This is an overview of SAS programs used in the analysis for “Health care utilization before and after a dementia diagnosis in Medicare Advantage vs Traditional Medicare,” by Mireille Jacobson, Patricia Ferido, and Julie Zissimopoulos published in the *Journal of the American Geriatrics Society* in 2023. The programs are meant to run in order, with later programs relying on data created by earlier ones. A header program, not included, held most librefs so users will have to replace with their own.

**Sample**

clmids.sas

* Source data: Medicare Part A, B, and D claims - specifically carrier, dme, hha, hospice, inpatient, outpatient, SNF and Part D claims
* Creates: clmid[year]
* creates annual files flagging whether a beneficiary has a claim in that year from any of the files

bene\_demog2020.sas

* Source data: Medicare beneficiary summary files, clmid[year]
* Creates: bene\_demogall2020, bene\_demog2020
* creates a file of beneficiary non-time-varying demographics across all years of available data

p2egwp2018.sas

* Source data: Medicare Part D plan characteristics files
* Creates: p2egwp.fmt
* creates a format identifying different Part D plans made up of contract ID, plan ID and EGWP indicator

bene\_status\_year2020.sas, statyr.sas, bene\_status.fmt, p2egwp.fmt

* Source data: Medicare beneficiary summary files and harmonized files from bene\_demog2020
* Creates: bene\_status\_year[year]
* summarizes enrollment data.sas, HMO status.sas, dual eligibility.sas, Part D plan by year

sample\_selection\_3yrFFSptd0620.sas

* Source data: harmonized MBSF files (bene\_status\_year[year] and bene\_demog2020)
* Creates: samp\_3yrffsptd\_0620
* Summarize sample information and identify sample as those 67+ and enrolled in FFS and Part D in years *t-2, t-1,* and *t*

sample\_selection\_3yrMAptd0620.sas

* Source data: harmonized MBSF files (bene\_status\_year[year] and bene\_demog2020)
* Creates: samp\_3yrmaptd\_0620
* Summarize sample information and identify sample as those 67+ and enrolled in MA and Part D in years *t-2, t-1,* and *t*

ltc\_pos0618.sas

* Source data: RIF carrier files 2006 to 2018
* Creates: ltc\_poscarline\_2006- ltc\_poscarline\_2018
* Identify all POS claims with an LTC code

ltc\_partd0618.sas

* Source data: Part D pharmacy characteristics files 2006 to 2019
* Creates: pdeltc2006-pdeltc2018
* Identify all Part D claims from an LTC pharmacy

ltc\_prcdr0618.sas

* Source data: RIF carrier, inpatient, outpatient, SNF, HHA claims 2006 to 2018
* Creates: ltc\_prcdr\_2006-ltc\_prcdr\_2018
* Identify all LTC procedure codes from 2006 to 2018

ltc\_0618.sas

* Source data: ltc\_prcdr\_2006-ltc\_prcdr\_2018, ltc\_poscarline\_2006-ltc\_poscarline\_2018, pdeltc2006-pdeltc2018, RIF SNF claims
* Creates: ltc2006\_bene-ltc2018\_bene
* Combine LTC information from procedure, pharmacy claims, and POS codes and make beneficiary level

ma\_ltc\_pos1518.sas

* Source data: Encounter inpatient and outpatient base files, and revenue files
* Creates: ltc\_poscarline\_2015- ltc\_poscarline\_2018
* Identify all POS claims with an LTC code

ma\_ltc\_prcdr1518.sas

* Source data: Encounter Carrier line files
* Creates: ma\_ltc\_prcdr\_2015-ma\_ltc\_prcdr\_2018
* Identify all LTC procedure codes from 2015 to 2018

ma\_ltc\_1518.sas

* Source data: ma\_ltc\_prcdr\_2015-ma\_ltc\_prcdr\_2018, ma\_ltc\_poscarline\_2015-ma\_ltc\_poscarline\_2018, pdeltc2015-pdeltc2018, Encounter SNF claims
* Creates: ma\_ltc2015\_bene-ma\_ltc2018\_bene
* Combine LTC information from procedure, pharmacy claims, and POS codes and make beneficiary level for MA patients

