This is an overview of SAS programs used in the analysis for “Estimates of Diagnosed Dementia Prevalence and Incidence in Traditional Medicare and Medicare Advantage,” by Sidra Haye, Johanna Thunell, Geoffrey Joyce, Patricia Ferido, Bryan Tysinger, Mireille Jacobson, and Julie Zissimopoulos published in *Alzheimer’s & Dementia* 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\_1yrFFSptd0620.sas

* Source data: harmonized MBSF files (bene\_status\_year[year] and bene\_demog2020)
* Creates: samp\_1yrffsptd\_0620
* Summarize sample information and identify sample as those 65+ and enrolled in FFS and Part D in year *t*

sample\_selection\_1yrMAptd0620.sas

* Source data: harmonized MBSF files (bene\_status\_year[year] and bene\_demog2020)
* Creates: samp\_1yrmaptd\_0620
* Summarize sample information and identify sample as those 65+ and enrolled in MA and Part D in year *t*

sample\_selection\_1yroptumptd0620.sas

* Source data: harmonized MBSF files (bene\_status\_year[year] and bene\_demog2020)
* Creates: samp\_1yroptumptd\_0620\_66plus
* Summarize sample information and identify sample as those 65+ and enrolled in Optum and Part D in year *t*

sample\_selection\_66plus.sas

* Source data: samp\_1yrffsptd\_0620, samp\_1yrmaptd\_0620
* Creates: samp\_1yrffsptd\_0620\_66plus, samp\_1yrmaptd\_0620\_66plus
* Adjust sample so it's age is the same as Optum calculation

cci\_ffsptd\_bene0619.sas

* Source data: Encounter base carrier, SNF, HHA, inpatient and outpatient files
* Creates: cci\_ffsptd\_bene0619
* Pull CCI for the FFS sample from carrier, IP, OP, SNF, HHA

cci\_ma\_adj16.sas, cci\_ma\_adj17.sas

* Source data: Encounter base carrier, SNF, HHA, inpatient and outpatient files
* Creates: cci\_ma\_bene[yr]
* Pull CCI for the MA sample on adjudicated encounters from carrier, IP, OP, SNF, HHA

**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

**Analysis**

AD Incidence - MA

build\_ADRDinc\_verified\_ma\_yrly\_1yrv\_matchccw

* Source data: dementia\_dt\_ma15\_18, bene\_demog2020, addrugs\_dts\_0619
* Creates: adrdinc\_dxrxsymp\_yrly\_1yrv[year]ma
* Considers every year separately and looks for a 1 year verification from that year (so considering year t and year t+1) run for all verification methods

ma\_prevalence\_1617.sas

* Source data: samp\_1yrmaptd\_0620\_66plus, cci\_ma\_beneadj16, cci\_ma\_beneadj17, adrdinc\_dxrxsymp\_yrly\_1yrv2016ma, adrdinc\_dxrxsymp\_yrly\_1yrv2017ma, bene\_status\_year2016, bene\_status\_year2017, ffsptd\_weights16, ffsptd\_weights17, prevpredict16\_ses, prevpredict17\_ses, prevpredict16, prevpredict17, ffsptd\_weights16ses, ffsptd\_weights17ses
* Creates: maptd\_prev, maptd\_prev1yrv1617
* Runs prevalence adjusted and unadjusted, and sample characteristics

ma\_prevalencesubgroup\_1617.sas

* Source data: predict[yr]\_byrace, prevpredict[yr]\_bysex, ffsptd\_weights16, ffsptd\_weights17
* Creates: prev16\_ma\_wsub, prev\_17\_ma\_wsub
* runs prevalence for each subgroup, run t-tests within subgroup (race relative to white, female v male)

ma\_prevalencesubgroupses\_1617.sas

* Source data: predict[yr]\_byraceses, prevpredict[yr]\_bysexses, ffsptd\_weights16ses, ffsptd\_weights17ses
* Creates: prev16\_ma\_wsubses, prev\_17\_ma\_wsubses
* runs prevalence for each subgroup with dual/LIS, run t-tests within subgroup (race relative to white, female v male)

maeo\_prevalence\_1617.sas

* Source data: samp\_1yroptumptd\_0620\_66plus, cci\_ma\_beneadj16, cci\_ma\_beneadj17, adrdinc\_dxrxsymp\_yrly\_1yrv2016ma, adrdinc\_dxrxsymp\_yrly\_1yrv2017ma, sh054066.bene\_status\_year2016, sh054066.bene\_status\_year2017, ffsptd\_weights16, ffsptd\_weights17, prevpredict16\_ses, prevpredict17\_ses, prevpredict16, prevpredict17, ffsptd\_weights16ses, ffsptd\_weights17ses
* Creates: maptd\_prev, maptd\_prev1yrv1617
* runs prevalence adjusted and unadjusted, and sample characteristics for Optum MA

