdata.org [7]. Census-tract level estimates of the BRFSS data were obtained from the 500-cities data set [5]. The 500-cities uses the BRFSS data and the techniques of small-area estimation [6] to estimate the values of the BRFSS survey questions at the census tract level for 500 U.S. cities.

A Social Vulnerability Index developed by the CDC is included. It is intended to be an aggregate index that represents the decree of vulnerability that a community has to disasters and hazards based on its social and demographic characteristics. [7]

For high risk and medium risk properties, some information at the Assessors' Parcel level were used. Parcel data were from CoreLogic [11], which aggregates assessors' parcel information for the entire country.

Information on smoking percentages at the state level are summarized from Census' National Health Interview Survey (NHIS) which has been conducted since 1957. "The NHIS is a large-scale household interview survey of a statistically representative sample of the U.S. civilian noninstitutionalized population. Interviewers visit 35 000 to 40 000 households across the country and collect data about 75 000 to 100 000 individuals. [8]"

Each census tract was associated with a specific department as part of this estimation. In a number of cases, the NFIRS data reported multiple departments responding to fires in a single census tract. There were a number of reasons for this. In some cases, this was a simple product of a geolocation error. In other cases, it was a mutual aid call. Some census tracts are served by multiple departments. If NFIRS reported multiple departments responding to a particular tract, then the department responding to the most calls for that tract became the "owner" of the tract. In case of a tie, then the department with the department id first in alphabetical order was selected. Ties occurred in only about 2 % of cases.

Specific fields used in the analyses below, descriptions and their individual sources are listed in Appendix A.

Data from 2007 to 2013 was used to estimate the models.

Census tracts were filtered using the following filters:

- *base*

  Tracts with any of the following characteristics were excluded:

  - SVI < 0
  - No reported median income
  - No reported department size
  - No reported County smoking data

- *small.x*

  Departments (and tracts) are excluded if the department responded to fewer incidents than a specified floor, or if the number of incidents it responded to was an outlier compared to other years for the same department. The objective is to exclude years where reporting issues are a significant factor in the data. For low-hazard properties the definition of *small* varied depending on the model. Specifics of the various *small* filters are listed in Table 2. For all other risk models the 'small.0a' definition was used. The use of a variety of definitions for low-hazard properties made it possible to evaluate the effectiveness of the various definitions.

  "Outlier" years were defined as those years which fell at least 2 standard deviations below the mean number of incidents for the department. Note that the "two standard deviations" standard is based on at most 7 years per department of data reported as part of the study.

Table 2: *Small* Filters: Specific Definitions.

Filter	Floor	Outlier
small.0	25	
small.1	50	
small.2	100	
small.3	150	
small.4	200	
small.5	250	
small.6	500	
small.7	1000	
small.0a	25	X
small.1a	50	X
small.2a	100	X
small.3a	150	X
small.4a	200	X
small.5a	250	X
small.6a	500	X
small.7a	1000	X

- *giants*

  Any tracts in the top 0.1 % for population, number of housing units, number of males, or people in the age range of 45 to 54 were excluded from model estimation. This was done because direct examination of the data indicated that many of these tracts were not linearly related to the rest of the data set and tended to have disproportionate influence on the model.

- *random_subset*

  One third of the tracts was selected at random and set aside to serve as a test set. The remaining tracts are used as the training set.

The total number of records for each property hazard group and the percent of records removed by each filter is listed in Table 3.

Department Size × Region

All departments serving fewer than 10 000 people (sizes 0 to 2 in Table 1 above) are excluded from the analysis. All departments nationwide serving one million or more people were analyzed together. For some models (more details below) departments in the Northeast in size group 8 (see Table 1) were combined with those in the size group 7.

Table 3: Percent of records removed for each filter by property hazard level.

	N	Total	base	small	giants
Low Hazard	963 001	60 %	59 %	39 %	1 %
Medium Hazard	963 001	61 %	60 %	39 %	
High Hazard	1 845 431	49 %	48 %	29 %	
EMS: 500-cities	296 393	80 %	80 %	5 %	
EMS: county	296 393	70 %	70 %	5 %	

2.2. Models

All models except those for high-hazard properties are estimated at the census tract level. High-hazard properties are estimated at the Assessors' parcel level.

Models fell into three broad categories: linear models, usually with department random effects; Random Forest models; and LASSO (least absolute shrinkage and selection operator) models.
All the linear random effects models were estimated using the techniques of generalized linear models (GLM), and had the following basic form:

$$g\left(E\left(y_{ijt}\right)\right) = a_{ijt} + t\beta_t + x_{ijt}^{'}\beta + \eta_j \quad (1)$$

Where E is the expectation operator, y_{ijt} is the dependent variable being analyzed for the *i*th tract served by the *j*th department in year *t*, *g* is a linking function used in the glm analysis, a_{ijt} is a *known* offset value for the model, x_{ijt} are the predictors used for that observation, β_t is the change per year, β are the parameter estimates, η_j is the department effect.

It is further assumed that

$$\eta_j \sim N(0, \sigma_D^2), \quad (2)$$

where σ_D^2 is the variance of the department effects, and is estimated as part of the model. What is reported in the model is σ_D^2. Specific values for the individual departments can be provided on request. The one exception to this was the models for high-hazard properties, which did not include department random effects.

It was assumed that the number of fires, EMS calls, injuries or deaths in a tract follow a (over-dispersed) Poisson process. An offset term is used to reflect the proportion of incidents that were geolocated by department. That should convert these estimates, based on geolocated EMS calls, fires, injuries or deaths, into a model of total EMS calls, fires, injuries or deaths.

It was assumed that fire size followed a binomial model. No offset was used for the fire size models because the number of relevant fires was already included as part of the model.

In Random Forest models [9], a small random sample is drawn from the data and a regression tree is fit to it. This is repeated a large number of times, and the results of the random trees is averaged for the result. For this to work, all variables were included in the random forest estimation except for the department random effects. For medium-hazard properties separate models with 500 and 2500 trees were grown. Since the difference between the two was minimal, all other models used only 500 trees for the random forest.

LASSO models [9] estimate a standard linear model, but with the addition of a penalty term on the magnitude of the parameters. The penalty is the sum of the absolute values of the predictors. This results in parameters that are smaller than they would be in a regular linear regression. In fact, due to the form of the LASSO model some parameters will have a value of exactly zero. A LASSO model was run for fires, fire deaths and injuries, and EMS calls. The offset term was included as part of the LASSO analysis, and all the variables listed above were included. A large number of LASSO models were run and compared using cross-validation over the training set. Two LASSO models were selected for evaluation against the test set: the model with the cross-validation minimum error ("min"), and the model with the largest cross-validated error within 1 standard error of the minimum ("1se").

In addition, three naïve models were run for each analysis: a constant model, a pure department effects model, and a "tract" model. The constant model fits a single constant to the data (and does not include

department effects). In effect, it assumes that all tracts have the same (average) expected value per year. The department-effect model fits the department effects only to the data. In effect, it assumes that all tracts served by a particular department have the same expected value per year. The "tract" model predicts that the value for a tract would be the same as the value for that tract experienced in the previous year. Since the dataset did not include 2006, no estimate was made for 2007 for the tract model.

Geocoding is incomplete and varies by department and year. All models (except for the fire-size models) are adjusted for geocoding percentage at the department × year level, by including the geocoding percentage of all reported incidents (by department and year) as an offset to the model.

2.3. Analysis Groups

Several separate analyses are conducted as part of this work to estimate community risk. Fires (and fire-related quantities) are analyzed separately based on fire hazard types as defined in NFPA Standard 1710 [10]. In the standard, low-hazard properties consist of one-, two- or three-family dwellings and scattered small business and industrial occupancies. Medium hazard properties consist of apartments, offices, mercantile and industrial occupancies not normally requiring extensive rescue by firefighting forces. High-hazard properties consist of schools, hospitals, nursing homes, explosive plants, refineries, high-rise buildings and other high life hazard or large fire potential occupancies. There is a low-hazard occupancy fire-risk estimate, a medium hazard occupancy fire-risk estimate, etc. For each hazard type, fire risk is estimated as well as injury and death risk from fire, estimates of the proportion of fires that grow beyond the room of origin, and estimates of the proportion of fires that grow beyond the structure of origin.

A separate analysis is conducted of EMS risk.

The discussion below is structured based on property hazard levels (for fires and fire-related quantities) and EMS calls.

3. Fire Risk in Low-Hazard Properties

In this section a series of models are presented that model community risk levels for number of fires, fire size, and number of fire injuries and deaths in low-hazard properties.

Predictors used in the model were organized into subgroups to simplify model selection for most models. The groups are summarized in Table 4 (see Appendix A for definitions of the variables).

A large number of different linear models were run, each with different combinations of the groups of predictor variables listed above. The models fall into two main classes. In the first group (labeled 'L'), separate models were estimated for each region × department size group of departments (while excluding the 'region' group from the analysis). In the second group (labeled 'S'), all models were estimated over the entire data set while including the 'region' dummies.

Results

All models are estimated against the training set. Then the estimated model is used to predict number of fires (or percent of fires for fire size, or fire injuries or deaths, depending on the model) for each tract in the test set. Then for each model the Root Mean Square error (RMSE) of the predicted value is calculated for the test set. Note that all models (except the "constant" model, the random forest model, and the LASSO model) reported here include a department dummy as part of the model estimate. All "Dummies" models also include dummies for department size and region, in addition to the variables listed. There are a few tracts in the test set associated with departments which do not appear in the training set and, therefore, for which no department dummy could be estimated. In those cases, the department dummy for that department was arbitrarily assigned a value of zero, effectively assuming that it behaves like the "average" department.

In all cases below, the test set was restricted to departments serving 100 000 people or more. Since much of the model testing for low-hazard properties involved different definitions of *small*, a test set was needed that used a criterion different from the various *small* filters. The restriction based on department size was deemed the best way of determining what effect the various *small* filters had on predictions for the departments that will most likely be using the FireCARES system. Note that the test set against

Table 4:Predictor groups used for low-hazard property models.

Group	Terms	Source
Time	Year, with 2014 being zero	NFIRS
Base	population, number of males, and hse_units	ACS
Race	black, amer_es, other, hispanic,	ACS
Age	age_under5, age_5_9, age_10_14, age_15_19, age_20_24, age_35_44, age_45_54, age_55_64, age_65_74, age_75_84, age_85_up	ACS
House	vacant, renter_occ, crowded, sfr,units_10, mh, older	ACS
Personal	inc_hh, svi, married, unemployed, nilf, smoke_st, smoke_cty	ACS
Fuel	fuel_gas, fuel_tank, fuel_oil, fuel_coal, fuel_wood, fuel_solar, fuel_other, fuel_none	ACS
Region	region, fd_size,	FireCARES
Department	fd_id	FireCARES

which RMSE was computed stayed the same regardless of the definition of the *small* filter used. That enabled an "apples to apples" comparison when assessing the effectiveness of the various models.

Results are reported in Appendix B. Comparing the results to the averages per tract in the test set indicates that the models for fires, fire injuries and deaths are still over-dispersed relative to a Poisson model. Overfitting of the models is apparent for many models estimating fire size, fire injuries or deaths. It is a severe problem for deaths.

For the most part, the best models compare well to the naïve models. As a rule, about half the reduction in variance is attributable to the department effect. The "tract" naïve model beats the other model for fires, but does poorly for all the other models. Remember that the tract ID contains a lot of information, including department ID and all the census data. That is why it performs so well against the fire models. However, once the event being predicted becomes rare (e.g., 88 % of the time there are zero injuries in a tract), then the tract label contains only a little information about occurrence. So, pooling information about similar tracts, which is essentially what the models do, improves the prediction.

4. Fire Risk in Medium-Hazard Properties

In this section a series of models are estimated that model community risk levels for number of fires in medium-hazard properties, fire size, and number of fire injuries and deaths for medium-hazard properties.

As with low-hazard properties, predictors used in the model were organized into subgroups to simplify model selection for most models. The groups are summarized in Table 5.

A large number of different linear models were run, each with different combinations of the groups of predictor variables listed above. The models fall into two main classes. In the first group, separate models for each region × department size group of departments were estimated (while excluding the 'region' group from the analysis). In the second group, all models were estimated over the entire data set while including the 'region' dummies.

Results

All models are estimated against the training set. Then the estimated model is used to predict the number of fires (or percent of fires for fire size, or fire injuries or deaths, depending on the model) for each tract in the test set. Then for each model the RMSE of the predicted value is calculated for the test set. Note that all models except the constant, LASSO and random forest models, include a department dummy as part of the model estimate. All "Dummies" models, and the LASSO and random forest models also include dummies for department size and region, in addition to the variables listed. There are a few tracts in the test set associated with departments which do not appear in the training set and, therefore, for which no department dummy could be estimated. In those cases, the department dummy for that department was arbitrarily assigned a value of zero.

In all cases below, the test set is restricted to departments serving 100 000 people or more. This is consistent with the test set used in the low-hazard property models.

Results are reported in Appendix C. Comparing the results to the averages per tract in the test set indicates that the models for fires, fire injuries and deaths are still over-dispersed relative to a Poisson

Table 5:Predictor groups used for medium-hazard property models.

Group	Terms	Source
Time	Year, with 2014 being zero	NFIRS
Base	pop, males, and hse_units	ACS
Race	black, amer_es, other, hispanic,	ACS
Age	age_under5, age_5_9, age_10_14, age_15_19, age_20_24, age_35_44, age_45_54, age_55_64, age_65_74, age_75_84, age_85_up	ACS
House	vacant, renter_occ, crowded, sfr, units_10, mh, older, apt_parcels, mr_parcels	ACS, CoreLogic
Personal	inc_hh, svi, married, unemployed, nilf, smoke_st, smoke_cty	ACS
Fuel	fuel_gas, fuel_tank, fuel_oil, fuel_coal, fuel_wood, fuel_solar, fuel_other, fuel_none	ACS
Region	region, fd_size,	FireCARES
Department	fd_id	FireCARES

model. Overfitting of the models is apparent for many models estimating number of fires, fire size, fire injuries or deaths.

For fires, the random forest model handily beat all other models except for the “tract” model. That is particularly impressive considering that the random forest models do not include department effects. The “tract” naïve model did very well for fires, but poorly for all the other effects. As with low risk fires, the tract ID contains a lot of information, including department ID and all the census data, but for fire injuries and deaths contains little information about occurrence.

For fire deaths, the LASSO model is the best predictor.

5. Fire Risk in High-Hazard Properties

In this section a series of models are estimated that model community risk levels for number of fires in high-hazard properties, fire size, and number of fire injuries and deaths for high-hazard properties.

Unlike in the previous analyses, this analysis operates at the parcel level. Predictions are rolled up to the census tract level for FireCARES.

Predictors used in the model were organized into subgroups to simplify model selection for most models. The groups are summarized in Table 6.

Occupancy class was included in the set of predictors because the risks presented by the different classes of properties were expected to be different. Occupancy class was included in all models. The remaining groups where included in some models but not all.

Data

Risk for high-hazard properties was determined differently from the determination for low and medium hazard properties. Risk was estimated at the parcel level.

Parcels were selected from the CoreLogic data set based on the specific properties identified by the FireCARES team from other data sets. Fires were identified based on their geocoded location. Any fire that overlapped the bounding box for a high-risk parcel and was a structural fire (any NFIRS incident type beginning with ‘11’) was included as a high-risk fire and associated with the overlapping parcel. Note that the bounding box is guaranteed to be at least as large as the parcel, and in most cases will be bigger.

There are several potential problems with the incident selection approach. First it seems likely that some incidents at high-hazard properties were not included due to poor quality geocoding. Second, it seems likely that some non-high-hazard incidents were included, both due to geocoding issues and due to the fact that bounding boxes are often bigger than the actual parcels. Since high hazard parcels are a small percentage of the total number of parcels in the data set, the first effect seems likely to have a bigger effect than the latter.

Table 6:Predictor groups used for high-hazard property models.

Group	Terms	Source
Time	Year, with 2014 being zero	NFIRS
Base	pop, males, and hse_units	ACS
Race	black, amer_es, other, hispanic,	ACS
Age	age_under5, age_5_9, age_10_14, age_15_19, age_20_24, age_35_44, age_45_54, age_55_64, age_65_74, age_75_84, age_85_up	ACS
House	vacant, renter_occ, crowded, sfr, units_10, mh, older	ACS
Personal	inc_hh, svi, married, unemployed, nilf, smoke_st, smoke_cty	ACS
Occupancy Class	occ_class	CoreLogic
High Rise	hr_floors	CoreLogic
Region	region, fd_size,	FireCARES
Department	fd_id	FireCARES

Third, there are likely cases where the same incident is associated with more than one high-hazard parcel due to the fact that bounding boxes are (in some cases) larger than the parcels themselves. This problem was addressed by 'unioning' any overlapping high-hazard parcels into a single parcel group. Thus, if multiple parcels are in the same location, they are combined into a single parcel group, and then the parcel groups are matched to fires.

Table 7: Number of CoreLogic parcels by risk level

CoreLogic Land Use	FireCARES 'High'	FireCARES Low / Med
High	66 871	*721 506*
Medium	*228 804*	13 273 678
Low	*24 452*	94 785 759
(blank)	658	*139 132*

Since the approach used to identify high hazard parcels is different from that used to identify low and medium hazard parcels, the possibility exists of parcels being identified as both as high and medium or low hazard, and of parcels that end up unclassified. Table 7 lists the number of parcels in the CoreLogic data set by both their CoreLogic categorization and by their FireCARES categorization. Italicized groups are either double-counted or excluded.

As with the other classes of fires, geocoding is incomplete, and varies by department and year. This model adjusts for geocoding percentage at the department × year level, by including the geocoding percentage of all reported incidents (by department and year) as an offset to the model.

Different from the other property hazard groups, a department effect was not included.

Results

All models are estimated against the training set. Then the estimated model is used to predict number of fires (or percent of fires for fire size, or fire injuries or deaths, depending on the model) for each parcel in the test set. Then for each model the RMSE) of the predicted value is calculated for the test set. All "Dummies" models, and the LASSO and random forest models also include dummies for department size and region, in addition to the variables listed.

Since department effect was not included in this model, no pure-department effect naïve model was estimated. Instead a pure risk-class naïve model was estimated. It assumes that all tracts in the same risk-class have the same expected value per year.

In all cases below, the test set is restricted to departments serving 100 000 people or more. This is consistent with the test set used in the low-hazard property models.

Results are reported in Appendix D. Overfitting is a noticeable problem for fire deaths and injuries. The random forest model is the best for everything except injuries. For injuries the best model is likely the model labeled "hr.0101011" for the "separate" class of models. However, there are many models that are very similar to that model and are likely indistinguishable from it.

6. EMS "Risk"

In this section a series of models are estimated that model community risk levels EMS calls.

For EMS risk, two separate groups of models were run, depending on whether health information is from the 500-cities project or from countyhealthrankings.org. Since the 500-cities project provides data estimated at the census tract level, it is better suited to this analysis, but it does not cover the entire country. While the countyhealthrankings.org data is only at the county level, it is available for the entire country. The intent is to use the estimates based on the 500-cities data for those portions of the country where it is available, and to use estimates based on the countyhealthrankings.org data for the rest of the country.

County Clusters

The County Health Data and the ACS were summarized by county and clustered into nine clusters using the *pam* algorithm, part of the cluster package [11] in R [12].

All the data from the ACS and countyhealthrankings.org [4] used in the EMS analysis was used here for clustering by county. ACS Data was rolled up to the county level where necessary. For most columns, that amounted to summing up the column values for all tracts in a county. In a few cases (e.g., number of people per household), a weighted average was computed. All columns were standardized by mean and standard deviation before estimation of the clusters.

One cluster was dropped because it had no departments with EMS data. Each cluster represents a set of counties that are more similar to each other than they are to counties in other clusters. Figure 1 shows a map of the clustered counties.

As with the fire risk models, there were several different groups of linear models. The first group (labeled "S" for "Short") estimated a single model against the entire data set. This version always included the "regional" group of terms. The second group (labeled "L" for "Long") estimated separate models against each region × department-size group. Details are discussed in Section 2.1 above. The third group (labeled "C" for "Cluster" was unique to EMS risk) estimated separate models for each cluster.

