Below is a description of code scripts for this study.

We used SAS 9.4, Stata/MP 17.0, and Python 3.8 for this analysis.

Step 1: Identify infection claims for UTI and pneumonia from hospital and SNF claims in MedPAR

| **Script Name** | **Infection type** | **Description** | **Input** | **Output** |
| --- | --- | --- | --- | --- |
| medpar\_infections\_noadmission.py | UTI & pneumonia | Identify UTI and pneumonia hospital claims from MedPAR hospital claims data according to diagnosis code and their corresponding POA indicators for the diagnosis code. These claims are categorized as primary (principal diagnosis code), second (the second diagnosis code), and secondary (any remaining secondary diagnosis code) UTI or pneumonia claims. Later, the second and the secondary claims were combined into the secondary diagnosis claims. | MedPAR data for 100% sample of Medicare fee-for-service beneficiaries in 2011 - 2017 | parquet files in  primaryUTI/ secondUTI/ secondaryUTI/ primaryPNEU/ secondPNEU/ secondaryPNEU/ |
| merge\_mbsf.py | UTI & pneumonia | Merge UTI and pneumonia hospital claims with Master Beneficiary Summary File (MBSF) for patient characteristics and subset the population to only fee-for-service beneficiaries. | Output from medpar\_infections\_noadmission.py and MBSF data | parquet files in  primaryUTI\_MBSF/ secondUTI\_MBSF/ secondaryUT\_MBSFI/ primaryPNEU\_MBSF/ secondPNEU\_MBSF/ secondaryPNEU\_MBSF/ |
| snf\_infections.py | UTI & pneumonia | Identify primary SNF claims from MedPAR where the first or the second diagnosis code is related to UTI or pneumonia. | MedPAR data for 100% sample of Medicare fee-for-service beneficiaries in 2011 - 2017 | parquet files in  SNFprimaryUTI/ SNFprimaryPNEU/ |
| merge\_snf\_mbsf.py | UTI & pneumonia | Merge SNF claims with Master Beneficiary Summary File (MBSF) for patient characteristics and subset the population to only fee-for-service beneficiaries. | Output from snf\_infections.py and MBSF data | parquet files in SNFprimaryUTI\_MBSF/ SNFprimaryPNEU\_MBSF/ |

Step 2: Link infection claims with MDS assessments

| **Script Name** | **Infection type** | **Description** | **Input** | **Output** |
| --- | --- | --- | --- | --- |
| merge\_mds.py | UTI & pneumonia | Merge UTI and pneumonia hospital claims with nursing home MDS to identify residents discharged from nursing home and admitted to hospital within 1 day and to extract discharge MDS information (for UTI claims only because pneumonia is not reported on discharge assessments) for these residents. | Output from merge\_mbsf.py | parquet files in  CDISCHRG/ |
| select\_samenh.py | UTI | For the UTI analytical sample, select residents who returned to the same nursing home within 1 day after hospital discharge. | Output in CDISCHRG/ | parquet files in CDISCHRG\_SAMENH/ |
| select\_reenter.py | Pneumonia | For the pneumonia analytical sample, select residents who returned to the same nursing home within 1 day after hospital discharge and merge MDS completed after readmission to the nursing home within 7 days of hospital discharge. | Output in CDISCHRG/ | parquet files in CREENTER/ |
| merge\_snf\_mds.py (merge\_snf\_mds\_pneu.py) | UTI & pneumonia | Merge SNF claims with MDS assessments within the beneficiaries' stay at the nursing home. | Output in SNFprimaryUTI\_MBSF/ SNFprimaryPNEU\_MBSF/ | parquet files in  SMDS/ |

Step 3: Merge individual- and nursing home-level covariates

| **Script Name** | **Infection type** | **Description** | **Input** | **Output** |
| --- | --- | --- | --- | --- |
| merge\_mbsfcc.py | UTI & pneumonia | Get residents' chronic conditions from Master Beneficiary Summary File Chronic Condition (MBSFCC). | Output in CDISCHRG\_SAMENH/ (or CREENTER/) and MBSFCC data | parquet files in CDISCHRG\_SAMENH\_CC/ |
| identify\_sl\_residents.py | UTI & pneumonia | Identify long-stay vs short-stay nursing home residents. If residents had a 5-day PPS assessment within 100 days before discharge assessment, they were short-stay residents. Otherwise, they were identified as long-stay residents. | Output in CDISCHRG\_SAMENH\_CC/ and MDS | parquet files in CDISCHRG\_SL/ |
| get\_comorb\_claims.py | UTI & pneumonia | Create data frames with all diagnosis codes within a year of hospitalization for residents in analytical samples. These datasets were used to calculate comorbidity score. | Output in CDISCHRG\_SL/ | csv files in DX/ |
| create\_comorbidity.sas | UTI & pneumonia | Create Charlson/Elixhauser comorbidity score. | csv output in DX/ | comorbidity.csv for primary UTI, secondary UTI, primary pneumonia, and secondary pneumonia claims |
| merge\_facility\_data.py | UTI & pneumonia | Merge denominator files with LCTFocus and CASPER for facility-level variables. | Output in CDISCHRG\_SL/ | parquet files in CDISCHRG\_FAC/ |
| merge\_star.py | UTI & pneumonia | Merge NHC star-ratings, quality ratings and urinary tract infection quality measures with denominator files. Create claims-based UTI and pneumonia rate for each nursing home. | Output in CDISCHRG\_FAC/ | parquet files in CDISCHRG\_STAR/ |
| merge\_readmission.py | UTI | Merge the earliest post-hospitalization MDS from the same nursing home completed within 30 days after hospital discharge to UTI hospital claims sample. | Output in CDISCHRG\_STAR/ | parquet files in CREADMISSION\_UTI |
| construct\_model\_data.py | UTI & pneumonia | Construct patient- and facility-level variables and output final datasets for analysis. | Output in CDISCHRG\_STAR/ and CREADMISSION\_UTI | csv files in FINAL/new/ |
| construct\_snf\_final\_data.py | UTI & pneumonia | Clean the SNF denominator file for final analysis. | Output in  SMDS/ | parquet files in  FINAL/SMDS/ |

Step 4: Create exhibits

| **Script Name** | **Infection type** | **Description** | **Input** | **Output** |
| --- | --- | --- | --- | --- |
| exhibit2.py | UTI & pneumonia | Create descriptive statistics for residents’ demographics for primary UTI and pneumonia hospital claims. | Output in FINAL/new/ |  |
| exhibit3.py | UTI & pneumonia | Calculate reporting rates of UTI and pneumonia cases on discharge or post-hospitalization MDS. Calculate nursing home-level reporting rates for UTI and pneumonia. | Output in FINAL/new/ | hos\_claims\_count.csv hos\_claims\_reporting.csv NHReporting.csv |
| exhibit3\_weighted.py | UTI & pneumonia | Calculate the 25th and 75th percentile of nursing home reporting rates of UTI and pneumonia weighted by the number of claims. | NHReporting.csv | quintileReporting.csv |
| model.do | UTI & pneumonia | Built the logistic multilevel model and estimated predictions of reporting rates. | Output in FINAL/new/ | longstay/shortstay\_regression\_results.csv longstay/shortstay\_preditions.csv |
| exhibit5.py | UTI & pneumonia | Create a table of quintiles of hospital claims-based infection rates and the mean of NHC MDS-based ulcer measures and star-ratings within each quintile, as well as correlations between claims-based and MDS-based measures for each year. | Output in FINAL/new/ | exhibit5\_main\_pneu/uti\_rate\_medicare{year}\_quintile\_QM.csv |