```
1
2   /*******************************************************************************
3   //format of med4way
4   command outcome exposure mediator covariates a0() a1() m() yreg() mreg()
5
6   a0()    --> specifies the referent level of exposure
7   a1()    --> specifies the actual level of the exposure
8   m()     --> specifies the level of the mediator at which the four-way decomposition is computed
9   yreg()  --> specifies the form of the regression model for the outcome
10  mreg()  --> specifies the form of the regression model for the mediator
11
12  //key variables used with corresponding UK Biobank data-field ID for reproducibility
13  ethnicity                       21000
14  townsend deprivation            189
15  primary death cause             40001
16  date of death                   40000
17  sex                             31
18  age                             21003
19  date attend assessment centre   53
20  location of assessment centre   54
21
22  covid outcomes from data portal as per biobank protocol suggests so no data-field ID
23  *******************************************************************************/
24
25  which med4way
26  adoupdate med4way, update
27
28
29  use "\...", clear
30
31  ****key variables derived****
32  //age
33  generate specdate2 = date(specdate, "DMY")                                          /* specdate2 = date of covid test */
34  format  %td specdate2
35  gen     covidage_dif =(specdate2-date_attending_centre)/365.25                      /* age dif based on covid test date */
36  replace covidage_dif =(date_censor2-date_attending_centre)/365.25 if covidage_dif ==.  /* age dif based on censoring date */
37  sum     covidage_dif
38  gen covidage =(covidage_dif+age)                                                    /* creating current age using age at
    recruitment*/
39
40  //ethnicity: grouping 1
41  gen     eth2 = 1 if eth==1 | eth==1001 | eth==1002 | eth==1003                      /* WE  ->1  */
42  replace eth2 = 2 if eth==3 | eth==3001 | eth==3002 | eth==3003                      /* SA  ->2  */
43  replace eth2 = 3 if eth==4 | eth==4001 | eth==4002 | eth==4003                      /* BAC ->3  */
44  replace eth2 =. if eth==-1 | eth==-3
45  label   define ethLabel 1 "WE" 2 "SA" 3 "BAC"
46  label   values eth2 ethLabel
```

```
47  tab     eth2, m
48
49  //ethnicity: grouping 2
50  gen     eth4 = 1 if eth2 == 2 | eth2 == 3                                   /* group SAs and BACs together */

51  replace eth4 = 0 if eth2 == 1                                               /* WE       ->0 */
52  tab     eth4, m                                                             /* SA + BAC ->1 */
53
54
55  //sex: men=1 women=0 */
56  //deprivation: Townsend score - continuous variable */
57
58
59  ****outcomes****
60  //infection covid
61  tab     result, m                                           /* binary outcome of test result 1=positive 0=negative/no disease */
62  replace result = 0 if result == .
63  tab     result, m
64
65  //severe covid
66  gen     sevcovid = 1 if result == 1 & origin == 1           /* generating severe covid case that requires hospitalisation */
67  replace sevcovid = 0 if sevcovid ==.                        /* origin: hospital inpatient test 1=inpatient; 0=community*/
68  replace sevcovid = . if result == 1 & origin == 0
69  tab     sevcovid, m
70
71  //mortality covid
72  gen     coviddeath = 1 if death2 == 1 & strpos(primarydeathcause,"U")   /* covid mortality primary cause of death only */
73  replace coviddeath = 0 if missing(coviddeath)
74  tab     coviddeath, m
75
76
77  ****exclude participants****
78  tab death2                                                  /* death = dead=1 alive=0 */
79  drop if (death2 == 1 & dod3 < date("16032020","DMY"))       /* removing those who died prior to 16.03.2020 [index date] */
80  tab death2
81
82  tab country                                                 /* removing those from scotland and wales */
83  drop if (country == "sco" | country == "wal")
84  tab country
85
86  tab center, m                                               /* removing those without assessment centre data */
87  drop if center == "."
88  tab center
89
90  tab eth2, m                                                 /* removing those who are not WE, SA or BAC */
91  drop if eth2 == .
92  tab eth2
```

```
93
94
95  *****creating mediator level 0/1 deprivation for binary mediator*****
96  sum imd, detail
97  xtile   median = imd, nq(2)                                    /* create binary mediator based on median split */
98  list    median imd in 1/100
99  tab     median, m
100 replace median = 0 if median == 2                              /* more affluent=1; more deprived=0 */
101 list    median imd in 1/100
102 tab     median, m
103
104 ****creation of 75th binary cut points for mediator (deprivation)****
105 sum imd, detail
106 local k = r(p75)
107 gen     medianimd75 = 0 if (imd >`k')                          /* create binary mediator based on 75th centile */
108 replace medianimd75 = 1 if (imd <=`k')
109 replace medianimd75 = . if (imd ==.)