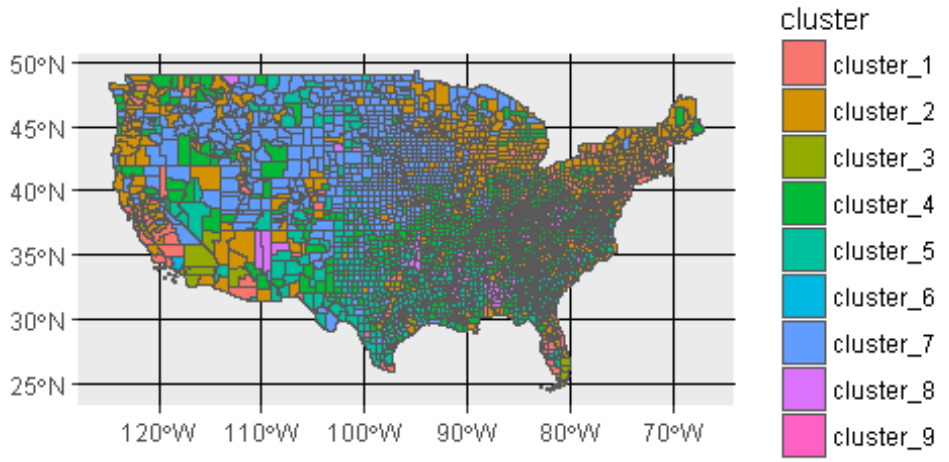

Figure 1: US Counties by cluster.

Table 8: Predictor groups used for the '500-cities' EMS models.

Group	Terms	Source
Year	year	NFIRS
Base	ave_hh_sz, pop,males	ACS
Demographic	black, amer_es, other, hispanic, age_under5, age_5_9, age_10_14, age_15_19, age_20_24, age_35_44, age_45_54, age_55_64, age_65_74, age_75_84, age_85_up	ACS
Housing	hse_units, vacant, renter_occ, crowded, sfr,units_10, mh,older	ACS
Personal	inc_hh, svi, married, unemployed, nilf	ACS
Fuel	fuel_gas, fuel_tank, fuel_oil, fuel_coal, fuel_wood, fuel_solar, fuel_other, fuel_none	ACS
Health1a	arthritis, bphigh, cancer, casthma, chd,copd, diabetes, highchol, kidney, mhlth, phlth, stroke, teethlost	500-Cities
Health2a	access2, binge, csmoking, lpa, obesity, sleep, bpmed, checkup, cholscreen, colon_screen, corem, corew, dental, mammouse, paptest	500-Cities
Region	region, fd_size, cluster	FireCARES
Department	fc_dept_id	FireCARES

Predictors used in the model were organized into subgroups to simplify model selection for most models. The groups are summarized in Table 8 and Table 9.

Analysis

Results are listed in Appendix E.

A number of models fail for some subgroups. The typical reason for a model to fail is that some of the explanatory variables are collinear. This problem occurs in two cases. In one case, the subgroup analyzed is so small that estimation fails for even a moderate number of variables. The second case arises only for the county set of models. For the county models, the health-related information is the same for all tracts in a county. However, for some subgroups there are so few counties that even a moderate number of health-related variables present problems. That applies even though there may be thousands of tracts to work with.

There is very little that can be done for the first case. Since those subgroups inherently have few departments, tracts, EMS calls and people, those cases are ignored. The second case potentially presents serious problems, since some of those subgroups have large populations.

In Appendix E, any model that runs into problems of the second type are identified. Any model with those problems is not considered in identifying the best models for subsequent analysis.

There were no problem models in the 500-cities data set. The best model in that set was ems.5.124S with an RMSE of 362.9.

There were a large number of problem models in the county-based data set. After removing those from consideration, the best model in that set was ems.C.031C with an RMSE of 329.0.

Table 9: Predictor groups used for the 'County' EMS models.

Group	Terms	Source
Year	year	NFIRS
Base	ave_hh_sz, pop,males	ACS
Demographic	Black , amer_es, other, hispanic, age_under5, age_5_9, age_10_14, age_15_19, age_20_24, age_35_44, age_45_54, age_55_64, age_65_74, age_75_84, age_85_up	ACS
Housing	hse_units, vacant, renter_occ, crowded, sfr, units_10, mh, older	ACS
Personal	inc_hh, svi, married, unemployed, nilf	ACS
Fuel	fuel_gas, fuel_tank, fuel_oil, fuel_coal, fuel_wood, fuel_solar, fuel_other, fuel_none	ACS
Health1b	diabetes, years_lost, poor_health, days_pr_hlth, days_pr_mntl, low_birthwt, early_mortality, child_mortality, infant_death, hiv	RWJ
Health2b	binge, csmoking, lpa, obesity, food_ndx, exercise_place, dui, stds, teen_births, drug_overdose, mv_deaths, lack_sleep	RWJ
Health3b	access2, physicians, dentists, shrinks, wrong_hosp, diabetic_scrn, mammography, nurses, pm10, house_probs, drive_alone, long_commute, high_school, college, child_pov, inequality, child_sngl_prnt, social, violent, injury_dths, food_insecurity, no_healthy_food, uninsured_adult, uninsured_child, hlth_cost, free_lunch, segregation1, segregation2, homicide, rural	RWJ
Region	region, fd_size, cluster	FireCARES
Department	fc_dept_id	FireCARES

7. Conclusions

This report documents the methods used to estimate community risk levels for the FireCARES project. Community risk levels were estimated for fires, fire injuries and fire deaths for low- medium- and high-hazard properties. Risks were estimated at the census tract level. In addition, community risk levels were estimated for EMS services.

The best models, and the models selected for production risk estimation, are listed in Table 10.

In most cases the model with the lowest RMS error was used. In a few cases a different model was selected. Where the difference in RMS errors was small, models with fewer predictors were preferred (and in particular "S" type models, i.e., models where the entire sample was estimated as a single model with dummies for department size and region were preferred over "L" type models). Models with time in the set of predictors were preferred to those without. Since random forest shows up as the model with the lowest RMS error for six out of the 17 test cases (and there were a number of other cases where it had an RMS error very close to the best) random forest was preferred to linear models.

With those considerations, the production models for fire size for low-hazard properties were used because they were more parsimonious than the base models. The production models for fires in medium hazard properties were used because they included time and the lowest RMS error models did not. The fire injury model for high-hazard properties was chosen because it was an "S" type model and the lowest RMS Error model was not. Random forest was chosen for the EMS "county" model because it had an RMS error very close to the lowest RMS error.

Table 10: Best models and models selected for FireCARES production use.

		Lowest RMS Error		Production Model	
Model Group	**Measure**	**Model**	**RMS Error**	**Model**	**RMS Error**
Low Hazard	Fire	rForest	2.3859	<same>	
Low Hazard	'Medium' Fires	base.S	0.3895	M100111.S	0.3895
Low Hazard	'Large Fires	base.S	0.2697	M100111.S	0.2697
Low Hazard	Fire Injury	M111110.S	0.6254	<same>	
Low Hazard	Fire Death	LASSO	0.1768	<same>	
Medium Hazard	Fire	rf.0500	2.9066	<same>	
Medium Hazard	'Medium' Fires	mr.011110.S	0.4064	mr.111110.S	0.4066
Medium Hazard	'Large Fires	mr.101110.S	0.3020	<same>	
Medium Hazard	Fire Injury	mr.000101.L	0.3754	mr.100101.L	0.3755
Medium Hazard	Fire Death	LASSO	0.0831	<same>	
High Hazard	Fire	rForest	0.6190	<same>	
High Hazard	'Medium' Fires	rForest	0.1597	<same>	
High Hazard	'Large Fires	rForest	0.1948	<same>	
High Hazard	Fire Injury	hr.0101011.L	0.1341	hr.1110111S	0.1352
High Hazard	Fire Death	rForest	0.0092	<same>	
EMS	500-Cities	ems.5.124.S	362.9	<same>	
EMS	County	ems.C.031.C	329.0	rForest	330.1

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Appendix A: Variables and Data Sources

Predictor	Description	Source
year	year, with 2014 as zero	NFIRS
region	Census Region	NFIRS
fd_id	Department ID	NFIRS
fd_size	Department Size (See Section 2.1)	NFIRS
cluster	Cluster (see Section 6)	
f_located	proportion incidents geolocated	NFIRS
c_located	proportion ems incidents geolocated	NFIRS
ave_hh_sz	Average household size	ACS
pop	Population	ACS
black	Number of black people in census tract	ACS
amer_es	Number of american indian/eskimo people in census tract	ACS
other	Number of people whose race is not white, black or amer_es	ACS
hispanic	Number of hispanics	ACS
males	Number of males	ACS
age_under5	Number of people whose age is < 5	ACS
age_5_9	Number of people whose age is between 5 and 9	ACS
age_10_14	Number of people whose age is between 10 and 14	ACS
age_15_19	Number of people whose age is between 15 and 19	ACS
age_20_24	Number of people whose age is between 20 and 24	ACS
age_25_34	Number of people whose age is between 25 and 34	ACS
age_35_44	Number of people whose age is between 35 and 44	ACS
age_45_54	Number of people whose age is between 45 and 54	ACS
age_55_64	Number of people whose age is between 55 and 64	ACS
age_65_74	Number of people whose age is between 65 and 74	ACS
age_75_84	Number of people whose age is between 75 and 84	ACS
age_85_up	Number of people whose age is 85 or higher	ACS
hse_units	Number of housing units	ACS
vacant	Number of housing units vacant	ACS
renter_occ	Number of renter-occupied housing units	ACS
crowded	Number of housing unit with more people than rooms	ACS
sfr	Number of single-family residences	ACS
units_10	Number of housing units part of a 10-unit or larger complex	ACS
mh	Number of mobile homes	ACS
older	Number of homes built before 1980	ACS
apt_parcels	Number of Assessors parcels zoned for apartments	CoreLogic
mr_parcels	Number of assessors parcels zoned commercial	CoreLogic
inc_hh	Average household income	ACS
svi	Social Vulnerability Index	ACS
married	Number of married people	ACS
unemployed	Number of unemployed	ACS
nilf	Number of people older than 15 and not in labor force	ACS
smoke_st	% of smokers in state	NHIS
smoke_cty	% of smokers in the county	county health

Predictor	Description	Source
fuel_gas	Number of households using gas for heating	ACS
fuel_tank	Number of households using tanked gas for heating	ACS
fuel_oil	Number of households using oil for heating	ACS
fuel_coal	Number of households using coal for heating	ACS
fuel_wood	Number of households using wood for heating	ACS
fuel_solar	Number of households using solar for heating	ACS
fuel_other	Number of households using another fuel for heating	ACS
fuel_none	Number of households without heating	ACS
bld_units	Number of building units on a parcel	CoreLogic
hr_floors	Number of floors	CoreLogic
eff_year	Year built	CoreLogic
risk_class	One of “Assembly,” “High Rise,” “Industrial,” “Institutional,” “Medical,” and “School.”	CoreLogic
arthritis	% of adults with arthritis	500-Cities
bphigh	% of adults with high blood pressure	500-Cities
cancer	% of adults who have ever had cancer	500-Cities
casthma	% of adults who currently have asthma	500-Cities
chd	% of adults with coronary heart disease	500-Cities
copd	% of adults with Chronic obstructive pulmonary disease	500-Cities
diabetes	% of adults with diabetes	500-Cities
highchol	% of adults with high cholesterol	500-Cities
kidney	% of adults with chronic kidney disease	500-Cities
mhlth	% of adults with poor mental health for >= 14 of the last 30 days	500-Cities
phlth	% of adults with poor health for >= 14 of the last 30 days	500-Cities
stroke	% of adults who have had a stroke	500-Cities
teethlost	% of adults who have lost all their teeth	500-Cities
access2	% adult uninsured	500-Cities
bpmed	% of those prescribed who are taking blood pressure meds	500-Cities
checkup	% of adults who have had a checkup in the last year	500-Cities
cholscreen	% of adults who have had cholesterol screening in the last 5 years	500-Cities
colon_screen	% of adults 50-75 who have had colon exam	500-Cities
corem	% of men >=65 who have had a set of core medical services	500-Cities
corew	% of women >=65 who have had a set of core medical services	500-Cities
dental	% of adults who have been to the dentist in the last year	500-Cities
mammouse	% of women 40-75 who have had a mammogram in the last 2 years	500-Cities
paptest	% of women 21-65 who have had a pap smear in the last 3 years	500-Cities
binge	% of adults "binge" drinking in the last 30 days	500-Cities
csmoking	% of adults who are current smokers	500-Cities
lpa	% of adults with no leisure physical activity in the last month	500-Cities
obesity	% of adults who are obese	500-Cities
sleep	% of adults averaging <7 hours of sleep per night	500-Cities
years_lost	Estimated years of potential life lost before age 75	county health

Predictor	Description	Source
poor_health	% of adults with poor health for >= 14 of the last 30 days	county health
days_pr_hlth	days of poor health for >= 14 of the last 30 days	county health
days_pr_mntl	days of poor mental health for >= 14 of the last 30 days	county health
low_birthwt	% of live births with low birthweight	county health
csmoking	% of adults who are current smokers	county health
obesity	% of adults who are obese	county health
food_ndx	Food environment index	county health
lpa	% of adults with no leisure physical activity in the last month	county health
exercise_place	Access to exercise opportunities	county health
binge	% of adults "binge" drinking in the last 30 days	county health
dui	# alcohol-impaired driving deaths	county health
stds	Chlamydia cases per 100 000	county health
teen_births	Teen birth rate	county health
access2	% adult uninsured	county health
physicians	Primary care physicians per 100 000	county health
dentists	Dentists per 100 000	county health
shrinks	Mental health providers per 100 000	county health
wrong_hosp	Preventable hospital stay rate	county health
diabetic_scrn	% of diabetics with testing	county health
mammography	% of women 40-75 who have had a mammogram in the last 2 years	county health
high_school	% of adults with high-school diploma	county health
college	% of adults with some college	county health
child_pov	# of children in poverty	county health
inequality	Income inequality	county health
child_sngl_prnt	# of children in single-parent households	county health
social	social associations	county health
violent	# of violent crimes	county health
injury_dths	# of injury deaths	county health
pm10	air pollution	county health
house_probs	severe housing problems	county health
drive_alone	% of commuters who drive alone to work	county health
long_commute	% of commuters with a long commute driving alone	county health
early_mortality	Premature age-adjsted mortality	county health
child_mortality	Child mortality rate	county health
infant_death	Infant mortality rate	county health
phys_distress	% frequent physical distress	county health
mntl_distress	% frequent mental distress	county health
diabetes	diabetes prevalence	county health
hiv	HIV prevalence	county health
food_insecurity	% Food insecurity	county health
no_healthy_food	% with limited access to healthy foods	county health
drug_overdose	Drug overdose death rate	county health
mv_deaths	Moter vehicle accident death rate	county health

Predictor	Description	Source
lack_sleep	% insufficent sleep	county health
uninsured_adult	% adults uninsured	county health
uninsured_child	% children uninsured	county health
hlth_cost	Health care costs	county health
nurses	Other primary care provider rate	county health
free_lunch	Children eligible for free lunch	county health
segregation1	black/while segregation	county health
segregation2	white/non-white segregation	county health
homicide	Homicides	county health
rural	% rural	county health

Appendix B: Low- Hazard Properties: Model Results

Table 11: Root Mean Square (RMS) Errors of models of fire risk for low hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

		Small Filter			MSE	
Model Run	**Predictors**	**Floor**	**Outlier**	**Mean**	**Separate**	**Dummies**
Constant		25	X	2.1228		2.9559
dept.effect		25	X	2.1228		2.8447
tract				2.1228		2.5570
lasso.min	time, base, race, age, house, personal, fuel	25	X	2.1228		2.6180
lasso.1se	time, base, race, age, house, personal, fuel	25	X	2.1228		2.6526
rForest	time, base, race, age, house, personal, fuel	25	X	2.1228		**2.3859**
base	time, base, race, age, house, personal, fuel	25	X	2.1228	2.6641	2.6191
M101111	time, base, age, house, personal, fuel	25	X	2.1228	2.6383	2.6244
M100111	time, base, house, personal, fuel	25	X	2.1228	2.6046	2.6176
M101011	time, base, age, personal, fuel	25	X	2.1228	2.7534	2.7888
M101101	time, base, age, house, fuel	25	X	2.1228	2.6115	2.6290
M101110	time, base, age, house, personal	25	X	2.1228	2.6392	2.6186
M110111	time, base, race, house, personal, fuel	25	X	2.1228	2.6322	2.6271
M110011	time, base, race, personal, fuel	25	X	2.1228	2.7421	2.7856
M110101	time, base, race, house, fuel	25	X	2.1228	2.6474	2.6435
M110110	time, base, race, house, personal	25	X	2.1228	2.6353	2.6189
M111011	time, base, race, age, personal, fuel	25	X	2.1228	2.7735	2.7504
M111001	time, base, race, age, fuel	25	X	2.1228	2.8366	2.8048
M111010	time, base, race, age, personal	25	X	2.1228	2.7798	2.7541
M111101	time, base, race, age, house, fuel	25	X	2.1228	2.6579	2.6322
M111100	time, base, race, age, house	25	X	2.1228	2.6626	2.6242
M111110	time, base, race, age, house, personal	25	X	2.1228	2.6635	2.6130
f.050	time, base, house, personal, fuel	50	X	2.1228	2.6055	
f.100	time, base, house, personal, fuel	100	X	2.1228	2.6060	
f.150	time, base, house, personal, fuel	150	X	2.1228	2.6083	
f.200	time, base, house, personal, fuel	200	X	2.1228	2.6119	
f.250	time, base, house, personal, fuel	250	X	2.1228	2.6260	
f.500	time, base, house, personal, fuel	500	X	2.1228	2.6378	
f.000	time, base, house, personal, fuel	1000	X	2.1228	2.9886	

Table 12: RMS Errors of models of percent of fires that grow beyond the room of origin for low hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

		Small Filter		Mean	MSE	
Model Run	**Predictors**	**Floor**	**Outlier**	**(%)**	**Separate**	**Dummies**
Constant		25	X	0.4247	0.4132	
dept.effect		25	X	0.4247	0.3909	
tract				0.4247	0.5095	
base	time, base, race, age, house, personal, fuel	25	X	0.4247	0.3901	**0.3895**
M101111	time, base, age, house, personal, fuel	25	X	0.4247	0.3908	0.3896
M100111	time, base, house, personal, fuel	25	X	0.4247	0.3901	0.3895
M101011	time, base, age, personal, fuel	25	X	0.4247	0.3910	0.3899
M101101	time, base, age, house, fuel	25	X	0.4247	0.3909	0.3898
M101110	time, base, age, house, personal	25	X	0.4247	0.3908	0.3897
M110111	time, base, race, house, personal, fuel	25	X	0.4247	0.3901	0.3895
M110011	time, base, race, personal, fuel	25	X	0.4247	0.3903	0.3900
M110101	time, base, race, house, fuel	25	X	0.4247	0.3901	0.3897
M110110	time, base, race, house, personal	25	X	0.4247	0.3901	0.3896
M111011	time, base, race, age, personal, fuel	25	X	0.4247	0.3910	0.3899
M111001	time, base, race, age, fuel	25	X	0.4247	0.3911	0.3903
M111010	time, base, race, age, personal	25	X	0.4247	0.3911	0.3902
M111101	time, base, race, age, house, fuel	25	X	0.4247	0.3909	0.3898
M111100	time, base, race, age, house	25	X	0.4247	0.3909	0.3899
M111110	time, base, race, age, house, personal	25	X	0.4247	0.3909	0.3896

Table 13: RMS Errors of models of percent of fires that grow beyond the structure of origin for low hazard properties. Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

		Small Filter		Mean	MSE	
Model Run	**Predictors**	**Floor**	**Outlier**	**(%)**	**Separate**	**Dummies**
Constant		25	X	0.1082	0.2710	
dept.effect		25	X	0.1082	0.2704	
tract				0.1082	0.3487	
base	time, base, race, age, house, personal, fuel	25	X	0.1082	0.2708	**0.2697**
M101111	time, base, age, house, personal, fuel	25	X	0.1082	0.2722	0.2698
M100111	time, base, house, personal, fuel	25	X	0.1082	0.2708	0.2697
M101011	time, base, age, personal, fuel	25	X	0.1082	0.2717	0.2699
M101101	time, base, age, house, fuel	25	X	0.1082	0.2716	0.2697
M101110	time, base, age, house, personal	25	X	0.1082	0.2722	0.2702
M110111	time, base, race, house, personal, fuel	25	X	0.1082	0.2706	0.2698
M110011	time, base, race, personal, fuel	25	X	0.1082	0.2702	0.2699
M110101	time, base, race, house, fuel	25	X	0.1082	0.2705	0.2698
M110110	time, base, race, house, personal	25	X	0.1082	0.2708	0.2703
M111011	time, base, race, age, personal, fuel	25	X	0.1082	0.2715	0.2699
M111001	time, base, race, age, fuel	25	X	0.1082	0.2710	0.2700
M111010	time, base, race, age, personal	25	X	0.1082	0.2715	0.2705
M111101	time, base, race, age, house, fuel	25	X	0.1082	0.2715	0.2699
M111100	time, base, race, age, house	25	X	0.1082	0.2715	0.2703
M111110	time, base, race, age, house, personal	25	X	0.1082	0.2719	0.2703

