README file for
"Adaptation and the Mortality Effects of Temperature Across U.S. Climate Regions"

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This document describes how to replicate the results in this paper. We have included all scripts necessary to replicate the analysis. However, because the Medicare data used for this analysis are confidential, we cannot publicly post or share these data with other researchers. Thus, **the provided replication files are not sufficient for fully replicating our work**. Anyone interested in replicating our analysis must obtain a Data Use Agreement from the Centers for Medicare and Medicaid Services, as described here: https://www.cms.gov/Research-Statistics-Data-and-Systems/Files-for-Order/Data-Disclosures-Data-Agreements/Overview.html

We summarize the replication scripts and data files here, and provide additional descriptions of each main analysis script and data file on the following pages.

Project Folder Structure. The following diagram shows the first two levels of the project tree structure.

```
Project_folder/
├── README.docx
├── scripts/
│   ├── _auxiliary/
│   ├── _packages/
│   ├── main_analysis/
│   └── _run_all.do
└── data/
    ├── mortality_ghcn-temperature_daily_nonconfidential.dta
    ├── mortality_prism-temperature_daily_nonconfidential.dta
    └── zcta5_climate_change_estimates_nonconfidential.dta
```

Project Scripts. Project scripts are contained in the `/scripts` directory—extract from `scripts.tar.bz2` using the tar utility (Linux or macOS) or 7zip (Windows). Master script `_run_all.do` contains Stata commands that run all the other scripts in the right order. These other scripts are organized into the following script subdirectories.

- `/scripts/_auxiliary` contains custom Stata ado files and `/scripts/_packages` contains user-built Stata commands used in the analysis.
- `/scripts/main_analysis` contains scripts that process confidential Medicare data, merge in temperature data, estimate our main regressions, and perform the climate change assessments. These scripts also generate the results for all the tables and figures in our paper. See "Guide to scripts inside '/scripts/main_analysis'" below for a listing and summary of each file within the six subfolders of this folder.

Project Data. Project data are contained in the `/data` directory—extract from `data.tar.bz2` using the tar utility (Linux or macOS) or 7zip (Windows). We have included copies of the primary data files used for our analysis, with confidential Medicare variables removed. Even without access to Medicare data, these files may be of use to other researchers who are interested in implementing our research design in another context, obtaining climate model projections of end-of-century (2080–2099) climate and climate change at the ZCTA level, or using our ZCTA-level measures of climate change effects on mortality. The "Guide to data files inside '/data'" below lists and summarizes of each of the three data files in this folder.

Guide to scripts inside "/scripts/main_analysis"

Main analysis scripts (/scripts/main_analysis/)	Function
1_raw_to_proc/	
census_relationship/1_zcta_to_county.do	Process raw 2010 Census ZCTA relationship file
ghcn/1.clean_ghcn.do	Process raw GHCN station data
ghcn/2.ghcn_stations.R	Create master file of GHCN station locations
medicare/1_create_medicare.do	Process raw Medicare data
normals/1.clean_normals.do	Process raw NOAA 1981-2010 Climate Normals data
normals/2.normals_stations.R	Create master file of NOAA Climate Normals station locations
prism/1.prism_grid.R	Create master file of PRISM grid point locations
prism/2.prism_to_csv.R	Process raw PRISM data
science2017/model_weights.do	Process CMIP5 climate model weights
tiger/1_tiger_as_sf.R	Process raw TIGER/Line shapefiles
tiger/2_tiger_line_simplified.R	Create simplified TIGER/Line shapefiles
tiger/3_tiger_line_attributes.R	Create master list of TIGER/Line geography IDs, centroids
zip5/1_clean_zip5.do	Process raw Census Gazetteer ZIP code data
zip5/2_zip5_add_county2010.R	Match Gazetteer ZIP centroids to county FIPS
zip5/3_zip5_add_zctace2010.R	Match Gazetteer ZIP centroids to ZCTA
2_proc/	
01_geog_climate_match.R	Match PRISM, GHCN-daily, Climate Normals locations to ZCTAs
02_geog_weather_daily.do	Aggregate daily weather to ZCTA level
03_geog_weather_normals.do	Aggregate Climate Normals to ZCTA level
04_medicare_daily_zcta5.do	Aggregate mortality files to ZCTA level
05a_nex-gddp-grid_tavg_bin_predictions.do	Process climate model predictions from NEX-GDDP data
05b_zcta5_tavg_bin_predictions.R	Aggregate climate model predictions to ZCTA level
05c_zcta5_tavg_bin_predictions_combine.do	Create master file of climate model predictions at ZCTA level
06a_RECS_process.do	Process RECS data and create analogous ZCTA characteristics file
06b_RECS_ac_impute.do	Use RECS data to create a prediction of ZIP code AC penetration based on ZIP characteristics available in the ACS
06c_RECS_lasso.R	Called by 06b_RECS_ac_impute.do to implement AC prediction
3_build_analysis/	
01_build_analysis.do	Combine data on daily temperature and mortality and climate normals to create regression analysis files