ma\_incidence\_1617.sas

* Source data: samp\_1yrmaptd\_0620\_66plus, cci\_ma\_beneadj16, cci\_ma\_beneadj17, adrdinc\_dxrxsymp\_yrly\_1yrv2015ma, adrdinc\_dxrxsymp\_yrly\_1yrv2016ma, adrdinc\_dxrxsymp\_yrly\_1yrv2017ma, sh054066.bene\_status\_year2016, sh054066.bene\_status\_year2017, ffsptd\_weights16, ffsptd\_weights17, incpredict16\_ses, incpredict17\_ses, incpredict16, incpredict17, ffsptd\_weights16ses, ffsptd\_weights17ses
* Creates: maptd\_inc, maptd\_inc1yrv1617
* runs incidence adjusted and unadjusted, and sample characteristics

ma\_incidencesubgroup\_1617.sas

* Source\_data: maptd\_inc, incpredict[yr]\_byrace, incpredict[yr]\_bysex, ffsptd\_incweights16, ffsptd\_incweights17
* Creates: inc16\_ma\_wsub, inc17\_ma\_wsub
* runs incidence for each subgroup, run t-tests within subgroup (race relative to white, female v male) runs

ma\_incidencesubgroupses\_1617.sas

* Source data: maptd\_inc, incpredict[yr]\_byraceses, incpredict[yr]\_bysexses, ffsptd\_incweights16ses, ffsptd\_incweights17ses
* Creates: inc16\_ma\_wsubses, inc17\_ma\_wsubses
* incidence for each subgroup with dual/LIS, run t-tests within subgroup (race relative to white, female v male)

maeo\_incidence\_1617.sas

* Source data: samp\_1yroptumptd\_0620\_66plus, cci\_ma\_beneadj16, cci\_ma\_beneadj17, adrdprev\_dxrxsymp\_yrly\_1yrv2015ma, adrdprev\_dxrxsymp\_yrly\_1yrv2016ma, adrdinc\_dxrxsymp\_yrly\_1yrv2017ma, sh054066.bene\_status\_year2016, sh054066.bene\_status\_year2017, ffsptd\_incweights16, ffsptd\_incweights17, incpredict16\_ses, incpredict17\_ses, incpredict16, incpredict17, ffsptd\_incweights16ses, ffsptd\_incweights17ses
* Creates: maeoptd\_inc
* runs incidence adj and unadj, and sample characteristics for Optum MA

maprev\_breakdown.sas

* Source data: maptd\_prev, adrdinc\_dxrxsymp\_yrly\_1yrv2016ma, adrdinc\_dxrxsymp\_yrly\_1yrv2017ma, dementia\_dt\_ma15\_18
* Creates: ffs\_bene\_ip1518, ffs\_ip1518
* location and type of prevalent DX using first qualifying claim in the year, weight to look like FFS

mainc\_breakdown.sas

* Source data: maptd\_inc, adrdinc\_dxrxsymp\_yrly\_1yrv2016ma, adrdinc\_dxrxsymp\_yrly\_1yrv2017ma, dementia\_dt\_ma15\_18
* Creates: ma\_bene\_ip1518, ma\_ip1518
* location and type of incidence DX using first qualifying claim in the year, weight to look like FFS

AD Incidence - FFS

build\_ADRDinc\_verified\_ffsptd\_yrly\_1yrv\_matchccw.sas

* Source data: dementia\_dt\_1999\_2021, sh054066.bene\_demog2021,addrugs\_dts\_0619
* Creates: adadrdinc\_dxrxsymp\_yrly\_1yrv[year]
* Considers every year separately and looks for a 1 year verification from that year (so considering year t and year t+1) run for all verification methods

prevalence\_1617.sas

* Source data: samp\_1yrffsptd\_0620\_66plus, cci\_ffsptd\_bene0619, adrdinc\_dxrxsymp\_yrly\_1yrv2016,adrdinc\_dxrxsymp\_yrly\_1yrv2017, sh054066.bene\_status\_year2016, sh054066.bene\_status\_year2017
* Creates: ffsptd\_prev1yrv1617, ffsptd\_prev, prevpredict16, prevpredict17, ffsptd\_weights16, ffsptd\_weights17, prevpredict16\_ses, prevpredict17\_ses, ffsptd\_weights16ses, ffsptd\_weights17ses
* FFS Part D prevalence and sample characteristics, creates weights and distributions for MA programs