Table 14: RMS Errors of models of fire injury for low hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

		Small Filter			MSE	
Model Run	**Predictors**	**Floor**	**Outlier**	**Mean**	**Separate**	**Dummies**
Constant		25	X	0.1805	0.6442	
dept.effect		25	X	0.1805	0.6331	
tract				0.1805	0.8746	
lasso.min	time, base, race, age, house, personal, fuel	25	X	0.1805	0.6327	
lasso.1se	time, base, race, age, house, personal, fuel	25	X	0.1805	0.6340	
rForest	time, base, race, age, house, personal, fuel	25	X	0.1805	0.6402	
base	time, base, race, age, house, personal, fuel	25	X	0.1805	0.6448	0.6263
M101111	time, base, age, house, personal, fuel	25	X	0.1805	0.6479	0.6257
M100111	time, base, house, personal, fuel	25	X	0.1805	0.6448	0.6263
M101011	time, base, age, personal, fuel	25	X	0.1805	0.6333	0.6260
M101101	time, base, age, house, fuel	25	X	0.1805	0.6469	0.6273
M101110	time, base, age, house, personal	25	X	0.1805	0.6449	0.6258
M110111	time, base, race, house, personal, fuel	25	X	0.1805	0.6478	0.6264
M110011	time, base, race, personal, fuel	25	X	0.1805	0.6313	0.6275
M110101	time, base, race, house, fuel	25	X	0.1805	0.6478	0.6281
M110110	time, base, race, house, personal	25	X	0.1805	0.6415	0.6264
M111011	time, base, race, age, personal, fuel	25	X	0.1805	0.6395	0.6260
M111001	time, base, race, age, fuel	25	X	0.1805	0.6411	0.6313
M111010	time, base, race, age, personal	25	X	0.1805	0.6361	0.6261
M111101	time, base, race, age, house, fuel	25	X	0.1805	0.6505	0.6276
M111100	time, base, race, age, house	25	X	0.1805	0.6469	0.6275
M111110	time, base, race, age, house, personal	25	X	0.1805	0.6475	**0.6254**

Table 15: RMS Errors of models of fire deaths for low hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

		Small Filter			MSE	
Model Run	**Predictors**	**Floor**	**Outlier**	**Mean**	**Separate**	**Dummies**
Constant		25	X	0.0184	0.1772	
dept.effect		25	X	0.0184	0.1772	
tract				0.0184	0.2538	
lasso.min	time, base, race, age, house, personal, fuel	25	X	0.0184	**0.1768**	
lasso.1se	time, base, race, age, house, personal, fuel	25	X	0.0184	0.1770	
rForest	time, base, race, age, house, personal, fuel	25	X	0.0184	0.1789	
base	time, base, race, age, house, personal, fuel	25	X	0.0184	5.3604	0.1769
M101111	time, base, age, house, personal, fuel	25	X	0.0184	6.3266	**0.1769**
M100111	time, base, house, personal, fuel	25	X	0.0184	5.3604	0.1769
M101011	time, base, age, personal, fuel	25	X	0.0184	0.1793	0.1769
M101101	time, base, age, house, fuel	25	X	0.0184	2.5591	0.1769
M101110	time, base, age, house, personal	25	X	0.0184	4.0317	0.1769
M110111	time, base, race, house, personal, fuel	25	X	0.0184	7.0284	0.1769
M110011	time, base, race, personal, fuel	25	X	0.0184	0.1778	0.1770
M110101	time, base, race, house, fuel	25	X	0.0184	2.9679	0.1769
M110110	time, base, race, house, personal	25	X	0.0184	2.9177	0.1769
M111011	time, base, race, age, personal, fuel	25	X	0.0184	0.1794	0.1769
M111001	time, base, race, age, fuel	25	X	0.0184	0.1784	0.1770
M111010	time, base, race, age, personal	25	X	0.0184	0.1780	0.1770
M111101	time, base, race, age, house, fuel	25	X	0.0184	3.5768	0.1769
M111100	time, base, race, age, house	25	X	0.0184	2.2835	0.1769
M111110	time, base, race, age, house, personal	25	X	0.0184	5.5102	0.1769

Appendix C: Medium- Hazard Properties: Model Results

Table 16: RMS Errors of models of fire risk for medium hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model Run	Predictors	Mean	RMSE Separate	RMSE Dummies
constant		1.96	4.2898	
fx		1.96	3.8521	
tract		1.96	2.9349	
lasso.min	time, base, race, age, house, personal	1.96	5.4329	
lasso.1se	time, base, race, age, house, personal	1.96	5.1042	
rf.0500	time, base, race, age, house, personal	1.96	**2.9066**	
rf.2500	time, base, race, age, house, personal	1.96	**2.9066**	
mr.100000	time	1.96	3.8528	3.8550
mr.010000	base	1.96	6.0926	4.0019
mr.110000	time, base	1.96	6.0855	4.0033
mr.001000	race	1.96	9.1421	7.4384
mr.101000	time, race	1.96	9.1411	7.4365
mr.011000	base, race	1.96	14.0619	18.1033
mr.111000	time, base, race	1.96	14.0684	18.0627
mr.000100	age	1.96	3.5807	3.6102
mr.100100	time, age	1.96	3.5794	3.6134
mr.010100	base, age	1.96	4.0325	8.3532
mr.110100	time, base, age	1.96	4.0801	8.7797
mr.001100	race, age	1.96	4.9517	6.2661
mr.101100	time, race, age	1.96	4.9333	6.2540
mr.011100	base, race, age	1.96	4.8144	13.8594
mr.111100	time, base, race, age	1.96	4.7710	14.3395
mr.000010	house	1.96	3.6017	4.1742
mr.100010	time, house	1.96	3.6040	4.1763
mr.010010	base, house	1.96	3.5931	4.3357
mr.110010	time, base, house	1.96	3.5861	4.3348
mr.001010	race, house	1.96	4.5524	5.4363
mr.101010	time, race, house	1.96	4.5539	5.4312
mr.011010	base, race, house	1.96	4.5188	5.9286
mr.111010	time, base, race, house	1.96	4.5158	5.9245
mr.000110	age, house	1.96	3.6150	4.1887
mr.100110	time, age, house	1.96	3.6181	4.1992
mr.010110	base, age, house	1.96	3.6307	3.8707
mr.110110	time, base, age, house	1.96	3.6364	3.8759
mr.001110	race, age, house	1.96	3.7425	4.4266
mr.101110	time, race, age, house	1.96	3.7372	4.4276
mr.011110	base, race, age, house	1.96	4.4387	5.2162
mr.111110	time, base, race, age, house	1.96	4.4181	5.1980
mr.000001	personal	1.96	5.3904	4.3304

Model Run	Predictors	Mean	RMSE Separate	RMSE Dummies
mr.100001	time, personal	1.96	5.3992	4.3367
mr.010001	base, personal	1.96	3.9126	4.7478
mr.110001	time, base, personal	1.96	3.9665	4.7706
mr.001001	race, personal	1.96	7.5266	5.6002
mr.101001	time, race, personal	1.96	7.5237	5.6153
mr.011001	base, race, personal	1.96	4.3830	6.1931
mr.111001	time, base, race, personal	1.96	4.4337	6.2262
mr.000101	age, personal	1.96	3.9020	5.0191
mr.100101	time, age, personal	1.96	3.8976	5.0339
mr.010101	base, age, personal	1.96	3.7502	4.1935
mr.110101	time, base, age, personal	1.96	3.7622	4.1918
mr.001101	race, age, personal	1.96	4.2938	5.9742
mr.101101	time, race, age, personal	1.96	4.2904	5.9802
mr.011101	base, race, age, personal	1.96	4.1424	5.4903
mr.111101	time, base, race, age, personal	1.96	4.1526	5.4922
mr.000011	house, personal	1.96	3.4203	5.0597
mr.100011	time, house, personal	1.96	3.4223	5.0871
mr.010011	base, house, personal	1.96	3.7852	5.4390
mr.110011	time, base, house, personal	1.96	3.7756	5.4675
mr.001011	race, house, personal	1.96	4.0709	6.5501
mr.101011	time, race, house, personal	1.96	4.0924	6.5815
mr.011011	base, race, house, personal	1.96	4.8339	7.7235
mr.111011	time, base, race, house, personal	1.96	4.8298	7.7502
mr.000111	age, house, personal	1.96	3.6996	5.0109
mr.100111	time, age, house, personal	1.96	3.6901	5.0014
mr.010111	base, age, house, personal	1.96	4.1191	5.4157
mr.110111	time, base, age, house, personal	1.96	4.1015	5.3867
mr.001111	race, age, house, personal	1.96	4.1740	5.5691
mr.101111	time, race, age, house, personal	1.96	4.1772	5.5584
mr.011111	base, race, age, house, personal	1.96	4.9311	6.8501
mr.base	time, base, race, age, house, personal	1.96	4.9303	6.8467

Table 17: RMS Errors of models of percent of fires that grow beyond the room of origin for medium hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model Run	Predictors	Mean (%)	RMSE Separate	RMSE Dummies
constant		0.3653	0.4275	
fx		0.3653	0.4051	
tract		0.3653	0.5279	
mr.100000	time	0.3653	0.4103	0.4100
mr.010000	base	0.3653	0.4089	0.4088
mr.110000	time, base	0.3653	0.4094	0.4090
mr.001000	race	0.3653	0.4095	0.4096
mr.101000	time, race	0.3653	0.4099	0.4098
mr.011000	base, race	0.3653	0.4084	0.4086
mr.111000	time, base, race	0.3653	0.4089	0.4088
mr.000100	age	0.3653	0.4090	0.4086
mr.100100	time, age	0.3653	0.4093	0.4087
mr.010100	base, age	0.3653	0.4085	0.4081
mr.110100	time, base, age	0.3653	0.4089	0.4083
mr.001100	race, age	0.3653	0.4086	0.4084
mr.101100	time, race, age	0.3653	0.4090	0.4086
mr.011100	base, race, age	0.3653	0.4082	0.4080
mr.111100	time, base, race, age	0.3653	0.4085	0.4082
mr.000010	house	0.3653	0.4066	0.4066
mr.100010	time, house	0.3653	0.4069	0.4067
mr.010010	base, house	0.3653	0.4065	0.4065
mr.110010	time, base, house	0.3653	0.4068	0.4067
mr.001010	race, house	0.3653	0.4064	0.4065
mr.101010	time, race, house	0.3653	0.4067	0.4067
mr.011010	base, race, house	0.3653	**0.4064**	0.4064
mr.111010	time, base, race, house	0.3653	0.4067	0.4066
mr.000110	age, house	0.3653	0.4072	0.4066
mr.100110	time, age, house	0.3653	0.4075	0.4068
mr.010110	base, age, house	0.3653	0.4070	0.4065
mr.110110	time, base, age, house	0.3653	0.4073	0.4066
mr.001110	race, age, house	0.3653	0.4070	0.4066
mr.101110	time, race, age, house	0.3653	0.4073	0.4067
mr.011110	base, race, age, house	0.3653	0.4068	**0.4064**
mr.111110	time, base, race, age, house	0.3653	0.4072	0.4066
mr.000001	personal	0.3653	0.4097	0.4098
mr.100001	time, personal	0.3653	0.4102	0.4100
mr.010001	base, personal	0.3653	0.4086	0.4084
mr.110001	time, base, personal	0.3653	0.4090	0.4086
mr.001001	race, personal	0.3653	0.4093	0.4096
mr.101001	time, race, personal	0.3653	0.4097	0.4098

Model Run	Predictors	Mean (%)	RMSE	
			Separate	Dummies
mr.011001	base, race, personal	0.3653	0.4083	0.4082
mr.111001	time, base, race, personal	0.3653	0.4087	0.4084
mr.000101	age, personal	0.3653	0.4090	0.4085
mr.100101	time, age, personal	0.3653	0.4093	0.4087
mr.010101	base, age, personal	0.3653	0.4085	0.4081
mr.110101	time, base, age, personal	0.3653	0.4089	0.4083
mr.001101	race, age, personal	0.3653	0.4087	0.4084
mr.101101	time, race, age, personal	0.3653	0.4091	0.4085
mr.011101	base, race, age, personal	0.3653	0.4084	0.4079
mr.111101	time, base, race, age, personal	0.3653	0.4088	0.4081
mr.000011	house, personal	0.3653	0.4069	0.4067
mr.100011	time, house, personal	0.3653	0.4073	0.4069
mr.010011	base, house, personal	0.3653	0.4068	0.4065
mr.110011	time, base, house, personal	0.3653	0.4071	0.4067
mr.001011	race, house, personal	0.3653	0.4069	0.4067
mr.101011	time, race, house, personal	0.3653	0.4072	0.4069
mr.011011	base, race, house, personal	0.3653	0.4068	0.4065
mr.111011	time, base, race, house, personal	0.3653	0.4072	0.4067
mr.000111	age, house, personal	0.3653	0.4075	0.4066
mr.100111	time, age, house, personal	0.3653	0.4078	0.4068
mr.010111	base, age, house, personal	0.3653	0.4072	0.4065
mr.110111	time, base, age, house, personal	0.3653	0.4076	0.4067
mr.001111	race, age, house, personal	0.3653	0.4074	0.4066
mr.101111	time, race, age, house, personal	0.3653	0.4077	0.4068
mr.011111	base, race, age, house, personal	0.3653	0.4073	0.4065
mr.base	time, base, race, age, house, personal	0.3653	0.4076	0.4066

Table 18: RMS Errors of models of percent of fires that grow beyond the structure of origin for medium hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model Run	Predictors	Mean (%)	RMSE Separate	RMSE Dummies
constant		0.1229	0.3054	
fx		0.1229	0.3020	
tract		0.1229	0.3821	
mr.100000	time	0.1229	**0.3043**	0.3040
mr.010000	base	0.1229	0.3046	0.3037
mr.110000	time, base	0.1229	0.3046	0.3036
mr.001000	race	0.1229	0.3047	0.3041
mr.101000	time, race	0.1229	0.3048	0.3041
mr.011000	base, race	0.1229	0.3049	0.3037
mr.111000	time, base, race	0.1229	0.3049	0.3036
mr.000100	age	0.1229	0.3060	0.3033
mr.100100	time, age	0.1229	0.3061	0.3033
mr.010100	base, age	0.1229	0.3065	0.3032
mr.110100	time, base, age	0.1229	0.3066	0.3031
mr.001100	race, age	0.1229	0.3059	0.3033
mr.101100	time, race, age	0.1229	0.3061	0.3033
mr.011100	base, race, age	0.1229	0.3068	0.3032
mr.111100	time, base, race, age	0.1229	0.3070	0.3031
mr.000010	house	0.1229	0.3044	0.3022
mr.100010	time, house	0.1229	0.3045	0.3021
mr.010010	base, house	0.1229	0.3052	0.3021
mr.110010	time, base, house	0.1229	0.3053	0.3021
mr.001010	race, house	0.1229	0.3050	0.3021
mr.101010	time, race, house	0.1229	0.3050	0.3021
mr.011010	base, race, house	0.1229	0.3054	0.3022
mr.111010	time, base, race, house	0.1229	0.3055	0.3021
mr.000110	age, house	0.1229	0.3071	0.3021
mr.100110	time, age, house	0.1229	0.3073	0.3020
mr.010110	base, age, house	0.1229	0.3074	0.3021
mr.110110	time, base, age, house	0.1229	0.3077	0.3020
mr.001110	race, age, house	0.1229	0.3071	0.3020
mr.101110	time, race, age, house	0.1229	0.3073	**0.3020**
mr.011110	base, race, age, house	0.1229	0.3075	0.3021
mr.111110	time, base, race, age, house	0.1229	0.3079	0.3020
mr.000001	personal	0.1229	0.3048	0.3037
mr.100001	time, personal	0.1229	0.3048	0.3036
mr.010001	base, personal	0.1229	0.3054	0.3031
mr.110001	time, base, personal	0.1229	0.3054	0.3031
mr.001001	race, personal	0.1229	0.3051	0.3036
mr.101001	time, race, personal	0.1229	0.3051	0.3036

Model Run	Predictors	Mean (%)	RMSE	
			Separate	Dummies
mr.011001	base, race, personal	0.1229	0.3054	0.3031
mr.111001	time, base, race, personal	0.1229	0.3054	0.3030
mr.000101	age, personal	0.1229	0.3074	0.3031
mr.100101	time, age, personal	0.1229	0.3075	0.3031
mr.010101	base, age, personal	0.1229	0.3079	0.3029
mr.110101	time, base, age, personal	0.1229	0.3081	0.3029
mr.001101	race, age, personal	0.1229	0.3074	0.3031
mr.101101	time, race, age, personal	0.1229	0.3076	0.3031
mr.011101	base, race, age, personal	0.1229	0.3081	0.3029
mr.111101	time, base, race, age, personal	0.1229	0.3084	0.3029
mr.000011	house, personal	0.1229	0.3060	0.3023
mr.100011	time, house, personal	0.1229	0.3061	0.3022
mr.010011	base, house, personal	0.1229	0.3065	0.3023
mr.110011	time, base, house, personal	0.1229	0.3066	0.3022
mr.001011	race, house, personal	0.1229	0.3063	0.3023
mr.101011	time, race, house, personal	0.1229	0.3063	0.3022
mr.011011	base, race, house, personal	0.1229	0.3068	0.3022
mr.111011	time, base, race, house, personal	0.1229	0.3069	0.3022
mr.000111	age, house, personal	0.1229	0.3088	0.3021
mr.100111	time, age, house, personal	0.1229	0.3090	0.3021
mr.010111	base, age, house, personal	0.1229	0.3091	0.3021
mr.110111	time, base, age, house, personal	0.1229	0.3094	0.3021
mr.001111	race, age, house, personal	0.1229	0.3092	0.3021
mr.101111	time, race, age, house, personal	0.1229	0.3094	0.3021
mr.011111	base, race, age, house, personal	0.1229	0.3095	0.3021
mr.base	time, base, race, age, house, personal	0.1229	0.3098	0.3021

Table 19: RMS Errors of models of fire injury for medium hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model Run	Predictors	Mean	RMSE	
			Separate	Dummies
constant		0.0628	0.3786	
fx		0.0628	0.3777	
tract		0.0628	0.5490	
lasso.min	time, base, race, age, house, personal	0.0628	0.3830	
lasso.1se	time, base, race, age, house, personal	0.0628	0.3791	
rf.0500	time, base, race, age, house, personal	0.0628	0.3816	
rf.2500	time, base, race, age, house, personal	0.0628	0.3812	
mr.100000	time	0.0628	0.3780	0.3776
mr.010000	base	0.0628	0.3814	0.3784
mr.110000	time, base	0.0628	0.3816	0.3784
mr.001000	race	0.0628	0.3874	0.3925
mr.101000	time, race	0.0628	0.3875	0.3925
mr.011000	base, race	0.0628	0.3962	0.4781
mr.111000	time, base, race	0.0628	0.3953	0.4781
mr.000100	age	0.0628	0.3773	0.3779
mr.100100	time, age	0.0628	0.3775	0.3779
mr.010100	base, age	0.0628	0.3813	0.3918
mr.110100	time, base, age	0.0628	0.3814	0.3928
mr.001100	race, age	0.0628	0.3769	0.3891
mr.101100	time, race, age	0.0628	0.3768	0.3894
mr.011100	base, race, age	0.0628	0.3814	0.4078
mr.111100	time, base, race, age	0.0628	0.3811	0.4085
mr.000010	house	0.0628	0.5522	0.3788
mr.100010	time, house	0.0628	0.5541	0.3787
mr.010010	base, house	0.0628	0.5733	0.3788
mr.110010	time, base, house	0.0628	0.5775	0.3787
mr.001010	race, house	0.0628	1.1627	0.3799
mr.101010	time, race, house	0.0628	1.1654	0.3797
mr.011010	base, race, house	0.0628	0.9225	0.3815
mr.111010	time, base, race, house	0.0628	0.9254	0.3814
mr.000110	age, house	0.0628	0.7159	0.3795
mr.100110	time, age, house	0.0628	0.7155	0.3793
mr.010110	base, age, house	0.0628	0.7082	0.3785
mr.110110	time, base, age, house	0.0628	0.7082	0.3785
mr.001110	race, age, house	0.0628	0.7995	0.3820
mr.101110	time, race, age, house	0.0628	0.8011	0.3818
mr.011110	base, race, age, house	0.0628	0.8089	0.3830
mr.111110	time, base, race, age, house	0.0628	0.8087	0.3830
mr.000001	personal	0.0628	0.3784	**0.3761**
mr.100001	time, personal	0.0628	0.3790	0.3761
mr.010001	base, personal	0.0628	0.3846	0.3778