**Identify Dementia**

pull\_dementia\_dx\_ma1518.sas

* Source data: fmt, Part A and B claims – carrier, outpatient, inpatient, SNF, HHA
* Creates: dementia\_dx\_carrier\_ma15\_18, dementia\_dx\_hha\_ma15\_18, dementia\_dx\_ip\_ma15\_18, dementia\_dx\_op\_ma15\_18, dementia\_dx\_snf\_ma15\_18
* Pulls dementia encounters from 2015-2018

adjudicate\_claims1518.sas

* Source data: dementia\_dx\_carrier\_ma15\_18, dementia\_dx\_hha\_ma15\_18, dementia\_dx\_ip\_ma15\_18, dementia\_dx\_op\_ma15\_18, dementia\_dx\_snf\_ma15\_18
* Creates: dementia\_dx\_carrier\_adj\_ma15\_18, dementia\_dx\_hha\_adj\_ma15\_18, dementia\_dx\_ip\_adj\_ma15\_18, dementia\_dx\_op\_adj\_ma15\_18, dementia\_dx\_snf\_adj\_ma15\_18
* Adjudicate diagnoses on Encounter 2015-2018 claims

dementia\_dxdt\_ma1518.sas

* Source data: dementia\_dx\_carrier\_adj\_ma15\_18, dementia\_dx\_hha\_adj\_ma15\_18, dementia\_dx\_ip\_adj\_ma15\_18, dementia\_dx\_op\_adj\_ma15\_18, dementia\_dx\_snf\_adj\_ma15\_18
* Creates: dementia\_dt\_ma15\_18
* Make 2015-2018 adjudicated claims date level

pull\_dementia\_dx\_2020.sas

* Source data: fmt, Part A and B claims – carrier, outpatient, inpatient, SNF, HHA
* Creates: dementia\_dx\_bcarrier\_[year], dementia\_dx\_hha\_[year], dementia\_dx\_inpatient\_[year], dementia\_dx\_outpatient\_[year], dementia\_dx\_snf\_[year]
* Pulls all dementia claims from the Part A & B files

dementia\_dxdt\_2020.sas

* Source data: fmt, dementia\_dx\_bcarrier\_[year], dementia\_dx\_hha\_[year], dementia\_dx\_inpatient\_[year], dementia\_dx\_outpatient\_[year], dementia\_dx\_snf\_[year]
* Creates: dementia\_dt\_1999\_2020
* Combines all dementia claims and makes it patient date-level

**Build**

ffs\_verifiedmciplwd.sas

* Source data: dementia\_dt\_1999\_2020, bene\_demog2020
* Creates: dxmciinc1yrv\_scendx\_ffs
* Identify incidence dementia DX in FFS defined as first instance of a dementia or MCI verified by a second dementia or MCI or death in 1 year

ma\_verifiedmciplwd.sas

* Source data: dementia\_dt\_ma15\_18, bene\_demog2020
* Creates: dxmciinc1yrv\_scendx\_ma
* Identify incidence dementia DX in MA defined as first instance of a dementia or MCI verified by a second dementia or MCI or death in 1 year

get\_codes\_arthglau.sas

* Source data: CC\_Codes.csv
* Creates: macro variables with ICD codes
* Identify ICD codes for arthritis/glaucoma using the CCW

ffs\_arthritis\_glaucoma.sas

* Source data: RIF claims 2015 to 2018
* Creates: arthglau\_dx\_2015\_2018, bene\_arthglau\_ffs
* Pull FFS claims for arthritis/glaucoma and summarize at the bene level

ma\_arthritis\_glaucoma.sas

* Source data: Encounter claims 2015 to 2018
* Creates: arthglaudx\_[typ]\_15\_18
* Pull MA claims for arthritis/glaucoma