prevalencesubgroup\_1617.sas

* Source data: maptd\_prev1yrv1617, ffsptd\_prev1yrv1617, ffsptd\_weights16, ffsptd\_weights17
* Creates: ffs\_ccibyrace\_prev[yr], ffs\_ccibysex\_prev[yr], ffsprev16\_wsub,ffsprev17\_wsub, prevpredict[yr]\_byrace, prevpredict[yr]\_bysex
* runs prevalence for each subgroup, run t-tests within subgroup (race relative to white, female v male)

prevalencesubgroup\_1617ses.sas

* Source data: ffsptd\_prev1yrv1617, ffsptd\_weights16ses, ffsptd\_weights17ses
* Creates: prevpredict[yr]\_byraceses, prevpredict[yr]\_bysexses, prev16\_ffs\_wsubses, prev17\_ffs\_wsubses
* runs prevalence for each subgroup adding controls for dual/lis, run t-tests within subgroup (race relative to white, female v male)

prevalencesubgroup\_alltest\_1617.sas

* Source data: prev16\_ffs\_wsub, prev16\_ma\_wsub, prev17\_ffs\_wsub, prev17\_ma\_wsub, maptd\_prev1yr1617, ffsptd\_prev1yrv1617
* runs t-tests between MA and FFS subgroup prevalence (white in MA v white in FFS), run ttests on prevalent sample characteristics

prevalencesubgroup\_alltest\_1617ses.sas

* Source data: prev16\_ffs\_wsubses, prev16\_ma\_wsubses, maptd\_prev1yr1617, ffsptd\_prev1yrv1617
* runs t-tests between MA and FFS subgroup prevalence (white in MA v white in FFS) with dual/lis, run ttests on prevalent sample characteristics

incidence\_1617.sas

* Source data: samp\_1yrffsptd\_0620\_66plus, cci\_ffsptd\_bene0619, adrdinc\_dxrxsymp\_yrly\_1yrv2015,adrdinc\_dxrxsymp\_yrly\_1yrv2016,adrdinc\_dxrxsymp\_yrly\_1yrv2017, sh054066.bene\_status\_year2016, sh054066.bene\_status\_year2017
* Creates: incpredict16, incpredict17, ffsptd\_incweights16, ffsptd\_incweights17, incpredict16\_ses, incpredict17\_ses, ffsptd\_incweights16ses, ffsptd\_incweights17ses
* FFS Part D incidence and sample characteristics, creates weights and distributions for MA

incidencesubgroup\_1617.sas

* Source data: maptd\_inc1yrv1617, ffsptd\_inc1yrv1617,,ffsptd\_incweights16, ffsptd\_incweights17
* Creates: ffs\_ccibyrace\_prev[yr], ffs\_ccibysex\_prev[yr], inc16\_ffs\_wsub,inc17\_ffs\_wsub,incpredict[yr]\_byrace,incpredict[yr]\_bysex
* runs incidence for each subgroup, run t-tests within subgroup (race relative to white, female v male)

incidencesubgroupses\_1617.sas

* Source data: maptd\_inc1yrv1617, ffsptd\_inc1yrv1617, ffsptd\_incweights16ses, ffsptd\_incweights17ses
* Creates: inc16\_ffs\_wsubses,inc17\_ffs\_wsubses,incpredict[yr]\_byraceses, incpredict[yr]\_bysexses
* runs incidence for each subgroup with dual/lis in the models, run t-tests within subgroup (race relative to white, female v male)

incidencesubgroup\_alltest\_1617.sas

* Source data: ffsinc16\_wsub,ffsinc17\_wsub,mainc16\_wsub,mainc17\_wsub
* runs t-tests between MA and FFS subgroup incidence (white in MA v white in FFS)

incidencesubgroupses\_alltest\_1617.sas

* Source data: ffsinc16\_wsub, ffsinc17\_wsub, mainc16\_wsub, mainc17\_wsub, maptd\_inc1yrv1617, ffsptd\_inc1yrv1617
* runs t-tests between MA and FFS subgroup incidence (white in MA v white in FFS) with dual/lIS

incidence\_breakdown.sas

* Source data: ffsptd\_inc, adrdinc\_dxrxsymp\_yrly\_1yrv2016, adrdinc\_dxrxsymp\_yrly\_1yrv2017, dementia\_dt\_1999\_2021
* type of first dx and location of first dx

prevalence\_breakdown.sas

* Source data: ffsptd\_prev, adrdinc\_dxrxsymp\_yrly\_1yrv2016, adrdinc\_dxrxsymp\_yrly\_1yrv2017, dementia\_dt\_1999\_2021
* type of first dx and location of first dx for prevalence