Model Run	Predictors	Mean	RMSE	
			Separate	Dummies
mr.110001	time, base, personal	0.0628	0.3847	0.3778
mr.001001	race, personal	0.0628	0.3815	0.3788
mr.101001	time, race, personal	0.0628	0.3823	0.3788
mr.011001	base, race, personal	0.0628	0.3970	0.3825
mr.111001	time, base, race, personal	0.0628	0.3982	0.3825
mr.000101	age, personal	0.0628	**0.3754**	0.3820
mr.100101	time, age, personal	0.0628	0.3755	0.3823
mr.010101	base, age, personal	0.0628	0.3805	0.3775
mr.110101	time, base, age, personal	0.0628	0.3806	0.3775
mr.001101	race, age, personal	0.0628	0.3757	0.3824
mr.101101	time, race, age, personal	0.0628	0.3758	0.3826
mr.011101	base, race, age, personal	0.0628	0.3857	0.3800
mr.111101	time, base, race, age, personal	0.0628	0.3861	0.3800
mr.000011	house, personal	0.0628	0.9446	0.3786
mr.100011	time, house, personal	0.0628	0.9890	0.3786
mr.010011	base, house, personal	0.0628	0.8528	0.3793
mr.110011	time, base, house, personal	0.0628	0.9016	0.3793
mr.001011	race, house, personal	0.0628	2.6674	0.3825
mr.101011	time, race, house, personal	0.0628	2.8300	0.3825
mr.011011	base, race, house, personal	0.0628	2.1459	0.3850
mr.111011	time, base, race, house, personal	0.0628	2.3017	0.3851
mr.000111	age, house, personal	0.0628	0.9614	0.3847
mr.100111	time, age, house, personal	0.0628	0.9599	0.3847
mr.010111	base, age, house, personal	0.0628	1.1853	0.3848
mr.110111	time, base, age, house, personal	0.0628	1.1909	0.3848
mr.001111	race, age, house, personal	0.0628	1.3700	0.3851
mr.101111	time, race, age, house, personal	0.0628	1.3842	0.3851
mr.011111	base, race, age, house, personal	0.0628	1.5971	0.3868
mr.base	time, base, race, age, house, personal	0.0628	1.6196	0.3868

Table 20: RMS Errors of models of fire deaths for medium hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model Run	Predictors	Mean	RMSE Separate Dummies	
constant		0.0044	0.0831	
fx		0.0044	0.0832	
tract		0.0044	0.1176	
lasso.min	time, base, race, age, house, personal	0.0044	0.0831	
lasso.1se	time, base, race, age, house, personal	0.0044	0.0831	
rf.0500	time, base, race, age, house, personal	0.0044	0.0855	
rf.2500	time, base, race, age, house, personal	0.0044	0.0852	
mr.100000	time	0.0044	**0.0832**	0.0832
mr.010000	base	0.0044	0.0832	0.0832
mr.110000	time, base	0.0044	0.0833	0.0832
mr.001000	race	0.0044	0.0837	0.0832
mr.101000	time, race	0.0044	0.0838	0.0832
mr.011000	base, race	0.0044	0.0842	0.0838
mr.111000	time, base, race	0.0044	0.0844	0.0838
mr.000100	age	0.0044	0.0873	0.0832
mr.100100	time, age	0.0044	0.0971	0.0832
mr.010100	base, age	0.0044	0.0846	0.0835
mr.110100	time, base, age	0.0044	0.0845	0.0835
mr.001100	race, age	0.0044	0.1149	0.0833
mr.101100	time, race, age	0.0044	0.1092	0.0833
mr.011100	base, race, age	0.0044	0.0862	0.0838
mr.111100	time, base, race, age	0.0044	0.0860	0.0838
mr.000010	house	0.0044	0.0834	0.0832
mr.100010	time, house	0.0044	0.0835	0.0832
mr.010010	base, house	0.0044	0.0834	0.0832
mr.110010	time, base, house	0.0044	0.0836	0.0832
mr.001010	race, house	0.0044	0.0836	0.0832
mr.101010	time, race, house	0.0044	0.0843	0.0832
mr.011010	base, race, house	0.0044	0.0838	0.0832
mr.111010	time, base, race, house	0.0044	0.0842	0.0832
mr.000110	age, house	0.0044	0.0898	0.0832
mr.100110	time, age, house	0.0044	0.1267	0.0832
mr.010110	base, age, house	0.0044	0.0876	0.0832
mr.110110	time, base, age, house	0.0044	0.0938	0.0832
mr.001110	race, age, house	0.0044	0.0857	0.0832
mr.101110	time, race, age, house	0.0044	0.0857	0.0832
mr.011110	base, race, age, house	0.0044	0.4781	0.0832
mr.111110	time, base, race, age, house	0.0044	0.1750	0.0832
mr.000001	personal	0.0044	0.0833	0.0832
mr.100001	time, personal	0.0044	0.0833	0.0832
mr.010001	base, personal	0.0044	0.0833	0.0833

Model Run	Predictors	Mean	RMSE Separate	Dummies
mr.110001	time, base, personal	0.0044	0.0833	0.0833
mr.001001	race, personal	0.0044	0.0835	0.0832
mr.101001	time, race, personal	0.0044	0.0837	0.0832
mr.011001	base, race, personal	0.0044	0.0835	0.0834
mr.111001	time, base, race, personal	0.0044	0.0838	0.0834
mr.000101	age, personal	0.0044	0.0930	0.0833
mr.100101	time, age, personal	0.0044	0.1030	0.0833
mr.010101	base, age, personal	0.0044	0.0855	0.0833
mr.110101	time, base, age, personal	0.0044	0.0867	0.0833
mr.001101	race, age, personal	0.0044	0.1126	0.0833
mr.101101	time, race, age, personal	0.0044	0.1883	0.0833
mr.011101	base, race, age, personal	0.0044	0.0911	0.0833
mr.111101	time, base, race, age, personal	0.0044	0.1078	0.0833
mr.000011	house, personal	0.0044	0.0837	**0.0832**
mr.100011	time, house, personal	0.0044	0.0840	0.0832
mr.010011	base, house, personal	0.0044	0.0837	0.0832
mr.110011	time, base, house, personal	0.0044	0.0845	0.0832
mr.001011	race, house, personal	0.0044	0.0838	0.0832
mr.101011	time, race, house, personal	0.0044	0.0844	0.0832
mr.011011	base, race, house, personal	0.0044	0.0944	0.0832
mr.111011	time, base, race, house, personal	0.0044	307.3813	0.0832
mr.000111	age, house, personal	0.0044	0.4783	0.0832
mr.100111	time, age, house, personal	0.0044	1.85E+25	0.0832
mr.010111	base, age, house, personal	0.0044	0.0940	0.0833
mr.110111	time, base, age, house, personal	0.0044	0.1398	0.0833
mr.001111	race, age, house, personal	0.0044	0.0959	0.0832
mr.101111	time, race, age, house, personal	0.0044	0.7341	0.0832
mr.011111	base, race, age, house, personal	0.0044	0.0932	0.0832
mr.base	time, base, race, age, house, personal	0.0044	0.1434	0.0833

Appendix D: High-Hazard Properties: Model Results

Table 21: RMS Errors of models of fire risk for high hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model Run	Predictors	Mean	RMSE	
			Separate	Dummies
constant		0.0996	0.6967	
rsk.clss	risk class	0.0996	0.6964	
lasso.min	risk class, time, high.rise, base, race, age, house, personal	0.0996	0.8986	
lasso.1se	risk class, time, high.rise, base, race, age, house, personal	0.0996	0.9370	
rForest	risk class, time, high.rise, base, race, age, house, personal	0.0996	**0.6190**	
hr.0000000	risk class	0.0996	0.6904	0.6920
hr.0000001	risk class, personal	0.0996	0.6841	0.6913
hr.0000010	risk class, house	0.0996	0.6893	0.6840
hr.0000011	risk class, house, personal	0.0996	0.6821	0.6708
hr.0000100	risk class, age	0.0996	0.6883	0.7519
hr.0000101	risk class, age, personal	0.0996	0.6822	0.7236
hr.0000110	risk class, age, house	0.0996	0.6858	0.6961
hr.0000111	risk class, age, house, personal	0.0996	0.6794	0.6785
hr.0001000	risk class, race	0.0996	0.6892	0.7801
hr.0001001	risk class, race, personal	0.0996	0.6868	0.6862
hr.0001010	risk class, race, house	0.0996	0.6879	0.7317
hr.0001011	risk class, race, house, personal	0.0996	0.6855	0.7193
hr.0001100	risk class, race, age	0.0996	0.6862	0.6909
hr.0001101	risk class, race, age, personal	0.0996	0.6830	0.6753
hr.0001110	risk class, race, age, house	0.0996	0.6843	0.7129
hr.0001111	risk class, race, age, house, personal	0.0996	0.6821	0.6850
hr.0010000	risk class, base	0.0996	0.6883	0.7014
hr.0010001	risk class, base, personal	0.0996	0.6834	0.6774
hr.0010010	risk class, base, house	0.0996	0.6885	0.6908
hr.0010011	risk class, base, house, personal	0.0996	0.6824	0.6684
hr.0010100	risk class, base, age	0.0996	0.6880	0.7098
hr.0010101	risk class, base, age, personal	0.0996	0.6816	0.6802
hr.0010110	risk class, base, age, house	0.0996	0.6887	0.6825
hr.0010111	risk class, base, age, house, personal	0.0996	0.6788	0.6684
hr.0011000	risk class, base, race	0.0996	0.6883	0.6999
hr.0011001	risk class, base, race, personal	0.0996	0.6869	0.6779
hr.0011010	risk class, base, race, house	0.0996	0.6918	0.9260
hr.0011011	risk class, base, race, house, personal	0.0996	0.6861	0.7410
hr.0011100	risk class, base, race, age	0.0996	0.6869	0.7126
hr.0011101	risk class, base, race, age, personal	0.0996	0.6849	0.6799
hr.0011110	risk class, base, race, age, house	0.0996	0.6863	0.8090
hr.0011111	risk class, base, race, age, house, personal	0.0996	0.6825	0.7380
hr.0100000	risk class, high.rise	0.0996	0.6901	0.6906
hr.0100001	risk class, high.rise, personal	0.0996	0.6825	0.6870
hr.0100010	risk class, high.rise, house	0.0996	0.6891	0.6826
hr.0100011	risk class, high.rise, house, personal	0.0996	0.6798	0.6655
hr.0100100	risk class, high.rise, age	0.0996	0.6880	0.7655
hr.0100101	risk class, high.rise, age, personal	0.0996	0.6805	0.7165
hr.0100110	risk class, high.rise, age, house	0.0996	0.6858	0.6963
hr.0100111	risk class, high.rise, age, house, personal	0.0996	0.6771	0.6804
hr.0101000	risk class, high.rise, race	0.0996	0.6883	0.7633
hr.0101001	risk class, high.rise, race, personal	0.0996	0.6846	0.6769
hr.0101010	risk class, high.rise, race, house	0.0996	0.6858	0.7057
hr.0101011	risk class, high.rise, race, house, personal	0.0996	0.6824	0.6881
hr.0101100	risk class, high.rise, race, age	0.0996	0.6854	0.6880
hr.0101101	risk class, high.rise, race, age, personal	0.0996	0.6811	0.6686

Model Run	Predictors	Mean	RMSE Separate	RMSE Dummies
hr.0101110	risk class, high.rise, race, age, house	0.0996	0.6830	0.6887
hr.0101111	risk class, high.rise, race, age, house, personal	0.0996	0.6796	0.6707
hr.0110000	risk class, high.rise, base	0.0996	0.6880	0.7057
hr.0110001	risk class, high.rise, base, personal	0.0996	0.6819	0.6730
hr.0110010	risk class, high.rise, base, house	0.0996	0.6885	0.6907
hr.0110011	risk class, high.rise, base, house, personal	0.0996	0.6798	0.6627
hr.0110100	risk class, high.rise, base, age	0.0996	0.6875	0.7249
hr.0110101	risk class, high.rise, base, age, personal	0.0996	0.6799	0.6762
hr.0110110	risk class, high.rise, base, age, house	0.0996	0.6894	0.6847
hr.0110111	risk class, high.rise, base, age, house, personal	0.0996	0.6768	0.6698
hr.0111000	risk class, high.rise, base, race	0.0996	0.6870	0.6904
hr.0111001	risk class, high.rise, base, race, personal	0.0996	0.6848	0.6676
hr.0111010	risk class, high.rise, base, race, house	0.0996	0.6897	0.8122
hr.0111011	risk class, high.rise, base, race, house, personal	0.0996	0.6829	0.6943
hr.0111100	risk class, high.rise, base, race, age	0.0996	0.6861	0.7029
hr.0111101	risk class, high.rise, base, race, age, personal	0.0996	0.6832	0.6697
hr.0111110	risk class, high.rise, base, race, age, house	0.0996	0.6854	0.7556
hr.0111111	risk class, high.rise, base, race, age, house, personal	0.0996	0.6802	0.6960
hr.1000000	risk class, time	0.0996	0.6905	0.6911
hr.1000001	risk class, time, personal	0.0996	0.6842	0.6842
hr.1000010	risk class, time, house	0.0996	0.6895	0.6821
hr.1000011	risk class, time, house, personal	0.0996	0.6820	0.6659
hr.1000100	risk class, time, age	0.0996	0.6886	0.7120
hr.1000101	risk class, time, age, personal	0.0996	0.6823	0.6948
hr.1000110	risk class, time, age, house	0.0996	0.6860	0.6823
hr.1000111	risk class, time, age, house, personal	0.0996	0.6796	0.6686
hr.1001000	risk class, time, race	0.0996	0.6890	0.7722
hr.1001001	risk class, time, race, personal	0.0996	0.6873	0.6828
hr.1001010	risk class, time, race, house	0.0996	0.6874	0.7322
hr.1001011	risk class, time, race, house, personal	0.0996	0.6851	0.7170
hr.1001100	risk class, time, race, age	0.0996	0.6873	0.6870
hr.1001101	risk class, time, race, age, personal	0.0996	0.6838	0.6707
hr.1001110	risk class, time, race, age, house	0.0996	0.6850	0.7130
hr.1001111	risk class, time, race, age, house, personal	0.0996	0.6823	0.6828
hr.1010000	risk class, time, base	0.0996	0.6884	0.7049
hr.1010001	risk class, time, base, personal	0.0996	0.6836	0.6748
hr.1010010	risk class, time, base, house	0.0996	0.6893	0.6895
hr.1010011	risk class, time, base, house, personal	0.0996	0.6823	0.6666
hr.1010100	risk class, time, base, age	0.0996	0.6882	0.6998
hr.1010101	risk class, time, base, age, personal	0.0996	0.6819	0.6736
hr.1010110	risk class, time, base, age, house	0.0996	0.6903	0.6821
hr.1010111	risk class, time, base, age, house, personal	0.0996	0.6794	0.6670
hr.1011000	risk class, time, base, race	0.0996	0.6889	0.6962
hr.1011001	risk class, time, base, race, personal	0.0996	0.6873	0.6758
hr.1011010	risk class, time, base, race, house	0.0996	0.6915	0.9203
hr.1011011	risk class, time, base, race, house, personal	0.0996	0.6857	0.7379
hr.1011100	risk class, time, base, race, age	0.0996	0.6884	0.7089
hr.1011101	risk class, time, base, race, age, personal	0.0996	0.6863	0.6773
hr.1011110	risk class, time, base, race, age, house	0.0996	0.6880	0.8086
hr.1011111	risk class, time, base, race, age, house, personal	0.0996	0.6829	0.7343
hr.1100000	risk class, time, high.rise	0.0996	0.6902	0.6897
hr.1100001	risk class, time, high.rise, personal	0.0996	0.6827	0.6796
hr.1100010	risk class, time, high.rise, house	0.0996	0.6893	0.6805
hr.1100011	risk class, time, high.rise, house, personal	0.0996	0.6798	0.6602
hr.1100100	risk class, time, high.rise, age	0.0996	0.6883	0.7267
hr.1100101	risk class, time, high.rise, age, personal	0.0996	0.6806	0.6893
hr.1100110	risk class, time, high.rise, age, house	0.0996	0.6860	0.6825

Model Run	Predictors		RMSE	
		Mean	Separate	Dummies
hr.1100111	risk class, time, high.rise, age, house, personal	0.0996	0.6773	0.6695
hr.1101000	risk class, time, high.rise, race	0.0996	0.6881	0.7551
hr.1101001	risk class, time, high.rise, race, personal	0.0996	0.6850	0.6735
hr.1101010	risk class, time, high.rise, race, house	0.0996	0.6854	0.7042
hr.1101011	risk class, time, high.rise, race, house, personal	0.0996	0.6821	0.6860
hr.1101100	risk class, time, high.rise, race, age	0.0996	0.6864	0.6866
hr.1101101	risk class, time, high.rise, race, age, personal	0.0996	0.6819	0.6642
hr.1101110	risk class, time, high.rise, race, age, house	0.0996	0.6837	0.6881
hr.1101111	risk class, time, high.rise, race, age, house, personal	0.0996	0.6799	0.6685
hr.1110000	risk class, time, high.rise, base	0.0996	0.6881	0.7091
hr.1110001	risk class, time, high.rise, base, personal	0.0996	0.6821	0.6699
hr.1110010	risk class, time, high.rise, base, house	0.0996	0.6895	0.6909
hr.1110011	risk class, time, high.rise, base, house, personal	0.0996	0.6799	0.6606
hr.1110100	risk class, time, high.rise, base, age	0.0996	0.6877	0.7191
hr.1110101	risk class, time, high.rise, base, age, personal	0.0996	0.6802	0.6707
hr.1110110	risk class, time, high.rise, base, age, house	0.0996	0.6911	0.6862
hr.1110111	risk class, time, high.rise, base, age, house, personal	0.0996	0.6774	0.6684
hr.1111000	risk class, time, high.rise, base, race	0.0996	0.6876	0.6863
hr.1111001	risk class, time, high.rise, base, race, personal	0.0996	0.6852	0.6654
hr.1111010	risk class, time, high.rise, base, race, house	0.0996	0.6898	0.8079
hr.1111011	risk class, time, high.rise, base, race, house, personal	0.0996	0.6826	0.6911
hr.1111100	risk class, time, high.rise, base, race, age	0.0996	0.6875	0.7002
hr.1111101	risk class, time, high.rise, base, race, age, personal	0.0996	0.6845	0.6672
hr.1111110	risk class, time, high.rise, base, race, age, house	0.0996	0.6871	0.7549
hr.1111111	risk class, time, high.rise, base, race, age, house, personal	0.0996	0.6808	0.6937