ma\_arthritis\_glaucoma\_adj.sas

* Source data: arthglaudx\_[typ]\_15\_18, Encounter claims 2015 to 2018
* Creates: arthglaudx\_ma15\_18, bene\_arthglau\_ma
* Adjudicate MA claims for arthritis/glaucoma and summarize at the bene level

get\_codes\_cc.sas, ma\_cc.sas, ma\_cc\_adj.sas

* Source\_data: CC\_Codes.csv, CC\_Excl.csv, cc\_edits.csv, Encounter base files
* Creates: bene\_diabetes\_mainc, bene\_hyperl\_mainc, bene\_hypert\_mainc, bene\_strketia\_mainc, bene\_ami\_mainc, bene\_atf\_mainc
* Build equivalent of mbsf\_cc files for the MA population for diabetes, hyperlipidemia, hypertension, stroke/tia, AMI,atf

ffs\_procedures.sas

* Source data: RIF base & revenue
* Creates: ffs\_bene\_preventiveprcdr1518
* Pull preventive procedures FFS

ma\_procedures.sas

* Source data: Encounter base & revenue claims
* Creates: ma\_bene\_preventiveprcdr1518
* Pull preventive procedures MA

ffs\_inpatient.sas

* Source data: RIF inpatient claims
* Creates: ffs\_bene\_ip1518, ffs\_ip1518
* Pull inpatient visits FFS

ma\_inpatient\_cr.sas

* Source data: Encounter inpatient claims
* Creates: ma\_bene\_ip1518, ma\_ip1518
* Pull inpatient visits MA

ffs\_outpatient.sas

* Source data: ffs\_bene\_op1518
* Creates: ma\_bene\_ip1518, ma\_ip1518
* Pull outpatient visits FFS

ffs\_outpatient\_visitdays.sas

* Source data: RIF outpatient & carrier claims
* Creates: ffs\_bene\_op\_visitdays
* Make outpatient visits unique by day FFS

ma\_outpatient\_cr.sas

* Source data: Encounter outpatient & carrier
* Creates: ma\_bene\_op1518
* Pull outpatient visits MA

ma\_outpatient\_visitdays.sas

* Source data: Encounter outpatient & carrier
* Creates: ma\_bene\_op\_visitdays
* Make outpatient visits unique by day MA

ffs\_obs\_stays.sas

* Source data: RIF outpatient base, outpatient revenue & inpatient claims
* Creates: ffs\_obs1518
* Pull observation stays FFS

ma\_obs\_stays.sas

* Source data: Encounter outpatient base, outpatient revenue & inpatient claims
* Creates: ma\_obs1518
* Pull observation stays MA

**Analysis**

models\_samp.sas

* Source data: samp\_3yrffsptd\_0620, samp\_3yrmaptd\_0620, bene\_status\_year2017, dxmciincv1yrv\_scendx\_ffs, dxmciincv1yrv\_scendx\_ma, bene\_arthglau\_ffs, bene\_arthglau\_ma, mbsf\_cc\_2016, ltc2015\_bene, ltc2016\_bene, ltc2017\_bene, ltc2018\_bene, bene\_diabetes\_mainc, bene\_hyperl\_mainc, bene\_hypert\_mainc, bene\_strketia\_mainc, bene\_ami\_mainc, bene\_atf\_mainc, ma\_ltc2015\_bene, ma\_ltc2016\_bene, ma\_ltc2017\_bene, ma\_ltc2018\_bene
* Creates: ffs\_samp\_2yrwsh1yrv, ma\_samp\_2yrwsh1yrv
* Build FFs and MA sample for analysis, sample is enrolled in FFS or MA and Part D from 2015 to 2018 or death in 2017. Drop those in long-term care and clear out prior dementia and arth/glau from respective samples

monthly\_outcomes.sas

* Source data: ffs\_samp\_2yrwsh1yrv, ma\_samp\_2yrwsh1yrv, mbsf\_abcd\_2015-mbsf\_abcd\_2018, ffs\_bene\_preventiveprcdr1518, ffs\_bene\_ip1518, ffs\_bene\_op1518, ffs\_bene\_opvisitdays, ma\_bene\_preventiveprcdr1518, ma\_bene\_ip1518, ma\_bene\_op1518, ma\_bene\_opvisitdays
* Creates: ffs\_mocd2, ma\_mocd2
* Monthly outcomes % inpatient relative to dementia dx, avg # of outpatient visits unadjusted and age-adjusted to FFS