110 tab     medianimd75, m
111
112 ****analysis using binary mediator for updated analysis: ethnicity grouping 2****
113 //infection
114 med4way result eth4 median      covidage sex, a0(0) a1(1) m(1) yreg(logistic) mreg(logistic) fulloutput
115 med4way result eth4 medianimd75 covidage sex, a0(0) a1(1) m(1) yreg(logistic) mreg(logistic) fulloutput
116
117 //sereve covid
118 med4way sevcovid eth4 median        covidage sex, a0(0) a1(1) m(1) yreg(logistic) mreg(logistic) fulloutput
119 med4way sevcovid eth4 medianimd75   covidage sex, a0(0) a1(1) m(1) yreg(logistic) mreg(logistic) fulloutput
120
121 //mortality
122 med4way coviddeath eth4 median      covidage sex, a0(0) a1(1) m(1) yreg(logistic) mreg(logistic) fulloutput
123 med4way coviddeath eth4 medianimd75 covidage sex, a0(0) a1(1) m(1) yreg(logistic) mreg(logistic) fulloutput
124
125
126 ****sensitivity analysis with individual ethnic groups SA/BAC [ethnicity grouping 1] using logistic/binary mediator****
127 /*50th percentile*/
128 //SA
129 med4way result      eth2 median covidage sex, a0(1) a1(2) m(1) yreg(logistic) mreg(logistic) fulloutput            /* 50 - WE(1) v SA(2) */
130 med4way sevcovid    eth2 median covidage sex, a0(1) a1(2) m(1) yreg(logistic) mreg(logistic) fulloutput            /* 50 - WE(1) v SA(2) */
131 //BAC
132 med4way result      eth2 median covidage sex, a0(1) a1(3) m(1) yreg(logistic) mreg(logistic) fulloutput            /* 50 - WE(1) v BAC(3) */
133 med4way sevcovid    eth2 median covidage sex, a0(1) a1(3) m(1) yreg(logistic) mreg(logistic) fulloutput            /* 50 - WE(1) v BAC(3) */
134
135 /*75th percentile*/
136 //SA
137 med4way result      eth2 medianimd75 covidage sex, a0(1) a1(2) m(1) yreg(logistic) mreg(logistic) fulloutput       /* 75 - WE(1) v SA(2) */
138 med4way sevcovid    eth2 medianimd75 covidage sex, a0(1) a1(2) m(1) yreg(logistic) mreg(logistic) fulloutput       /* 75 - WE(1) v SA(2) */
139 //BAC
```

```
140  med4way result      eth2 medianimd75 covidage sex, a0(1) a1(3) m(1) yreg(logistic) mreg(logistic) fulloutput        /* 75 - WE(1) v BAC(3) */
141  med4way sevcovid    eth2 medianimd75 covidage sex, a0(1) a1(3) m(1) yreg(logistic) mreg(logistic) fulloutput        /* 75 - WE(1) v BAC(3) */
142
143  ****histogram imd****
144  histogram imd if eth4 == 0, frequency blcolor(blue%30) bfcolor(blue%30) ytitle("Frequency (people)") title("White European") nodraw name(
     histwhite, replace)
145  histogram imd if eth4 == 1, frequency bfcolor(orange%30) blcolor(orange%30) ytitle("Frequency (people)") title("Black and South Asian") nodraw
     name(histbme, replace)
146  graph combine histwhite histbme, row(2) xcommon
147
148  ****descriptives by ethnic group****
149  preserve
150  egen float miss = rowmiss(result coviddeath eth2 imd sex covidage)
151  tab miss, m
152  drop if miss !=0                                                    /*complete-case dataset used for analyses*/
153  baselinetable                                  /*
154  */  coviddeath(cat)                           /*
155  */  sevcovid(cat)                             /*
156  */  result(cat)                               /*
157  */  covidage(cts tab("p50 (p25-p75)"))        /*
158  */  sex(cat)                                  /*
159  */  imd(cts tab("p50 (p25-p75)"))             /*
160  */  , by(eth2, totalcolumn) exportexcel("\...", replace)
161  restore
162
163
164
165
166
```