Table 22: RMS Errors of models of percent of fires that grow beyond the room of origin for high hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model Run	Predictors	Mean (%)	RMSE	
			Dummies	Separate
constant		0.0568	0.2148	
rsk.clss	risk class	0.0568	0.2105	
lasso.min	risk class, time, high.rise, base, race, age, house, personal	0.0568	0.9259	
lasso.1se	risk class, time, high.rise, base, race, age, house, personal	0.0568	0.9267	
rForest	risk class, time, high.rise, base, race, age, house, personal	0.0568	**0.1597**	
hr.0000000	risk class	0.0568	0.2091	0.2043
hr.0000001	risk class, personal	0.0568	0.2081	0.1956
hr.0000010	risk class, house	0.0568	0.2068	0.1965
hr.0000011	risk class, house, personal	0.0568	0.2054	0.1894
hr.0000100	risk class, age	0.0568	0.2078	0.1945
hr.0000101	risk class, age, personal	0.0568	0.2070	0.1874
hr.0000110	risk class, age, house	0.0568	0.2057	0.1908
hr.0000111	risk class, age, house, personal	0.0568	0.2041	0.1845
hr.0001000	risk class, race	0.0568	0.2091	0.2033
hr.0001001	risk class, race, personal	0.0568	0.2079	0.1938
hr.0001010	risk class, race, house	0.0568	0.2067	0.1951
hr.0001011	risk class, race, house, personal	0.0568	0.2050	0.1876
hr.0001100	risk class, race, age	0.0568	0.2080	0.1937
hr.0001101	risk class, race, age, personal	0.0568	0.2068	0.1868
hr.0001110	risk class, race, age, house	0.0568	0.2058	0.1899
hr.0001111	risk class, race, age, house, personal	0.0568	0.2040	0.1844
hr.0010000	risk class, base	0.0568	0.2088	0.2004
hr.0010001	risk class, base, personal	0.0568	0.2075	0.1942
hr.0010010	risk class, base, house	0.0568	0.2055	0.1917
hr.0010011	risk class, base, house, personal	0.0568	0.2047	0.1871
hr.0010100	risk class, base, age	0.0568	0.2064	0.1923
hr.0010101	risk class, base, age, personal	0.0568	0.2055	0.1871
hr.0010110	risk class, base, age, house	0.0568	0.2048	0.1892
hr.0010111	risk class, base, age, house, personal	0.0568	0.2034	0.1845
hr.0011000	risk class, base, race	0.0568	0.2087	0.1998
hr.0011001	risk class, base, race, personal	0.0568	0.2074	0.1926
hr.0011010	risk class, base, race, house	0.0568	0.2056	0.1911
hr.0011011	risk class, base, race, house, personal	0.0568	0.2047	0.1862
hr.0011100	risk class, base, race, age	0.0568	0.2066	0.1912
hr.0011101	risk class, base, race, age, personal	0.0568	0.2056	0.1865
hr.0011110	risk class, base, race, age, house	0.0568	0.2048	0.1883
hr.0011111	risk class, base, race, age, house, personal	0.0568	0.2035	0.1844
hr.0100000	risk class, high.rise	0.0568	0.2081	0.2039
hr.0100001	risk class, high.rise, personal	0.0568	0.2075	0.1949
hr.0100010	risk class, high.rise, house	0.0568	0.2069	0.1964
hr.0100011	risk class, high.rise, house, personal	0.0568	0.2056	0.1896
hr.0100100	risk class, high.rise, age	0.0568	0.2072	0.1931
hr.0100101	risk class, high.rise, age, personal	0.0568	0.2065	0.1869
hr.0100110	risk class, high.rise, age, house	0.0568	0.2060	0.1901
hr.0100111	risk class, high.rise, age, house, personal	0.0568	0.2044	0.1842
hr.0101000	risk class, high.rise, race	0.0568	0.2081	0.2030
hr.0101001	risk class, high.rise, race, personal	0.0568	0.2073	0.1936
hr.0101010	risk class, high.rise, race, house	0.0568	0.2068	0.1945
hr.0101011	risk class, high.rise, race, house, personal	0.0568	0.2053	0.1880
hr.0101100	risk class, high.rise, race, age	0.0568	0.2074	0.1922
hr.0101101	risk class, high.rise, race, age, personal	0.0568	0.2065	0.1862

Model Run	Predictors	Mean (%)	RMSE Dummies	RMSE Separate
hr.0101110	risk class, high.rise, race, age, house	0.0568	0.2061	0.1891
hr.0101111	risk class, high.rise, race, age, house, personal	0.0568	0.2045	0.1841
hr.0110000	risk class, high.rise, base	0.0568	0.2081	0.1997
hr.0110001	risk class, high.rise, base, personal	0.0568	0.2070	0.1930
hr.0110010	risk class, high.rise, base, house	0.0568	0.2057	0.1916
hr.0110011	risk class, high.rise, base, house, personal	0.0568	0.2050	0.1866
hr.0110100	risk class, high.rise, base, age	0.0568	0.2061	0.1910
hr.0110101	risk class, high.rise, base, age, personal	0.0568	0.2053	0.1866
hr.0110110	risk class, high.rise, base, age, house	0.0568	0.2051	0.1883
hr.0110111	risk class, high.rise, base, age, house, personal	0.0568	0.2038	0.1841
hr.0111000	risk class, high.rise, base, race	0.0568	0.2080	0.1988
hr.0111001	risk class, high.rise, base, race, personal	0.0568	0.2070	0.1912
hr.0111010	risk class, high.rise, base, race, house	0.0568	0.2058	0.1904
hr.0111011	risk class, high.rise, base, race, house, personal	0.0568	0.2050	0.1855
hr.0111100	risk class, high.rise, base, race, age	0.0568	0.2063	0.1899
hr.0111101	risk class, high.rise, base, race, age, personal	0.0568	0.2054	0.1859
hr.0111110	risk class, high.rise, base, race, age, house	0.0568	0.2051	0.1871
hr.0111111	risk class, high.rise, base, race, age, house, personal	0.0568	0.2039	0.1840
hr.1000000	risk class, time	0.0568	0.2087	0.2021
hr.1000001	risk class, time, personal	0.0568	0.2079	0.1922
hr.1000010	risk class, time, house	0.0568	0.2063	0.1950
hr.1000011	risk class, time, house, personal	0.0568	0.2049	0.1880
hr.1000100	risk class, time, age	0.0568	0.2075	0.1938
hr.1000101	risk class, time, age, personal	0.0568	0.2067	0.1869
hr.1000110	risk class, time, age, house	0.0568	0.2053	0.1894
hr.1000111	risk class, time, age, house, personal	0.0568	0.2035	0.1837
hr.1001000	risk class, time, race	0.0568	0.2087	0.2013
hr.1001001	risk class, time, race, personal	0.0568	0.2076	0.1903
hr.1001010	risk class, time, race, house	0.0568	0.2062	0.1940
hr.1001011	risk class, time, race, house, personal	0.0568	0.2046	0.1864
hr.1001100	risk class, time, race, age	0.0568	0.2078	0.1932
hr.1001101	risk class, time, race, age, personal	0.0568	0.2066	0.1863
hr.1001110	risk class, time, race, age, house	0.0568	0.2054	0.1884
hr.1001111	risk class, time, race, age, house, personal	0.0568	0.2035	0.1837
hr.1010000	risk class, time, base	0.0568	0.2083	0.1981
hr.1010001	risk class, time, base, personal	0.0568	0.2071	0.1908
hr.1010010	risk class, time, base, house	0.0568	0.2051	0.1904
hr.1010011	risk class, time, base, house, personal	0.0568	0.2043	0.1860
hr.1010100	risk class, time, base, age	0.0568	0.2061	0.1914
hr.1010101	risk class, time, base, age, personal	0.0568	0.2051	0.1867
hr.1010110	risk class, time, base, age, house	0.0568	0.2044	0.1879
hr.1010111	risk class, time, base, age, house, personal	0.0568	0.2029	0.1836
hr.1011000	risk class, time, base, race	0.0568	0.2082	0.1976
hr.1011001	risk class, time, base, race, personal	0.0568	0.2070	0.1891
hr.1011010	risk class, time, base, race, house	0.0568	0.2053	0.1898
hr.1011011	risk class, time, base, race, house, personal	0.0568	0.2043	0.1847
hr.1011100	risk class, time, base, race, age	0.0568	0.2063	0.1905
hr.1011101	risk class, time, base, race, age, personal	0.0568	0.2052	0.1861
hr.1011110	risk class, time, base, race, age, house	0.0568	0.2045	0.1871
hr.1011111	risk class, time, base, race, age, house, personal	0.0568	0.2029	0.1837
hr.1100000	risk class, time, high.rise	0.0568	0.2076	0.2019
hr.1100001	risk class, time, high.rise, personal	0.0568	0.2071	0.1918
hr.1100010	risk class, time, high.rise, house	0.0568	0.2064	0.1944
hr.1100011	risk class, time, high.rise, house, personal	0.0568	0.2052	0.1883
hr.1100100	risk class, time, high.rise, age	0.0568	0.2069	0.1922
hr.1100101	risk class, time, high.rise, age, personal	0.0568	0.2063	0.1866
hr.1100110	risk class, time, high.rise, age, house	0.0568	0.2055	0.1888

Model Run	Predictors	Mean (%)	RMSE Dummies	RMSE Separate
hr.1100111	risk class, time, high.rise, age, house, personal	0.0568	0.2039	0.1835
hr.1101000	risk class, time, high.rise, race	0.0568	0.2076	0.2010
hr.1101001	risk class, time, high.rise, race, personal	0.0568	0.2069	0.1907
hr.1101010	risk class, time, high.rise, race, house	0.0568	0.2063	0.1931
hr.1101011	risk class, time, high.rise, race, house, personal	0.0568	0.2048	0.1867
hr.1101100	risk class, time, high.rise, race, age	0.0568	0.2072	0.1914
hr.1101101	risk class, time, high.rise, race, age, personal	0.0568	0.2062	0.1860
hr.1101110	risk class, time, high.rise, race, age, house	0.0568	0.2056	0.1880
hr.1101111	risk class, time, high.rise, race, age, house, personal	0.0568	0.2040	0.1836
hr.1110000	risk class, time, high.rise, base	0.0568	0.2075	0.1968
hr.1110001	risk class, time, high.rise, base, personal	0.0568	0.2066	0.1904
hr.1110010	risk class, time, high.rise, base, house	0.0568	0.2053	0.1899
hr.1110011	risk class, time, high.rise, base, house, personal	0.0568	0.2046	0.1857
hr.1110100	risk class, time, high.rise, base, age	0.0568	0.2058	0.1903
hr.1110101	risk class, time, high.rise, base, age, personal	0.0568	0.2049	0.1862
hr.1110110	risk class, time, high.rise, base, age, house	0.0568	0.2047	0.1872
hr.1110111	risk class, time, high.rise, base, age, house, personal	0.0568	0.2033	0.1833
hr.1111000	risk class, time, high.rise, base, race	0.0568	0.2075	0.1962
hr.1111001	risk class, time, high.rise, base, race, personal	0.0568	0.2066	0.1885
hr.1111010	risk class, time, high.rise, base, race, house	0.0568	0.2055	0.1889
hr.1111011	risk class, time, high.rise, base, race, house, personal	0.0568	0.2046	0.1843
hr.1111100	risk class, time, high.rise, base, race, age	0.0568	0.2060	0.1894
hr.1111101	risk class, time, high.rise, base, race, age, personal	0.0568	0.2051	0.1857
hr.1111110	risk class, time, high.rise, base, race, age, house	0.0568	0.2047	0.1864
hr.1111111	risk class, time, high.rise, base, race, age, house, personal	0.0568	0.2033	0.1833

Table 23: RMS Errors of models of percent of fires that grow beyond the structure of origin for high hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model Run	Predictors	Mean (%)	RMSE	
			Dummies	Separate
constant		0.0892	0.2774	
rsk.clss	risk class	0.0892	0.2689	
lasso.min	risk class, time, high.rise, base, race, age, house, personal	0.0892	0.8957	
lasso.1se	risk class, time, high.rise, base, race, age, house, personal	0.0892	0.8782	
rForest	risk class, time, high.rise, base, race, age, house, personal	0.0892	**0.1948**	
hr.0000000	risk class	0.0892	0.2684	0.2702
hr.0000001	risk class, personal	0.0892	0.2654	0.2391
hr.0000010	risk class, house	0.0892	0.2617	0.2425
hr.0000011	risk class, house, personal	0.0892	0.2583	0.2543
hr.0000100	risk class, age	0.0892	0.2580	0.2334
hr.0000101	risk class, age, personal	0.0892	0.2536	0.2484
hr.0000110	risk class, age, house	0.0892	0.2509	0.2558
hr.0000111	risk class, age, house, personal	0.0892	0.2475	0.2552
hr.0001000	risk class, race	0.0892	0.2639	0.2336
hr.0001001	risk class, race, personal	0.0892	0.2607	0.2302
hr.0001010	risk class, race, house	0.0892	0.2583	0.2466
hr.0001011	risk class, race, house, personal	0.0892	0.2553	0.2484
hr.0001100	risk class, race, age	0.0892	0.2548	0.2463
hr.0001101	risk class, race, age, personal	0.0892	0.2512	0.2560
hr.0001110	risk class, race, age, house	0.0892	0.2478	0.2685
hr.0001111	risk class, race, age, house, personal	0.0892	0.2454	0.2845
hr.0010000	risk class, base	0.0892	0.2685	0.2633
hr.0010001	risk class, base, personal	0.0892	0.2654	0.2348
hr.0010010	risk class, base, house	0.0892	0.2574	0.2477
hr.0010011	risk class, base, house, personal	0.0892	0.2506	0.2471
hr.0010100	risk class, base, age	0.0892	0.2571	0.2414
hr.0010101	risk class, base, age, personal	0.0892	0.2523	0.2496
hr.0010110	risk class, base, age, house	0.0892	0.2451	0.2635
hr.0010111	risk class, base, age, house, personal	0.0892	0.2403	0.2652
hr.0011000	risk class, base, race	0.0892	0.2620	0.2209
hr.0011001	risk class, base, race, personal	0.0892	0.2590	0.2344
hr.0011010	risk class, base, race, house	0.0892	0.2519	0.2463
hr.0011011	risk class, base, race, house, personal	0.0892	0.2478	0.2463
hr.0011100	risk class, base, race, age	0.0892	0.2537	0.2541
hr.0011101	risk class, base, race, age, personal	0.0892	0.2498	0.2581
hr.0011110	risk class, base, race, age, house	0.0892	0.2403	0.2680
hr.0011111	risk class, base, race, age, house, personal	0.0892	0.2382	0.2849
hr.0100000	risk class, high.rise	0.0892	0.2679	0.2759
hr.0100001	risk class, high.rise, personal	0.0892	0.2651	0.2383
hr.0100010	risk class, high.rise, house	0.0892	0.2615	0.2449
hr.0100011	risk class, high.rise, house, personal	0.0892	0.2580	0.2607
hr.0100100	risk class, high.rise, age	0.0892	0.2577	0.2404
hr.0100101	risk class, high.rise, age, personal	0.0892	0.2535	0.2550
hr.0100110	risk class, high.rise, age, house	0.0892	0.2506	0.2701
hr.0100111	risk class, high.rise, age, house, personal	0.0892	0.2474	0.2642
hr.0101000	risk class, high.rise, race	0.0892	0.2640	0.2403
hr.0101001	risk class, high.rise, race, personal	0.0892	0.2610	0.2323
hr.0101010	risk class, high.rise, race, house	0.0892	0.2584	0.2502
hr.0101011	risk class, high.rise, race, house, personal	0.0892	0.2553	0.2511
hr.0101100	risk class, high.rise, race, age	0.0892	0.2549	0.2504
hr.0101101	risk class, high.rise, race, age, personal	0.0892	0.2514	0.2629

Model Run	Predictors	Mean (%)	RMSE Dummies	RMSE Separate
hr.0101110	risk class, high.rise, race, age, house	0.0892	0.2476	0.2732
hr.0101111	risk class, high.rise, race, age, house, personal	0.0892	0.2455	0.2822
hr.0110000	risk class, high.rise, base	0.0892	0.2682	0.2683
hr.0110001	risk class, high.rise, base, personal	0.0892	0.2649	0.2389
hr.0110010	risk class, high.rise, base, house	0.0892	0.2573	0.2532
hr.0110011	risk class, high.rise, base, house, personal	0.0892	0.2506	0.2582
hr.0110100	risk class, high.rise, base, age	0.0892	0.2567	0.2471
hr.0110101	risk class, high.rise, base, age, personal	0.0892	0.2518	0.2643
hr.0110110	risk class, high.rise, base, age, house	0.0892	0.2450	0.2689
hr.0110111	risk class, high.rise, base, age, house, personal	0.0892	0.2404	0.2631
hr.0111000	risk class, high.rise, base, race	0.0892	0.2619	0.2279
hr.0111001	risk class, high.rise, base, race, personal	0.0892	0.2589	0.2415
hr.0111010	risk class, high.rise, base, race, house	0.0892	0.2517	0.2571
hr.0111011	risk class, high.rise, base, race, house, personal	0.0892	0.2478	0.2586
hr.0111100	risk class, high.rise, base, race, age	0.0892	0.2535	0.2513
hr.0111101	risk class, high.rise, base, race, age, personal	0.0892	0.2495	0.2669
hr.0111110	risk class, high.rise, base, race, age, house	0.0892	0.2403	0.2696
hr.0111111	risk class, high.rise, base, race, age, house, personal	0.0892	0.2384	0.2956
hr.1000000	risk class, time	0.0892	0.2504	0.2155
hr.1000001	risk class, time, personal	0.0892	0.2442	0.2191
hr.1000010	risk class, time, house	0.0892	0.2453	0.2283
hr.1000011	risk class, time, house, personal	0.0892	0.2416	0.2469
hr.1000100	risk class, time, age	0.0892	0.2451	0.2384
hr.1000101	risk class, time, age, personal	0.0892	0.2389	0.2541
hr.1000110	risk class, time, age, house	0.0892	0.2407	0.2620
hr.1000111	risk class, time, age, house, personal	0.0892	0.2360	0.2702
hr.1001000	risk class, time, race	0.0892	0.2457	0.2154
hr.1001001	risk class, time, race, personal	0.0892	0.2419	0.2285
hr.1001010	risk class, time, race, house	0.0892	0.2435	0.2369
hr.1001011	risk class, time, race, house, personal	0.0892	0.2403	0.2498
hr.1001100	risk class, time, race, age	0.0892	0.2424	0.2575
hr.1001101	risk class, time, race, age, personal	0.0892	0.2371	0.2700
hr.1001110	risk class, time, race, age, house	0.0892	0.2385	0.2674
hr.1001111	risk class, time, race, age, house, personal	0.0892	0.2347	0.2873
hr.1010000	risk class, time, base	0.0892	0.2496	0.2155
hr.1010001	risk class, time, base, personal	0.0892	0.2439	0.2267
hr.1010010	risk class, time, base, house	0.0892	0.2436	0.2291
hr.1010011	risk class, time, base, house, personal	0.0892	0.2383	0.2397
hr.1010100	risk class, time, base, age	0.0892	0.2448	0.2436
hr.1010101	risk class, time, base, age, personal	0.0892	0.2384	0.2572
hr.1010110	risk class, time, base, age, house	0.0892	0.2381	0.2587
hr.1010111	risk class, time, base, age, house, personal	0.0892	0.2328	0.2852
hr.1011000	risk class, time, base, race	0.0892	0.2444	0.2161
hr.1011001	risk class, time, base, race, personal	0.0892	0.2404	0.2277
hr.1011010	risk class, time, base, race, house	0.0892	0.2409	0.2439
hr.1011011	risk class, time, base, race, house, personal	0.0892	0.2369	0.2505
hr.1011100	risk class, time, base, race, age	0.0892	0.2418	0.2479
hr.1011101	risk class, time, base, race, age, personal	0.0892	0.2365	0.2646
hr.1011110	risk class, time, base, race, age, house	0.0892	0.2348	0.2718
hr.1011111	risk class, time, base, race, age, house, personal	0.0892	0.2314	0.2896
hr.1100000	risk class, time, high.rise	0.0892	0.2493	0.2221
hr.1100001	risk class, time, high.rise, personal	0.0892	0.2439	0.2253
hr.1100010	risk class, time, high.rise, house	0.0892	0.2441	0.2358
hr.1100011	risk class, time, high.rise, house, personal	0.0892	0.2410	0.2534
hr.1100100	risk class, time, high.rise, age	0.0892	0.2443	0.2446
hr.1100101	risk class, time, high.rise, age, personal	0.0892	0.2387	0.2639
hr.1100110	risk class, time, high.rise, age, house	0.0892	0.2396	0.2650