AD Incidence – TM & MA

all\_prevalence\_1617.sas

* Source data: ffsptd\_prev, maptd\_prev1yrv1617
* Unadjusted prevalence at the population level

all\_incidence\_1617.sas

* Source data: ffsptd\_inc, maptd\_inc1yrv1617
* Unadjusted incidence at the population level

Optum

samp\_ma0719.sas

* Source data: dod\_mbr\_enroll\_r, dod\_mbrwdeath
* Creates: samp\_ma20072019
* Get sample information for all medicare beneficiaries enrolled in Optum

samp\_1yrma0619.sas

* Source data: samp\_ma20072019
* Creates: samp\_1yrma20072019
* Identify a sample who is enrolled continuously for 1 year

pull\_dementia\_dx.sas

* Source data: dod\_diag[yr]q[q]
* Creates: dementia\_dx2007\_2019
* Pull all claims with a dementia dx

dementia\_dxdt.sas

* Source data: dementia\_dx2007\_2019, dod\_m2016q1-dod\_m2016q4
* Creates: dementia\_dxdt2007\_2019
* Collapse dementia claims to date level

pull\_dementia\_rx.sas

* Source data: dod\_r[yr]q[q]
* Creates: dementia\_rx2007\_2019, dementia\_rxdt2007\_2019
* Pull all dementia drug claims

build\_adrdinc\_verified\_optum\_yrly\_1yv\_matchccw.sas

* Source data dementia\_dxdt2007\_2019, samp\_ma20072019
* Creates: adrdinc1yrv\_scendxrxsymp\_long, adrdinc\_dxrxsymp\_yrly\_1yrv[yr]
* Run verified dementia algorithm

cci.sas

* Source data: samp\_1yrma20072019, samp\_3yrma20072019, dod\_diag[yr]q[q], cci\_icd\_macro.sas
* Creates: cci\_bene[yr], cci\_bene0719
* Calculate CCI for all beneficiaries

explore\_duallis.sas

* Source data: dod\_mbr\_enroll\_r
* Creates: bene\_duallis1617
* Get all beneficiaries who were Dual or LIS in 2016 or 2017

readin\_weights.sas

* Source data: ffsptd\_incweights16.csv, ffsptd\_incweights17.csv,ffsptd\_prevweights16.csv, ffsptd\_prevweights17.csv,ffsptd\_incweights16ses.csv, ffsptd\_incweights17ses.csv,ffsptd\_prevweights16ses.csv, ffsptd\_prevweights17ses.csv
* Creates: ffsptd\_incweights16, ffsptd\_incweights17, ffsptd\_prevweights16, ffsptd\_prevweights17, ffsptd\_incweights16ses, ffsptd\_incweights17ses, ffsptd\_prevweights16ses, ffsptd\_prevweights17ses
* FFS Read in the FFS weights

incidence\_1617.sas

* Source data: samp\_1yrma20072019\_66plus, cci\_bene0719, adrdinc\_dxrxsymp\_yrly\_1yrv2015, adrdinc\_dxrxsymp\_yrly\_1yrv2016, adrdinc\_dxrxsymp\_yrly\_1yrv2017, bene\_duallis1617, ffsptd\_incweights16, ffsptd\_incweights17
* Optum adj and unadj incidence, sample characteristics

prevalence\_1617.sas

* Source data: samp\_1yrma20072019\_66plus, cci\_bene0719, adrdinc\_dxrxsymp\_yrly\_1yrv2016, adrdinc\_dxrxsymp\_yrly\_1yrv2017, bene\_duallis1617, ffsptd\_prevweights16, ffsptd\_prevweights17
* Optum adj and unadj prevalence, sample characteristics

incidence\_1617ses.sas

* Source data: samp\_1yrma20072019\_66plus, cci\_bene0719, adrdinc\_dxrxsymp\_yrly\_1yrv2015, adrdinc\_dxrxsymp\_yrly\_1yrv2016, adrdinc\_dxrxsymp\_yrly\_1yrv2017, bene\_duallis1617, ffsptd\_incweights16ses, ffsptd\_incweights17ses
* Optum adj with dual/lis and unadj incidence, sample characteristics

prevalence\_1617ses.sas

* Source data: samp\_1yrma20072019\_66plus, cci\_bene0719, adrdinc\_dxrxsymp\_yrly\_1yrv2016, adrdinc\_dxrxsymp\_yrly\_1yrv2017, bene\_duallis1617, ffsptd\_prevweights16ses, ffsptd\_prevweights17ses
* Optum adj with dual/lis and unadj prevalence, sample characteristics