observation\_stays.sas

* Source data: ffs\_mocd2, ma\_mocd2, ffs\_obs1518
* Creates: ffs\_mocd2\_obs, ma\_mocd2\_obs
* Monthly outcomes of % observation stay and # of observation stays, unadjusted and age-adjusted to FFS

models.sas

* Source data: ffs\_mocd2\_obs, ma\_mocd2\_obs
* Model difference between FFS and MA outcomes controlling for observables

mortality\_models.sas

* Source data: ffs\_mocd2, ma\_mocd2, ma\_bene\_ip1518, ffs\_bene\_ip1518, dementia\_dt\_1999\_2020, dementia\_dt\_ma15\_18, arthglau\_dx\_2015\_2018, arthglaudx\_ma15\_18, RIF inpatient claims 2017, MA Inpatient Encounters 2017
* Creates: ipincdx\_bene
* Model mortality between FFS and MA

location\_dx.sas

* Source data: dementia\_dt\_1999\_2021, ffs\_samp\_2yrwsh1yrv, ma\_samp\_2yrwsh1yrv, RIF 2017 revenue files, RIF 2017 Carrier line file, Encounter 2017 revenue files, Encounter 2017 Carrier line file
* Explore location of incident dx

**Sensitivity**

ma\_high\_complete.sas

* Source data: ma\_complete\_contracts.csv, mbsf\_abcd\_[year]
* Creates: benecomplete1518
* Identify MA contracts with "high data completion" based on Jung et al, used list of contracts in Supplementary materials <https://onlinelibrary.wiley.com/doi/full/10.1111/1475-6773.13970>

samp\_complete.sas, outcomes\_complete.sas, models\_complete.sas, mortalitymodels\_complete.sas, mortalitymodels\_loc\_complete.sas

* Source data: benecomplete1518, ffs\_samp\_2yrwsh1yrv, ma\_samp\_2yrwsh1yrv, ffs\_mocd2, ma\_mocd2
* Analysis limited to beneficiaries in high data completion contracts

identify\_SNP.sas

* Source data: mbsf\_abcd\_[year]
* Creates: benesnp1518
* Identify beneficiaries who are enrolled in Special Needs Plans

sample\_nonsnp.sas, outcomes\_nonsnp.sas, models\_nonsnp.sas, modelsmortality\_nonsnp.sas, modelsmortality\_loc\_nonsnp.sas

* Source data: benesnp1518, ffs\_samp\_2yrwsh1yrv, ma\_samp\_2yrwsh1yrv, ffs\_mocd2, ma\_mocd2
* Analysis excluding beneficiaries in an SNP, to be run in the order listed

sample\_2yrwsh1yrv\_switchers.sas

* Source data: bene\_status\_year[year], bene\_demog2020, dxmciinc1yrv\_scendx\_ffs, mbsf\_cc\_2016, bene\_arthglau\_ffs, ltc2015\_bene-ltc2018\_bene, dxmciinc1yrv\_scendx\_ma, bene\_arthglau\_ma, bene\_diabetes\_mainc, bene\_hyperl\_mainc, bene\_hypert\_mainc, bene\_strketia\_mainc, bene\_ami\_mainc, bene\_atf\_mainc, ma\_ltc2015\_bene-ma\_ltc2018\_bene
* Creates: switch\_2yrwsh\_1yrv
* Get sample characteristics for sample including those who switch between MA and TM

models\_mortality\_switchers.sas

* Source data: switch\_2yrwsh\_1yrv, dementia\_dt\_1999\_2020, dementia\_dt\_ma15\_18, arthglau\_dx\_2015\_2018, arthglaudx\_ma15\_18
* Run mortality models including switchers