Model Run	Predictors	Mean (%)	RMSE Dummies	RMSE Separate
hr.1100111	risk class, time, high.rise, age, house, personal	0.0892	0.2356	0.2749
hr.1101000	risk class, time, high.rise, race	0.0892	0.2453	0.2225
hr.1101001	risk class, time, high.rise, race, personal	0.0892	0.2422	0.2355
hr.1101010	risk class, time, high.rise, race, house	0.0892	0.2429	0.2428
hr.1101011	risk class, time, high.rise, race, house, personal	0.0892	0.2400	0.2574
hr.1101100	risk class, time, high.rise, race, age	0.0892	0.2421	0.2577
hr.1101101	risk class, time, high.rise, race, age, personal	0.0892	0.2372	0.2746
hr.1101110	risk class, time, high.rise, race, age, house	0.0892	0.2377	0.2716
hr.1101111	risk class, time, high.rise, race, age, house, personal	0.0892	0.2346	0.2815
hr.1110000	risk class, time, high.rise, base	0.0892	0.2486	0.2222
hr.1110001	risk class, time, high.rise, base, personal	0.0892	0.2434	0.2353
hr.1110010	risk class, time, high.rise, base, house	0.0892	0.2424	0.2445
hr.1110011	risk class, time, high.rise, base, house, personal	0.0892	0.2379	0.2518
hr.1110100	risk class, time, high.rise, base, age	0.0892	0.2440	0.2517
hr.1110101	risk class, time, high.rise, base, age, personal	0.0892	0.2379	0.2704
hr.1110110	risk class, time, high.rise, base, age, house	0.0892	0.2373	0.2643
hr.1110111	risk class, time, high.rise, base, age, house, personal	0.0892	0.2326	0.2716
hr.1111000	risk class, time, high.rise, base, race	0.0892	0.2438	0.2230
hr.1111001	risk class, time, high.rise, base, race, personal	0.0892	0.2405	0.2400
hr.1111010	risk class, time, high.rise, base, race, house	0.0892	0.2399	0.2456
hr.1111011	risk class, time, high.rise, base, race, house, personal	0.0892	0.2368	0.2601
hr.1111100	risk class, time, high.rise, base, race, age	0.0892	0.2414	0.2548
hr.1111101	risk class, time, high.rise, base, race, age, personal	0.0892	0.2363	0.2801
hr.1111110	risk class, time, high.rise, base, race, age, house	0.0892	0.2344	0.2718
hr.1111111	risk class, time, high.rise, base, race, age, house, personal	0.0892	0.2315	0.2875

Table 24: RMS Errors of models of fire injuries for high hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model Run	Predictors	Mean	RMSE	
			Dummies	Separate
constant		0.0030	0.1356	
rsk.clss	risk class	0.0030	0.1356	
lasso.min	risk class, time, high.rise, base, race, age, house, personal	0.0030	0.6045	
lasso.1se	risk class, time, high.rise, base, race, age, house, personal	0.0030	0.6071	
rForest	risk class, time, high.rise, base, race, age, house, personal	0.0030	0.1374	
hr.0000000	risk class	0.0030	0.1355	0.1356
hr.0000001	risk class, personal	0.0030	0.1354	0.1487
hr.0000010	risk class, house	0.0030	0.1355	0.1352
hr.0000011	risk class, house, personal	0.0030	0.1353	0.1383
hr.0000100	risk class, age	0.0030	0.1355	0.2024
hr.0000101	risk class, age, personal	0.0030	0.1355	0.1369
hr.0000110	risk class, age, house	0.0030	0.1354	1.68E+13
hr.0000111	risk class, age, house, personal	0.0030	0.1354	1.84E+04
hr.0001000	risk class, race	0.0030	0.1356	0.1378
hr.0001001	risk class, race, personal	0.0030	0.1354	0.1393
hr.0001010	risk class, race, house	0.0030	0.1354	0.1358
hr.0001011	risk class, race, house, personal	0.0030	0.1354	0.1347
hr.0001100	risk class, race, age	0.0030	0.1355	0.1367
hr.0001101	risk class, race, age, personal	0.0030	0.1355	9.38E+03
hr.0001110	risk class, race, age, house	0.0030	0.1354	6.12E+29
hr.0001111	risk class, race, age, house, personal	0.0030	0.1355	3.69E+04
hr.0010000	risk class, base	0.0030	0.1355	0.1357
hr.0010001	risk class, base, personal	0.0030	0.1354	0.1366
hr.0010010	risk class, base, house	0.0030	0.1354	0.1351
hr.0010011	risk class, base, house, personal	0.0030	0.1353	35.9960
hr.0010100	risk class, base, age	0.0030	0.1355	0.1407
hr.0010101	risk class, base, age, personal	0.0030	0.1355	2.18E+39
hr.0010110	risk class, base, age, house	0.0030	0.1354	7.64E+29
hr.0010111	risk class, base, age, house, personal	0.0030	0.1354	2.67E+04
hr.0011000	risk class, base, race	0.0030	0.1355	0.1358
hr.0011001	risk class, base, race, personal	0.0030	0.1354	0.1349
hr.0011010	risk class, base, race, house	0.0030	0.1354	0.1386
hr.0011011	risk class, base, race, house, personal	0.0030	0.1354	1.7652
hr.0011100	risk class, base, race, age	0.0030	0.1355	0.1365
hr.0011101	risk class, base, race, age, personal	0.0030	0.1354	1.49E+04
hr.0011110	risk class, base, race, age, house	0.0030	0.1354	1.60E+17
hr.0011111	risk class, base, race, age, house, personal	0.0030	0.1354	5.20E+04
hr.0100000	risk class, high.rise	0.0030	0.1355	0.1356
hr.0100001	risk class, high.rise, personal	0.0030	0.1354	0.1485
hr.0100010	risk class, high.rise, house	0.0030	0.1354	0.1500
hr.0100011	risk class, high.rise, house, personal	0.0030	0.1352	0.1378
hr.0100100	risk class, high.rise, age	0.0030	0.1354	0.2022
hr.0100101	risk class, high.rise, age, personal	0.0030	0.1354	0.1364
hr.0100110	risk class, high.rise, age, house	0.0030	0.1354	1.89E+11
hr.0100111	risk class, high.rise, age, house, personal	0.0030	0.1353	1.87E+04
hr.0101000	risk class, high.rise, race	0.0030	0.1356	0.1376
hr.0101001	risk class, high.rise, race, personal	0.0030	0.1353	0.1359
hr.0101010	risk class, high.rise, race, house	0.0030	0.1353	0.2220
hr.0101011	risk class, high.rise, race, house, personal	0.0030	0.1353	**0.1341**
hr.0101100	risk class, high.rise, race, age	0.0030	0.1355	0.1363
hr.0101101	risk class, high.rise, race, age, personal	0.0030	0.1354	9.24E+03
hr.0101110	risk class, high.rise, race, age, house	0.0030	0.1354	5.69E+34
hr.0101111	risk class, high.rise, race, age, house, personal	0.0030	0.1354	3.73E+04

Model Run	Predictors	Mean	RMSE	
			Dummies	Separate
hr.0110000	risk class, high.rise, base	0.0030	0.1355	0.1357
hr.0110001	risk class, high.rise, base, personal	0.0030	0.1354	0.1364
hr.0110010	risk class, high.rise, base, house	0.0030	0.1354	0.1353
hr.0110011	risk class, high.rise, base, house, personal	0.0030	0.1352	28.4462
hr.0110100	risk class, high.rise, base, age	0.0030	0.1354	0.1402
hr.0110101	risk class, high.rise, base, age, personal	0.0030	0.1354	6.16E+38
hr.0110110	risk class, high.rise, base, age, house	0.0030	0.1354	1.63E+30
hr.0110111	risk class, high.rise, base, age, house, personal	0.0030	**0.1352**	2.70E+04
hr.0111000	risk class, high.rise, base, race	0.0030	0.1354	0.1356
hr.0111001	risk class, high.rise, base, race, personal	0.0030	0.1353	0.1346
hr.0111010	risk class, high.rise, base, race, house	0.0030	0.1353	0.1369
hr.0111011	risk class, high.rise, base, race, house, personal	0.0030	0.1352	1.2336
hr.0111100	risk class, high.rise, base, race, age	0.0030	0.1354	0.1357
hr.0111101	risk class, high.rise, base, race, age, personal	0.0030	0.1353	1.58E+04
hr.0111110	risk class, high.rise, base, race, age, house	0.0030	0.1353	6.69E+06
hr.0111111	risk class, high.rise, base, race, age, house, personal	0.0030	0.1353	5.27E+04
hr.1000000	risk class, time	0.0030	0.1355	0.1356
hr.1000001	risk class, time, personal	0.0030	0.1354	0.1391
hr.1000010	risk class, time, house	0.0030	0.1355	0.1350
hr.1000011	risk class, time, house, personal	0.0030	0.1353	0.1359
hr.1000100	risk class, time, age	0.0030	0.1355	0.2951
hr.1000101	risk class, time, age, personal	0.0030	0.1355	0.1431
hr.1000110	risk class, time, age, house	0.0030	0.1354	2.20E+03
hr.1000111	risk class, time, age, house, personal	0.0030	0.1354	6.85E+05
hr.1001000	risk class, time, race	0.0030	0.1356	0.1379
hr.1001001	risk class, time, race, personal	0.0030	0.1354	0.1464
hr.1001010	risk class, time, race, house	0.0030	0.1354	0.1356
hr.1001011	risk class, time, race, house, personal	0.0030	0.1354	0.1350
hr.1001100	risk class, time, race, age	0.0030	0.1355	0.1362
hr.1001101	risk class, time, race, age, personal	0.0030	0.1354	1.03E+04
hr.1001110	risk class, time, race, age, house	0.0030	0.1354	7.13E+14
hr.1001111	risk class, time, race, age, house, personal	0.0030	0.1355	3.22E+04
hr.1010000	risk class, time, base	0.0030	0.1355	0.1354
hr.1010001	risk class, time, base, personal	0.0030	0.1354	0.1360
hr.1010010	risk class, time, base, house	0.0030	0.1354	0.1351
hr.1010011	risk class, time, base, house, personal	0.0030	0.1353	4.20E+10
hr.1010100	risk class, time, base, age	0.0030	0.1355	2.1950
hr.1010101	risk class, time, base, age, personal	0.0030	0.1355	5.65E+02
hr.1010110	risk class, time, base, age, house	0.0030	0.1355	7.36E+15
hr.1010111	risk class, time, base, age, house, personal	0.0030	0.1354	2.56E+04
hr.1011000	risk class, time, base, race	0.0030	0.1354	0.1358
hr.1011001	risk class, time, base, race, personal	0.0030	0.1354	0.1350
hr.1011010	risk class, time, base, race, house	0.0030	0.1354	0.1390
hr.1011011	risk class, time, base, race, house, personal	0.0030	0.1354	0.1371
hr.1011100	risk class, time, base, race, age	0.0030	0.1355	0.3003
hr.1011101	risk class, time, base, race, age, personal	0.0030	0.1354	1.39E+04
hr.1011110	risk class, time, base, race, age, house	0.0030	0.1354	4.08E+06
hr.1011111	risk class, time, base, race, age, house, personal	0.0030	0.1354	5.03E+04
hr.1100000	risk class, time, high.rise	0.0030	0.1355	0.1355
hr.1100001	risk class, time, high.rise, personal	0.0030	0.1354	0.1387
hr.1100010	risk class, time, high.rise, house	0.0030	0.1354	0.1592
hr.1100011	risk class, time, high.rise, house, personal	0.0030	0.1352	0.1351
hr.1100100	risk class, time, high.rise, age	0.0030	0.1354	0.2198
hr.1100101	risk class, time, high.rise, age, personal	0.0030	0.1354	0.1426
hr.1100110	risk class, time, high.rise, age, house	0.0030	0.1354	2.21E+03
hr.1100111	risk class, time, high.rise, age, house, personal	0.0030	0.1353	1.76E+06
hr.1101000	risk class, time, high.rise, race	0.0030	0.1356	0.1376

Model Run	Predictors	Mean	RMSE	
			Dummies	Separate
hr.1101001	risk class, time, high.rise, race, personal	0.0030	0.1353	0.1377
hr.1101010	risk class, time, high.rise, race, house	0.0030	0.1353	0.3407
hr.1101011	risk class, time, high.rise, race, house, personal	0.0030	0.1353	0.1341
hr.1101100	risk class, time, high.rise, race, age	0.0030	0.1355	0.1354
hr.1101101	risk class, time, high.rise, race, age, personal	0.0030	0.1354	1.08E+04
hr.1101110	risk class, time, high.rise, race, age, house	0.0030	0.1354	1.71E+25
hr.1101111	risk class, time, high.rise, race, age, house, personal	0.0030	0.1354	3.46E+04
hr.1110000	risk class, time, high.rise, base	0.0030	0.1355	0.1353
hr.1110001	risk class, time, high.rise, base, personal	0.0030	0.1354	0.1355
hr.1110010	risk class, time, high.rise, base, house	0.0030	0.1354	0.1356
hr.1110011	risk class, time, high.rise, base, house, personal	0.0030	0.1352	2.72E+10
hr.1110100	risk class, time, high.rise, base, age	0.0030	0.1354	0.9193
hr.1110101	risk class, time, high.rise, base, age, personal	0.0030	0.1354	3.65E+28
hr.1110110	risk class, time, high.rise, base, age, house	0.0030	0.1354	1.95E+18
hr.1110111	risk class, time, high.rise, base, age, house, personal	0.0030	0.1352	2.61E+04
hr.1111000	risk class, time, high.rise, base, race	0.0030	0.1354	0.1356
hr.1111001	risk class, time, high.rise, base, race, personal	0.0030	0.1353	0.1348
hr.1111010	risk class, time, high.rise, base, race, house	0.0030	0.1353	0.1400
hr.1111011	risk class, time, high.rise, base, race, house, personal	0.0030	0.1352	3.26E+14
hr.1111100	risk class, time, high.rise, base, race, age	0.0030	0.1354	0.1357
hr.1111101	risk class, time, high.rise, base, race, age, personal	0.0030	0.1353	1.43E+04
hr.1111110	risk class, time, high.rise, base, race, age, house	0.0030	0.1353	2.54E+07
hr.1111111	risk class, time, high.rise, base, race, age, house, personal	0.0030	0.1353	5.11E+04

Table 25: RMS Errors of models of fire deaths for high hazard properties.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model Run	Predictors	Mean	RMSE	
			Dummies	Separate
constant		0.0002	0.0157	
rsk.clss	risk class	0.0002	0.0157	
lasso.min	risk class, time, high.rise, base, race, age, house, personal	0.0002	0.5901	
lasso.1se	risk class, time, high.rise, base, race, age, house, personal	0.0002	0.5917	
rForest	risk class, time, high.rise, base, race, age, house, personal	0.0002	**0.0092**	
hr.0000000	risk class	0.0002	0.0157	0.0157
hr.0000001	risk class, personal	0.0002	0.0156	Infinity
hr.0000010	risk class, house	0.0002	0.0156	0.0176
hr.0000011	risk class, house, personal	0.0002	0.0147	4.69E+09
hr.0000100	risk class, age	0.0002	0.0118	4.73E+07
hr.0000101	risk class, age, personal	0.0002	0.0107	4.17E+20
hr.0000110	risk class, age, house	0.0002	0.0107	8.46E+12
hr.0000111	risk class, age, house, personal	0.0002	0.0102	2.09E+129
hr.0001000	risk class, race	0.0002	0.0157	0.0160
hr.0001001	risk class, race, personal	0.0002	0.0155	8.31E+38
hr.0001010	risk class, race, house	0.0002	0.0155	0.1351
hr.0001011	risk class, race, house, personal	0.0002	0.0141	1.45E+29
hr.0001100	risk class, race, age	0.0002	0.0115	1.66E+28
hr.0001101	risk class, race, age, personal	0.0002	0.0105	3.29E+24
hr.0001110	risk class, race, age, house	0.0002	0.0107	5.09E+20
hr.0001111	risk class, race, age, house, personal	0.0002	0.0101	7.50E+109
hr.0010000	risk class, base	0.0002	0.0157	0.0157
hr.0010001	risk class, base, personal	0.0002	0.0158	1.53E+26
hr.0010010	risk class, base, house	0.0002	0.0154	1.34E+26
hr.0010011	risk class, base, house, personal	0.0002	0.0142	1.42E+00
hr.0010100	risk class, base, age	0.0002	0.0111	7.19E+28
hr.0010101	risk class, base, age, personal	0.0002	0.0103	9.20E+12
hr.0010110	risk class, base, age, house	0.0002	0.0099	2.11E+14
hr.0010111	risk class, base, age, house, personal	0.0002	0.0095	5.70E+79
hr.0011000	risk class, base, race	0.0002	0.0157	0.0158
hr.0011001	risk class, base, race, personal	0.0002	0.0153	5.25E+13
hr.0011010	risk class, base, race, house	0.0002	0.0153	0.0478
hr.0011011	risk class, base, race, house, personal	0.0002	0.0139	Infinity
hr.0011100	risk class, base, race, age	0.0002	0.0109	3.49E+16
hr.0011101	risk class, base, race, age, personal	0.0002	0.0103	2.32E+55
hr.0011110	risk class, base, race, age, house	0.0002	0.0099	3.22E+10
hr.0011111	risk class, base, race, age, house, personal	0.0002	0.0095	2.57E+49
hr.0100000	risk class, high.rise	0.0002	0.0157	0.0157
hr.0100001	risk class, high.rise, personal	0.0002	0.0153	Infinity
hr.0100010	risk class, high.rise, house	0.0002	0.0156	0.0237
hr.0100011	risk class, high.rise, house, personal	0.0002	0.0146	Infinity
hr.0100100	risk class, high.rise, age	0.0002	0.0112	1.06E+84
hr.0100101	risk class, high.rise, age, personal	0.0002	0.0104	Infinity
hr.0100110	risk class, high.rise, age, house	0.0002	0.0106	1.75E+134
hr.0100111	risk class, high.rise, age, house, personal	0.0002	0.0101	1.65E+119
hr.0101000	risk class, high.rise, race	0.0002	0.0157	0.0162
hr.0101001	risk class, high.rise, race, personal	0.0002	0.0151	1.07E+43
hr.0101010	risk class, high.rise, race, house	0.0002	0.0155	0.0509
hr.0101011	risk class, high.rise, race, house, personal	0.0002	0.0139	2.87E+62
hr.0101100	risk class, high.rise, race, age	0.0002	0.0109	3.31E+107
hr.0101101	risk class, high.rise, race, age, personal	0.0002	0.0103	Infinity
hr.0101110	risk class, high.rise, race, age, house	0.0002	0.0106	Infinity
hr.0101111	risk class, high.rise, race, age, house, personal	0.0002	0.0100	2.19E+115

Model Run	Predictors	Mean	RMSE	
			Dummies	Separate
hr.0110000	risk class, high.rise, base	0.0002	0.0157	0.0158
hr.0110001	risk class, high.rise, base, personal	0.0002	0.0152	0.0086
hr.0110010	risk class, high.rise, base, house	0.0002	0.0153	7.57E+27
hr.0110011	risk class, high.rise, base, house, personal	0.0002	0.0139	1.31E+11
hr.0110100	risk class, high.rise, base, age	0.0002	0.0106	3.00E+92
hr.0110101	risk class, high.rise, base, age, personal	0.0002	0.0100	4.93E+91
hr.0110110	risk class, high.rise, base, age, house	0.0002	0.0099	Infinity
hr.0110111	risk class, high.rise, base, age, house, personal	0.0002	0.0095	3.12E+99
hr.0111000	risk class, high.rise, base, race	0.0002	0.0156	0.0161
hr.0111001	risk class, high.rise, base, race, personal	0.0002	0.0149	6.84E+21
hr.0111010	risk class, high.rise, base, race, house	0.0002	0.0152	6.7242
hr.0111011	risk class, high.rise, base, race, house, personal	0.0002	0.0136	Infinity
hr.0111100	risk class, high.rise, base, race, age	0.0002	0.0104	7.42E+122
hr.0111101	risk class, high.rise, base, race, age, personal	0.0002	0.0099	5.48E+89
hr.0111110	risk class, high.rise, base, race, age, house	0.0002	0.0099	Infinity
hr.0111111	risk class, high.rise, base, race, age, house, personal	0.0002	0.0094	3.33E+104
hr.1000000	risk class, time	0.0002	0.0157	0.0157
hr.1000001	risk class, time, personal	0.0002	0.0155	5.43E+07
hr.1000010	risk class, time, house	0.0002	0.0156	0.0268
hr.1000011	risk class, time, house, personal	0.0002	0.0147	3.56E+10
hr.1000100	risk class, time, age	0.0002	0.0118	3.49E+09
hr.1000101	risk class, time, age, personal	0.0002	0.0107	3.34E+27
hr.1000110	risk class, time, age, house	0.0002	0.0107	2.03E+18
hr.1000111	risk class, time, age, house, personal	0.0002	0.0102	5.66E+125
hr.1001000	risk class, time, race	0.0002	0.0157	0.0160
hr.1001001	risk class, time, race, personal	0.0002	0.0154	3.38E+16
hr.1001010	risk class, time, race, house	0.0002	0.0155	1.0271
hr.1001011	risk class, time, race, house, personal	0.0002	0.0141	5.85E+06
hr.1001100	risk class, time, race, age	0.0002	0.0115	1.23E+24
hr.1001101	risk class, time, race, age, personal	0.0002	0.0105	Infinity
hr.1001110	risk class, time, race, age, house	0.0002	0.0107	8.05E+30
hr.1001111	risk class, time, race, age, house, personal	0.0002	0.0101	4.03E+116
hr.1010000	risk class, time, base	0.0002	0.0157	0.0304
hr.1010001	risk class, time, base, personal	0.0002	0.0158	1.79E+12
hr.1010010	risk class, time, base, house	0.0002	0.0154	7.40E+19
hr.1010011	risk class, time, base, house, personal	0.0002	0.0141	Infinity
hr.1010100	risk class, time, base, age	0.0002	0.0111	1.80E+15
hr.1010101	risk class, time, base, age, personal	0.0002	0.0103	8.43E+13
hr.1010110	risk class, time, base, age, house	0.0002	0.0099	5.47E+33
hr.1010111	risk class, time, base, age, house, personal	0.0002	0.0095	1.55E+74
hr.1011000	risk class, time, base, race	0.0002	0.0157	8.43E+129
hr.1011001	risk class, time, base, race, personal	0.0002	0.0153	0.0114
hr.1011010	risk class, time, base, race, house	0.0002	0.0152	1.56E+07
hr.1011011	risk class, time, base, race, house, personal	0.0002	0.0139	Infinity
hr.1011100	risk class, time, base, race, age	0.0002	0.0109	1.05E+19
hr.1011101	risk class, time, base, race, age, personal	0.0002	0.0103	1.97E+68
hr.1011110	risk class, time, base, race, age, house	0.0002	0.0099	1.07E+23
hr.1011111	risk class, time, base, race, age, house, personal	0.0002	0.0095	3.11E+73
hr.1100000	risk class, time, high.rise	0.0002	0.0157	0.0157
hr.1100001	risk class, time, high.rise, personal	0.0002	0.0153	Infinity
hr.1100010	risk class, time, high.rise, house	0.0002	0.0156	0.0357
hr.1100011	risk class, time, high.rise, house, personal	0.0002	0.0146	Infinity
hr.1100100	risk class, time, high.rise, age	0.0002	0.0112	3.67E+100
hr.1100101	risk class, time, high.rise, age, personal	0.0002	0.0104	Infinity
hr.1100110	risk class, time, high.rise, age, house	0.0002	0.0106	8.22E+144
hr.1100111	risk class, time, high.rise, age, house, personal	0.0002	0.0101	9.72E+122
hr.1101000	risk class, time, high.rise, race	0.0002	0.0157	0.0162