4_run_analysis/	
01_temp_distribution.do	Calculate the distribution of days in 5-degree temperature bins (GHCN and PRISM), by climate tercile and ZCTA
02_regressions.do	Estimate the relationship between temperature and mortality
03_post_regression_data.do	Create tabular data from the regression estimates
04_tcl_climate_swaps.do	Calculate estimated mortality effects of "climate swaps"
05_zcta_climate_change.do	Use estimated mortality effects of temperature and climate model predictions to assess local and national damages from projected climate change
06_grid_climate_change_predictions.do	Compute predicted climate change, 2080–2099 versus current, at original grid resolution of the NEX-GDDP data (for summary visualization only)
07_supporting_calcs.do	Miscellaneous supporting calculations
5_make_figures/	
00_make_figures.do	Calls the other figure scripts
01_temperature_distribution.do	Main Figure 1, Appendix Figure B.3
02_tavg_mort_effects_byregion.do	Main Figure 2, Appendix Figure B.5
03_climate_swap_estimates.do	Main Figure 3
04_zcta5_climate_example_model.do	Main Figure 4
05_climate_effects_boxplots.do	Main Figure 5, Appendix Figure B.9, Appendix Figure B.10, Appendix Figure B.11
06a_county_climate_change_mortality_weighted-meta-NEX-GDDP_color.R	Main Figure 6, color version
06b_county_climate_change_mortality_weighted-meta-NEX-GDDP_grayscale.R	Main Figure 6, grayscale version
07_medicare_cmf_pop_mort.do	Appendix Figure B.1
08_zcta_normals_cdd_map.R	Appendix Figure B.2
09_tavg_bin_lr_effects.do	Appendix Figure B.4
10_grid_climate_change_tavg_weighted-meta-NEX-GDDP.R	Appendix Figure B.6, top panel
11_grid_climate_change_cdd_weighted-meta-NEX-GDDP.R	Appendix Figure B.6, bottom panel
12_tavg_bin_spline_compare.do	Appendix Figure B.7
13_zcta5_spline_examples_model.do	Appendix Figure B.8
14_tavg_bin_ac_effects.do	Appendix Figure B.12
6_make_tables/	
00_make_tables.do	Main Table 1, Appendix Table B.1, Appendix Table B.2, Appendix Table B.3, Appendix Table B.4

Guide to data files inside "/data"

Data files (/data)	Function
mortality_ghcn-temperature_daily_nonconfidential.dta	Regression analysis file for estimating (GHCN) temperature effects. ZCTA-daily level observations.
mortality_prism-temperature_daily_nonconfidential.dta	Regression analysis file for estimating (PRISM) temperature effects. ZCTA-daily level observations.

zcta5_climate_change_estimates_nonconfidential.dta	File containing the assessed mortality effects of projected end-of-century (2080–2099) climate change for each ZCTA under each of the following scenarios:
	- Temperature data source used to estimate temperature damages (GHCN or PRISM)
	- Climate model (23 different models, as listed in Appendix Table B.2)
	- Representative Concentration Pathways (RCP 4.5 or RCP 8.5)
	- Three different types of temperature effects:
	  - Homogeneous effects and no adaptation
	  - Current climate effects (heterogeneous effects) and no adaptation
	  - Current climate effects (heterogeneous effects) and future adaptation