Model Run	Predictors	Mean	RMSE	
			Dummies	Separate
hr.1101001	risk class, time, high.rise, race, personal	0.0002	0.0151	1.68E+21
hr.1101010	risk class, time, high.rise, race, house	0.0002	0.0154	0.1798
hr.1101011	risk class, time, high.rise, race, house, personal	0.0002	0.0138	2.86E+10
hr.1101100	risk class, time, high.rise, race, age	0.0002	0.0109	6.28E+96
hr.1101101	risk class, time, high.rise, race, age, personal	0.0002	0.0103	Infinity
hr.1101110	risk class, time, high.rise, race, age, house	0.0002	0.0106	2.26E+149
hr.1101111	risk class, time, high.rise, race, age, house, personal	0.0002	0.0100	5.49E+106
hr.1110000	risk class, time, high.rise, base	0.0002	0.0157	0.0301
hr.1110001	risk class, time, high.rise, base, personal	0.0002	0.0152	7.51E+12
hr.1110010	risk class, time, high.rise, base, house	0.0002	0.0153	7.91E+18
hr.1110011	risk class, time, high.rise, base, house, personal	0.0002	0.0139	6.98E+03
hr.1110100	risk class, time, high.rise, base, age	0.0002	0.0106	5.49E+71
hr.1110101	risk class, time, high.rise, base, age, personal	0.0002	0.0100	3.24E+22
hr.1110110	risk class, time, high.rise, base, age, house	0.0002	0.0098	Infinity
hr.1110111	risk class, time, high.rise, base, age, house, personal	0.0002	0.0095	3.28E+96
hr.1111000	risk class, time, high.rise, base, race	0.0002	0.0156	4.34E+130
hr.1111001	risk class, time, high.rise, base, race, personal	0.0002	0.0149	0.0110
hr.1111010	risk class, time, high.rise, base, race, house	0.0002	0.0152	3.78E+06
hr.1111011	risk class, time, high.rise, base, race, house, personal	0.0002	0.0136	Infinity
hr.1111100	risk class, time, high.rise, base, race, age	0.0002	0.0104	4.34E+96
hr.1111101	risk class, time, high.rise, base, race, age, personal	0.0002	0.0099	3.83E+55
hr.1111110	risk class, time, high.rise, base, race, age, house	0.0002	0.0098	6.17E+146
hr.1111111	risk class, time, high.rise, base, race, age, house, personal	0.0002	0.0094	6.70E+94

Appendix E: EMS Model Results

Table 26: RMS Errors of the models for EMS risk based on the 500-cities data set.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1a	Health2a	Region	Department	S	L	C
ems.5.const	No	No	No	No	No	No	No	No	No	No	419.7		
ems.5.fx	No	No	No	No	No	No	No	No	No	Yes	389.7		
ems.5.lasso.1se	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	407.9		
ems.5.lasso.min	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	387.3		
ems.5.rf	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	383.1		
ems.5.000	Yes	No	No	No	No	No	No	No	No	Yes	389.6	3.90E+02	389.6
ems.5.001	Yes	Yes	No	No	No	No	No	No	No	Yes	388.5	3.87E+02	713.4
ems.5.002	Yes	No	Yes	No	No	No	No	No	Yes	Yes	509.1	2.44E+03	464.8
ems.5.003	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	423.6	4.87E+03	409.9
ems.5.004	Yes	No	No	Yes	No	No	No	No	No	Yes	373.3	4.48E+02	374.4
ems.5.005	Yes	Yes	No	Yes	No	No	No	No	No	Yes	373.6	3.83E+02	373.2
ems.5.006	Yes	No	Yes	Yes	No	No	No	No	Yes	Yes	414.0	3.67E+06	389.1
ems.5.007	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	448.8	1.51E+06	396.0
ems.5.008	Yes	No	No	No	Yes	No	No	No	No	Yes	372.5	3.74E+02	9.21E+06
ems.5.009	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	372.3	3.71E+02	371.1
ems.5.010	Yes	No	Yes	No	Yes	No	No	No	No	Yes	404.1	4.41E+04	397.4
ems.5.011	Yes	Yes	Yes	No	Yes	No	No	No	No	Yes	378.5	3.73E+03	372.9
ems.5.012	Yes	No	No	Yes	Yes	No	No	No	No	Yes	376.0	3.26E+15	372.5
ems.5.013	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	372.4	4.28E+02	371.3

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1a	Health2a	Region	Department	S	L	C
ems.5.014	Yes	No	Yes	Yes	Yes	No	No	No	Yes	Yes	412.7	1.56E+05	386.3
ems.5.015	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	399.5	4.28E+03	370.3
ems.5.016	Yes	No	No	No	No	Yes	No	No	No	Yes	390.9	2.78E+03	390.8
ems.5.017	Yes	Yes	No	No	No	Yes	No	No	Yes	Yes	391.6	1.31E+05	393.4
ems.5.018	Yes	No	Yes	No	No	Yes	No	No	Yes	Yes	1803.2	7.31E+03	978.6
ems.5.019	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes	927.4	1.09E+04	678.7
ems.5.020	Yes	No	No	Yes	No	Yes	No	No	Yes	Yes	373.3	7.26E+02	374.0
ems.5.021	Yes	Yes	No	Yes	No	Yes	No	No	Yes	Yes	373.6	6.02E+02	373.9
ems.5.022	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes	416.6	3.11E+04	395.9
ems.5.023	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	461.9	2.92E+04	416.1
ems.5.024	Yes	No	No	No	Yes	Yes	No	No	No	Yes	380.6	2.12E+03	382.1
ems.5.025	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	377.3	5.76E+03	374.8
ems.5.026	Yes	No	Yes	No	Yes	Yes	No	No	Yes	Yes	492.7	1.23E+04	489.5
ems.5.027	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	377.9	1.59E+04	378.7
ems.5.028	Yes	No	No	Yes	Yes	Yes	No	No	Yes	Yes	372.9	6.45E+02	370.8
ems.5.029	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	372.8	9.05E+02	370.8
ems.5.030	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	382.2	1.00E+04	378.9
ems.5.031	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	377.3	2.25E+04	369.1
ems.5.032	Yes	No	No	No	No	No	Yes	No	No	Yes	378.2	2.78E+25	378.8
ems.5.033	Yes	Yes	No	No	No	No	Yes	No	No	Yes	373.2	4.36E+02	371.3
ems.5.034	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes	714.0	2.30E+03	727.3
ems.5.035	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	443.4	8.03E+05	495.2
ems.5.036	Yes	No	No	Yes	No	No	Yes	No	No	Yes	374.2	9.34E+02	370.7

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1a	Health2a	Region	Department	S	L	C
ems.5.037	Yes	Yes	No	Yes	No	No	Yes	No	Yes	Yes	373.5	7.91E+02	371.2
ems.5.038	Yes	No	Yes	Yes	No	No	Yes	No	Yes	Yes	479.0	8.05E+03	440.5
ems.5.039	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	495.3	3.94E+03	484.3
ems.5.040	Yes	No	No	No	Yes	No	Yes	No	Yes	Yes	369.5	4.20E+02	370.1
ems.5.041	Yes	Yes	No	No	Yes	No	Yes	No	Yes	Yes	368.5	6.58E+02	369.0
ems.5.042	Yes	No	Yes	No	Yes	No	Yes	No	Yes	Yes	509.5	8.06E+04	536.2
ems.5.043	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	397.8	2.86E+05	412.4
ems.5.044	Yes	No	No	Yes	Yes	No	Yes	No	No	Yes	369.9	8.74E+02	369.5
ems.5.045	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	368.6	1.25E+03	369.1
ems.5.046	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	426.8	2.07E+03	401.8
ems.5.047	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	409.2	6.57E+06	387.5
ems.5.048	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	387.7	1.41E+03	381.7
ems.5.049	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	385.3	9.32E+03	381.8
ems.5.050	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes	1619.2	9.25E+03	926.3
ems.5.051	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	577.4	4.80E+03	607.0
ems.5.052	Yes	No	No	Yes	No	Yes	Yes	No	Yes	Yes	372.2	5.12E+03	373.4
ems.5.053	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	372.2	7.82E+02	374.1
ems.5.054	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	432.5	2.12E+05	418.8
ems.5.055	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	445.1	2.54E+05	452.9
ems.5.056	Yes	No	No	No	Yes	Yes	Yes	No	Yes	Yes	378.9	7.79E+02	376.3
ems.5.057	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	374.9	6.06E+02	374.2
ems.5.058	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	636.6	7.45E+05	484.5
ems.5.059	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	392.0	5.35E+04	396.5

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1a	Health2a	Region	Department	S	L	C
ems.5.060	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	367.6	5.61E+02	371.0
ems.5.061	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	367.9	1.49E+03	370.7
ems.5.062	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	385.1	6.91E+06	392.8
ems.5.063	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	378.5	1.89E+07	380.4
ems.5.064	Yes	No	No	No	No	No	No	Yes	No	Yes	381.9	1.34E+03	382.2
ems.5.065	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	375.2	1.28E+03	373.5
ems.5.066	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes	579.5	2.70E+04	608.8
ems.5.067	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	404.1	1.01E+09	451.4
ems.5.068	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	375.4	7.57E+09	385.8
ems.5.069	Yes	Yes	No	Yes	No	No	No	Yes	Yes	Yes	375.9	3.11E+06	401.7
ems.5.070	Yes	No	Yes	Yes	No	No	No	Yes	Yes	Yes	483.4	7.52E+08	428.1
ems.5.071	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	492.6	6.26E+09	457.7
ems.5.072	Yes	No	No	No	Yes	No	No	Yes	No	Yes	369.3	4.76E+03	375.9
ems.5.073	Yes	Yes	No	No	Yes	No	No	Yes	Yes	Yes	368.8	3.41E+06	374.9
ems.5.074	Yes	No	Yes	No	Yes	No	No	Yes	Yes	Yes	503.5	4.79E+04	507.1
ems.5.075	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	398.1	3.38E+03	420.2
ems.5.076	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes	370.0	1.60E+06	375.4
ems.5.077	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	368.7	8.92E+07	390.1
ems.5.078	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	447.3	1.20E+09	396.0
ems.5.079	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	426.9	2.12E+10	387.1
ems.5.080	Yes	No	No	No	No	Yes	No	Yes	No	Yes	382.1	4.20E+02	382.0
ems.5.081	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes	379.0	4.02E+02	379.2
ems.5.082	Yes	No	Yes	No	No	Yes	No	Yes	Yes	Yes	1137.6	1.15E+04	632.3

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1a	Health2a	Region	Department	S	L	C
ems.5.083	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	471.5	1.80E+04	492.9
ems.5.084	Yes	No	No	Yes	No	Yes	No	Yes	Yes	Yes	373.9	7.27E+03	381.2
ems.5.085	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	375.6	9.72E+03	391.3
ems.5.086	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	423.8	4.67E+05	396.6
ems.5.087	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	438.6	6.07E+04	426.6
ems.5.088	Yes	No	No	No	Yes	Yes	No	Yes	Yes	Yes	371.3	4.43E+02	380.8
ems.5.089	Yes	Yes	No	No	Yes	Yes	No	Yes	No	Yes	370.4	4.61E+02	380.1
ems.5.090	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	566.0	1.63E+05	438.8
ems.5.091	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	388.9	1.62E+06	392.3
ems.5.092	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	366.5	2.07E+04	374.4
ems.5.093	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	367.9	8.73E+04	383.7
ems.5.094	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	390.4	8.83E+09	381.7
ems.5.095	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	385.6	1.98E+06	375.6
ems.5.096	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes	378.2	8.09E+19	380.0
ems.5.097	Yes	Yes	No	No	No	No	Yes	Yes	No	Yes	370.3	2.92E+19	371.1
ems.5.098	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	543.1	3.59E+25	543.2
ems.5.099	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	410.6	4.10E+15	436.9
ems.5.100	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	373.8	2.47E+08	370.5
ems.5.101	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	373.6	7.05E+16	374.4
ems.5.102	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	456.2	Inf	412.0
ems.5.103	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	488.0	3.32E+19	451.0
ems.5.104	Yes	No	No	No	Yes	No	Yes	Yes	No	Yes	365.3	1.68E+18	366.5
ems.5.105	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	364.6	2.06E+32	365.3

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1a	Health2a	Region	Department	S	L	C
ems.5.106	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	496.5	7.75E+31	467.2
ems.5.107	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	406.1	Inf	413.4
ems.5.108	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	367.7	2.73E+11	366.7
ems.5.109	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	366.5	1.09E+52	367.2
ems.5.110	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	432.3	4.64E+16	385.6
ems.5.111	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	431.8	3.20E+28	389.2
ems.5.112	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	378.0	6.50E+06	378.5
ems.5.113	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	373.2	2.11E+06	376.9
ems.5.114	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	816.9	4.27E+05	541.4
ems.5.115	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	445.4	3.24E+05	455.0
ems.5.116	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	369.1	1.29E+07	372.0
ems.5.117	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	369.3	6.85E+06	378.3
ems.5.118	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	400.0	2.13E+11	389.8
ems.5.119	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	417.4	2.68E+13	416.8
ems.5.120	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	366.8	1.02E+05	369.2
ems.5.121	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	365.7	5.78E+05	368.4
ems.5.122	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	508.7	6.77E+05	418.0
ems.5.123	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	385.3	1.27E+10	389.3
ems.5.124	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**362.9**	1.39E+04	368.7
ems.5.125	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	363.4	2.89E+04	370.0
ems.5.126	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	378.2	6.63E+09	379.2
ems.5.127	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	379.2	1.97E+12	378.2

Table 27:RMS Errors of the models for EMS risk based on the county health data set.
Model(s) with the lowest RMS Error are in bold. A blank field indicates that the relevant model was not run.

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.const	No	No	No	No	No	No	No	No	No	No	No	386.7			
ems.C.fx	No	No	No	No	No	No	No	No	No	No	Yes	356.2			
ems.C.lasso.min	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	348.0			
ems.C.lasso.1se	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	360.1			
ems.C.rf	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	330.1			
ems.C.000	Yes	No	No	No	No	No	No	No	No	No	Yes	356.2	3.56E+02	356.4	
ems.C.001	Yes	Yes	No	No	No	No	No	No	No	No	Yes	351.3	3.50E+02	350.8	
ems.C.002	Yes	No	Yes	No	No	No	No	No	No	No	Yes	436.5	4.07E+02	397.3	
ems.C.003	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes	377.6	3.75E+02	360.7	
ems.C.004	Yes	No	No	Yes	No	No	No	No	No	No	Yes	546.9	3.41E+02	336.3	
ems.C.005	Yes	Yes	No	Yes	No	No	No	No	No	No	Yes	563.0	3.39E+02	335.7	
ems.C.006	Yes	No	Yes	Yes	No	No	No	No	No	No	Yes	485.1	3.48E+02	343.5	
ems.C.007	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	483.5	3.63E+02	342.8	
ems.C.008	Yes	No	No	No	Yes	No	No	No	No	No	Yes	335.6	3.37E+02	336.2	
ems.C.009	Yes	Yes	No	No	Yes	No	No	No	No	No	Yes	335.0	3.35E+02	335.3	
ems.C.010	Yes	No	Yes	No	Yes	No	No	No	No	No	Yes	341.2	3.66E+02	348.0	
ems.C.011	Yes	Yes	Yes	No	Yes	No	No	No	No	No	Yes	333.6	3.51E+02	332.2	
ems.C.012	Yes	No	No	Yes	Yes	No	No	No	No	No	Yes	369.8	3.44E+02	332.6	
ems.C.013	Yes	Yes	No	Yes	Yes	No	No	No	No	No	Yes	365.9	3.49E+02	330.7	
ems.C.014	Yes	No	Yes	Yes	Yes	No	No	No	No	Yes	Yes	400.2	3.57E+02	342.2	
ems.C.015	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	386.7	3.58E+02	345.5	

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.016	Yes	No	No	No	No	Yes	No	No	No	No	Yes	353.4	3.82E+02	352.8	
ems.C.017	Yes	Yes	No	No	No	Yes	No	No	No	No	Yes	351.9	3.77E+02	350.8	
ems.C.018	Yes	No	Yes	No	No	Yes	No	No	No	Yes	Yes	1025.0	6.85E+02	650.8	
ems.C.019	Yes	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	539.9	5.43E+02	435.2	
ems.C.020	Yes	No	No	Yes	No	Yes	No	No	No	No	Yes	521.7	3.46E+02	336.5	
ems.C.021	Yes	Yes	No	Yes	No	Yes	No	No	No	No	Yes	533.2	3.45E+02	336.2	
ems.C.022	Yes	No	Yes	Yes	No	Yes	No	No	No	No	Yes	462.9	3.66E+02	338.2	
ems.C.023	Yes	Yes	Yes	Yes	No	Yes	No	No	No	Yes	Yes	457.2	3.97E+02	338.7	
ems.C.024	Yes	No	No	No	Yes	Yes	No	No	No	No	Yes	339.6	3.67E+02	337.0	
ems.C.025	Yes	Yes	No	No	Yes	Yes	No	No	No	No	Yes	338.9	3.59E+02	335.4	
ems.C.026	Yes	No	Yes	No	Yes	Yes	No	No	No	No	Yes	381.4	4.35E+02	373.5	
ems.C.027	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	335.9	3.81E+02	331.7	
ems.C.028	Yes	No	No	Yes	Yes	Yes	No	No	No	No	Yes	374.8	3.62E+02	331.6	
ems.C.029	Yes	Yes	No	Yes	Yes	Yes	No	No	No	Yes	Yes	375.2	3.65E+02	329.9	
ems.C.030	Yes	No	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	400.6	3.97E+02	337.0	
ems.C.031	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	389.2	3.89E+02	329.0	
ems.C.032	Yes	No	No	No	No	No	Yes	No	No	No	Yes	356.1	2.70E+03	343.1	*
ems.C.033	Yes	Yes	No	No	No	No	Yes	No	No	No	Yes	351.2	1.39E+06	338.0	*
ems.C.034	Yes	No	Yes	No	No	No	Yes	No	No	Yes	Yes	443.7	1.59E+04	384.3	*
ems.C.035	Yes	Yes	Yes	No	No	No	Yes	No	No	Yes	Yes	384.8	2.85E+06	351.7	*
ems.C.036	Yes	No	No	Yes	No	No	Yes	No	No	No	Yes	551.5	1.92E+05	321.7	*
ems.C.037	Yes	Yes	No	Yes	No	No	Yes	No	No	No	Yes	565.8	3.25E+06	321.9	*
ems.C.038	Yes	No	Yes	Yes	No	No	Yes	No	No	Yes	Yes	508.6	2.62E+05	328.2	*

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.039	Yes	Yes	Yes	Yes	No	No	Yes	No	No	No	Yes	515.1	8.68E+07	331.8	*
ems.C.040	Yes	No	No	No	Yes	No	Yes	No	No	No	Yes	335.6	6.88E+05	325.1	*
ems.C.041	Yes	Yes	No	No	Yes	No	Yes	No	No	No	Yes	335.1	4.39E+07	323.8	*
ems.C.042	Yes	No	Yes	No	Yes	No	Yes	No	No	No	Yes	340.3	1.06E+06	329.5	*
ems.C.043	Yes	Yes	Yes	No	Yes	No	Yes	No	No	Yes	Yes	334.2	3.38E+07	318.6	*
ems.C.044	Yes	No	No	Yes	Yes	No	Yes	No	No	No	Yes	371.0	6.62E+05	316.2	*
ems.C.045	Yes	Yes	No	Yes	Yes	No	Yes	No	No	No	Yes	366.7	1.32E+08	317.1	*
ems.C.046	Yes	No	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	404.8	1.28E+06	312.1	*
ems.C.047	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	390.7	2.36E+09	311.2	*
ems.C.048	Yes	No	No	No	No	Yes	Yes	No	No	No	Yes	353.8	2.08E+03	338.9	*
ems.C.049	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	352.0	2.26E+05	337.3	*
ems.C.050	Yes	No	Yes	No	No	Yes	Yes	No	No	No	Yes	977.3	6.01E+03	499.1	*
ems.C.051	Yes	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	552.6	3.14E+05	387.1	*
ems.C.052	Yes	No	No	Yes	No	Yes	Yes	No	No	No	Yes	532.4	3.04E+04	321.7	*
ems.C.053	Yes	Yes	No	Yes	No	Yes	Yes	No	No	No	Yes	543.0	1.37E+05	322.0	*
ems.C.054	Yes	No	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	476.3	1.66E+05	319.8	*
ems.C.055	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	478.3	8.51E+06	322.0	*
ems.C.056	Yes	No	No	No	Yes	Yes	Yes	No	No	No	Yes	337.2	5.37E+04	324.2	*
ems.C.057	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	Yes	336.7	1.20E+06	323.8	*
ems.C.058	Yes	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	366.2	3.45E+05	334.1	*
ems.C.059	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	No	Yes	335.9	3.75E+06	315.9	*
ems.C.060	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No	Yes	377.3	1.72E+05	315.9	*
ems.C.061	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	Yes	377.0	5.38E+06	316.8	*

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.062	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	403.9	8.55E+05	310.9	*
ems.C.063	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	392.5	2.07E+08	310.8	*
ems.C.064	Yes	No	No	No	No	No	No	Yes	No	No	Yes	356.3	9.56E+06	342.4	*
ems.C.065	Yes	Yes	No	No	No	No	No	Yes	No	No	Yes	351.3	2.34E+07	336.6	*
ems.C.066	Yes	No	Yes	No	No	No	No	Yes	No	Yes	Yes	444.3	1.83E+08	383.6	*
ems.C.067	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	385.2	2.01E+08	351.1	*
ems.C.068	Yes	No	No	Yes	No	No	No	Yes	No	No	Yes	542.8	4.97E+07	320.9	*
ems.C.069	Yes	Yes	No	Yes	No	No	No	Yes	No	No	Yes	557.6	7.52E+07	321.0	*
ems.C.070	Yes	No	Yes	Yes	No	No	No	Yes	No	No	Yes	510.3	1.08E+08	327.6	*
ems.C.071	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	517.4	1.24E+08	331.3	*
ems.C.072	Yes	No	No	No	Yes	No	No	Yes	No	No	Yes	335.6	8.50E+07	321.3	*
ems.C.073	Yes	Yes	No	No	Yes	No	No	Yes	No	No	Yes	335.0	1.60E+08	320.5	*
ems.C.074	Yes	No	Yes	No	Yes	No	No	Yes	No	Yes	Yes	340.7	1.71E+08	329.2	*
ems.C.075	Yes	Yes	Yes	No	Yes	No	No	Yes	No	Yes	Yes	334.3	1.87E+08	318.3	*
ems.C.076	Yes	No	No	Yes	Yes	No	No	Yes	No	No	Yes	371.5	8.63E+07	315.1	*
ems.C.077	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No	Yes	367.2	1.34E+08	314.6	*
ems.C.078	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	406.9	1.20E+08	311.9	*
ems.C.079	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	392.6	1.46E+08	310.9	*
ems.C.080	Yes	No	No	No	No	Yes	No	Yes	No	No	Yes	353.6	1.07E+07	337.9	*
ems.C.081	Yes	Yes	No	No	No	Yes	No	Yes	No	No	Yes	351.8	2.20E+07	336.2	*
ems.C.082	Yes	No	Yes	No	No	Yes	No	Yes	No	Yes	Yes	919.0	6.80E+07	498.4	*
ems.C.083	Yes	Yes	Yes	No	No	Yes	No	Yes	No	Yes	Yes	529.2	8.24E+07	386.4	*
ems.C.084	Yes	No	No	Yes	No	Yes	No	Yes	No	No	Yes	521.2	2.52E+07	320.9	*

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.085	Yes	Yes	No	Yes	No	Yes	No	Yes	No	No	Yes	531.7	3.93E+07	321.1	*
ems.C.086	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	474.6	5.63E+07	319.3	*
ems.C.087	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	475.1	6.80E+07	321.4	*
ems.C.088	Yes	No	No	No	Yes	Yes	No	Yes	No	No	Yes	337.3	4.27E+07	320.9	*
ems.C.089	Yes	Yes	No	No	Yes	Yes	No	Yes	No	No	Yes	336.8	7.81E+07	320.3	*
ems.C.090	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	Yes	366.7	8.56E+07	333.9	*
ems.C.091	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	No	Yes	335.9	8.68E+07	315.6	*
ems.C.092	Yes	No	No	Yes	Yes	Yes	No	Yes	No	No	Yes	376.7	4.65E+07	315.0	*
ems.C.093	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	No	Yes	376.8	6.84E+07	314.5	*
ems.C.094	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	404.5	6.22E+07	310.8	*
ems.C.095	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	393.0	7.63E+07	310.6	*
ems.C.096	Yes	No	No	No	No	No	Yes	Yes	No	No	Yes	356.2	1.56E+07	356.7	*
ems.C.097	Yes	Yes	No	No	No	No	Yes	Yes	No	No	Yes	351.3	1.25E+07	430.1	*
ems.C.098	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	Yes	446.6	2.04E+07	444.2	*
ems.C.099	Yes	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	386.5	2.62E+07	397.2	*
ems.C.100	Yes	No	No	Yes	No	No	Yes	Yes	No	No	Yes	555.0	2.54E+07	379.0	*
ems.C.101	Yes	Yes	No	Yes	No	No	Yes	Yes	No	No	Yes	568.4	2.20E+07	401.8	*
ems.C.102	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	515.2	9.92E+06	388.3	*
ems.C.103	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	No	Yes	521.3	9.72E+06	393.2	*
ems.C.104	Yes	No	No	No	Yes	No	Yes	Yes	No	No	Yes	335.8	1.12E+07	601.7	*
ems.C.105	Yes	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes	335.3	1.24E+07	618.3	*
ems.C.106	Yes	No	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	341.2	9.34E+06	392.3	*
ems.C.107	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	334.8	9.11E+06	378.6	*

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.108	Yes	No	No	Yes	Yes	No	Yes	Yes	No	No	Yes	373.0	1.97E+07	450.5	*
ems.C.109	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	Yes	368.5	1.87E+07	648.6	*
ems.C.110	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	409.2	8.51E+06	377.7	*
ems.C.111	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	394.6	7.68E+06	376.9	*
ems.C.112	Yes	No	No	No	No	Yes	Yes	Yes	No	No	Yes	353.5	2.40E+07	434.1	*
ems.C.113	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes	351.8	1.91E+07	464.1	*
ems.C.114	Yes	No	Yes	No	No	Yes	Yes	Yes	No	No	Yes	916.6	1.50E+07	577.4	*
ems.C.115	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	531.9	1.62E+07	452.4	*
ems.C.116	Yes	No	No	Yes	No	Yes	Yes	Yes	No	No	Yes	533.2	2.85E+07	398.6	*
ems.C.117	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	No	Yes	542.5	2.40E+07	428.2	*
ems.C.118	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	477.2	8.53E+06	406.2	*
ems.C.119	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	476.9	8.27E+06	410.5	*
ems.C.120	Yes	No	No	No	Yes	Yes	Yes	Yes	No	No	Yes	337.3	1.15E+07	753.2	*
ems.C.121	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	Yes	336.8	1.20E+07	837.3	*
ems.C.122	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	365.4	7.67E+06	444.9	*
ems.C.123	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	336.1	7.18E+06	411.7	*
ems.C.124	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	378.6	2.33E+07	488.4	*
ems.C.125	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	378.5	2.07E+07	764.5	*
ems.C.126	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	406.8	7.72E+06	408.0	*
ems.C.127	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	395.1	6.95E+06	407.7	*
ems.C.128	Yes	No	No	No	No	No	No	No	Yes	No	Yes	356.3	7.05E+06	322.5	*
ems.C.129	Yes	Yes	No	No	No	No	No	No	Yes	No	Yes	351.2	6.20E+06	308.3	*
ems.C.130	Yes	No	Yes	No	No	No	No	No	Yes	No	Yes	448.9	7.58E+06	296.1	*

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.131	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	387.4	3.11E+06	288.4	*
ems.C.132	Yes	No	No	Yes	No	No	No	No	Yes	No	Yes	550.4	5.45E+06	278.7	*
ems.C.133	Yes	Yes	No	Yes	No	No	No	No	Yes	No	Yes	561.7	6.86E+06	280.5	*
ems.C.134	Yes	No	Yes	Yes	No	No	No	No	Yes	Yes	Yes	518.1	2.42E+06	296.8	*
ems.C.135	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	525.3	4.32E+06	295.1	*
ems.C.136	Yes	No	No	No	Yes	No	No	No	Yes	No	Yes	335.6	1.92E+07	353.3	*
ems.C.137	Yes	Yes	No	No	Yes	No	No	No	Yes	No	Yes	335.0	1.86E+07	353.4	*
ems.C.138	Yes	No	Yes	No	Yes	No	No	No	Yes	Yes	Yes	341.6	2.03E+06	307.4	*
ems.C.139	Yes	Yes	Yes	No	Yes	No	No	No	Yes	Yes	Yes	335.0	3.79E+06	289.7	*
ems.C.140	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	372.3	4.55E+06	301.3	*
ems.C.141	Yes	Yes	No	Yes	Yes	No	No	No	Yes	No	Yes	367.2	6.03E+06	364.2	*
ems.C.142	Yes	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	409.1	1.66E+06	316.1	*
ems.C.143	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	394.2	4.81E+06	310.2	*
ems.C.144	Yes	No	No	No	No	Yes	No	No	Yes	No	Yes	353.6	5.01E+06	308.5	*
ems.C.145	Yes	Yes	No	No	No	Yes	No	No	Yes	No	Yes	351.8	2.27E+07	306.6	*
ems.C.146	Yes	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	931.0	5.94E+06	298.4	*
ems.C.147	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes	Yes	534.7	3.39E+06	290.0	*
ems.C.148	Yes	No	No	Yes	No	Yes	No	No	Yes	No	Yes	528.4	2.98E+06	279.6	*
ems.C.149	Yes	Yes	No	Yes	No	Yes	No	No	Yes	No	Yes	535.9	3.96E+06	281.7	*
ems.C.150	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	477.0	1.37E+06	295.8	*
ems.C.151	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	478.1	1.40E+06	293.4	*
ems.C.152	Yes	No	No	No	Yes	Yes	No	No	Yes	No	Yes	337.0	1.96E+07	355.4	*
ems.C.153	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No	Yes	336.5	1.94E+07	374.0	*

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.154	Yes	No	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	366.5	1.60E+06	317.5	*
ems.C.155	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	336.3	2.67E+06	296.7	*
ems.C.156	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	377.6	2.23E+06	303.3	*
ems.C.157	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	376.7	2.46E+06	372.9	*
ems.C.158	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	405.3	7.80E+05	325.5	*
ems.C.159	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	393.6	1.01E+06	319.9	*
ems.C.160	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes	356.9	8.29E+04	32 442.0	*
ems.C.161	Yes	Yes	No	No	No	No	Yes	No	Yes	No	Yes	351.6	1.33E+05	11 700.6	*
ems.C.162	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes	Yes	451.5	9.42E+04	11 182.6	*
ems.C.163	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes	388.7	8.98E+04	9358.3	*
ems.C.164	Yes	No	No	Yes	No	No	Yes	No	Yes	No	Yes	563.5	3.25E+04	9708.7	*
ems.C.165	Yes	Yes	No	Yes	No	No	Yes	No	Yes	Yes	Yes	574.8	2.85E+04	11 129.2	*
ems.C.166	Yes	No	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	521.2	2.29E+04	19 123.3	*
ems.C.167	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	528.8	2.16E+04	21 076.7	*
ems.C.168	Yes	No	No	No	Yes	No	Yes	No	Yes	No	Yes	336.4	5.85E+04	6467.6	*
ems.C.169	Yes	Yes	No	No	Yes	No	Yes	No	Yes	No	Yes	335.8	6.41E+04	6658.2	*
ems.C.170	Yes	No	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	342.6	1.09E+05	7070.4	*
ems.C.171	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	335.8	8.42E+04	6508.6	*
ems.C.172	Yes	No	No	Yes	Yes	No	Yes	No	Yes	No	Yes	375.1	4.95E+04	8784.1	*
ems.C.173	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes	369.7	3.36E+04	8370.4	*
ems.C.174	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	411.0	4.05E+04	11 576.5	*
ems.C.175	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	395.8	4.03E+04	12 128.6	*
ems.C.176	Yes	No	No	No	No	Yes	Yes	No	Yes	No	Yes	354.1	9.75E+04	24 638.5	*

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.177	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	Yes	352.4	1.43E+05	13 609.0	*
ems.C.178	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	934.0	1.16E+05	11 892.9	*
ems.C.179	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	537.0	1.19E+05	9768.3	*
ems.C.180	Yes	No	No	Yes	No	Yes	Yes	No	Yes	No	Yes	540.6	4.07E+04	10 210.0	*
ems.C.181	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	Yes	548.1	3.76E+04	12 234.2	*
ems.C.182	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	478.9	3.41E+04	20 539.6	*
ems.C.183	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	479.9	3.31E+04	22 560.9	*
ems.C.184	Yes	No	No	No	Yes	Yes	Yes	No	Yes	No	Yes	338.0	5.54E+04	9509.2	*
ems.C.185	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	No	Yes	337.5	6.27E+04	9756.5	*
ems.C.186	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	367.7	1.05E+05	7423.0	*
ems.C.187	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	337.2	8.61E+04	6169.5	*
ems.C.188	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	380.9	6.01E+04	10 835.9	*
ems.C.189	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	380.0	4.29E+04	10 190.2	*
ems.C.190	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	407.2	5.13E+04	10 806.8	*
ems.C.191	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	395.4	5.12E+04	11 372.3	*
ems.C.192	Yes	No	No	No	No	No	No	Yes	Yes	No	Yes	358.5	1.95E+05	295.7	*
ems.C.193	Yes	Yes	No	No	No	No	No	Yes	Yes	No	Yes	352.7	2.31E+05	285.5	*
ems.C.194	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes	Yes	453.0	2.42E+05	284.4	*
ems.C.195	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	390.0	2.12E+05	282.3	*
ems.C.196	Yes	No	No	Yes	No	No	No	Yes	Yes	No	Yes	565.9	1.09E+05	271.9	*
ems.C.197	Yes	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	575.1	1.44E+05	270.7	*
ems.C.198	Yes	No	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	523.4	1.46E+05	269.6	*
ems.C.199	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	530.9	1.67E+05	269.5	*

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.200	Yes	No	No	No	Yes	No	No	Yes	Yes	No	Yes	337.4	7.36E+04	277.1	*
ems.C.201	Yes	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	336.8	6.78E+04	275.2	*
ems.C.202	Yes	No	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	344.3	9.89E+04	275.2	*
ems.C.203	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	336.7	9.08E+04	270.8	*
ems.C.204	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	Yes	375.7	9.17E+04	265.0	*
ems.C.205	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Yes	370.7	9.79E+04	261.4	*
ems.C.206	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	413.0	8.26E+04	262.0	*
ems.C.207	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	397.6	8.41E+04	262.8	*
ems.C.208	Yes	No	No	No	No	Yes	No	Yes	Yes	No	Yes	355.0	2.15E+05	292.3	*
ems.C.209	Yes	Yes	No	No	No	Yes	No	Yes	Yes	No	Yes	353.9	3.65E+05	292.6	*
ems.C.210	Yes	No	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	945.4	1.66E+05	292.5	*
ems.C.211	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	543.5	1.41E+05	287.2	*
ems.C.212	Yes	No	No	Yes	No	Yes	No	Yes	Yes	No	Yes	543.1	1.15E+05	276.6	*
ems.C.213	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	No	Yes	548.5	1.83E+05	273.3	*
ems.C.214	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	482.7	1.02E+05	275.4	*
ems.C.215	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	484.5	9.66E+04	274.6	*
ems.C.216	Yes	No	No	No	Yes	Yes	No	Yes	Yes	No	Yes	338.7	9.32E+04	280.5	*
ems.C.217	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	338.2	9.86E+04	277.8	*
ems.C.218	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	370.9	8.35E+04	283.3	*
ems.C.219	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	338.5	7.90E+04	274.9	*
ems.C.220	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	381.5	8.82E+04	267.6	*
ems.C.221	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	380.8	9.98E+04	263.7	*
ems.C.222	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	409.3	8.89E+04	266.8	*

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.223	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	397.3	5.92E+04	267.1	*
ems.C.224	Yes	No	No	No	No	No	Yes	Yes	Yes	No	Yes	358.9	3.15E+02	294.4	*
ems.C.225	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No	Yes	353.4	3.02E+02	286.3	*
ems.C.226	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	452.9	2.95E+02	288.2	*
ems.C.227	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	390.4	2.87E+02	283.4	*
ems.C.228	Yes	No	No	Yes	No	No	Yes	Yes	Yes	No	Yes	573.4	3.39E+02	271.2	*
ems.C.229	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	No	Yes	582.0	3.22E+02	270.1	*
ems.C.230	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	524.4	3.29E+02	264.1	*
ems.C.231	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	531.4	3.07E+02	261.7	*
ems.C.232	Yes	No	No	No	Yes	No	Yes	Yes	Yes	No	Yes	339.8	5.12E+02	286.2	*
ems.C.233	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	Yes	339.1	2.83E+02	280.9	*
ems.C.234	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	346.7	3.37E+02	272.7	*
ems.C.235	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	338.7	3.38E+02	269.6	*
ems.C.236	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	379.1	2.98E+02	275.3	*
ems.C.237	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	374.8	2.95E+02	268.7	*
ems.C.238	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	415.3	3.48E+02	260.4	*
ems.C.239	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	399.9	3.31E+02	259.3	*
ems.C.240	Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	355.7	3.37E+02	287.2	*
ems.C.241	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	Yes	355.2	2.96E+02	285.9	*
ems.C.242	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	938.3	3.07E+02	287.6	*
ems.C.243	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	541.4	2.95E+02	282.8	*
ems.C.244	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	550.4	3.37E+02	272.1	*
ems.C.245	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	555.2	3.16E+02	271.0	*

Model	Year	Base	Demographic	Housing	Personal	Fuel	Health1b	Health2b	Health3b	Region	Department	S	L	C	Notes
ems.C.246	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	484.4	3.30E+02	265.6	*
ems.C.247	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	485.8	3.11E+02	263.2	*
ems.C.248	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	341.1	5.62E+02	282.9	*
ems.C.249	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	340.6	2.90E+02	278.8	*
ems.C.250	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	373.1	3.48E+02	274.4	*
ems.C.251	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	340.9	3.42E+02	269.2	*
ems.C.252	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	385.3	3.08E+02	274.8	*
ems.C.253	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	385.4	3.02E+02	269.7	*
ems.C.254	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	412.2	3.55E+02	262.5	*
ems.C.255	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	400.2	3.38E+02	261.4	*

* The Long and Cluster versions fail for this model for important sub groups.