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/*

PHD PROJECT: The role of depressive symptoms and cardiometabolic risk factors in the prediction of dementia: a cross-country comparison in England, the United States and China

STUDY 2: Mediating effects of depressive symptoms and cardiometabolic health on dementia development

Method of analysis:
Path Analysis (SEM)


MODEL

T1: EXPOSURE: DEPRESSIVE SYMPTOMS WV1 (BASELINE, 2011)
              CARDIOMETABOLIC RISK WV1 (BASELINE, 2011)
T2: MEDIATOR: DEPRESSIVE SYMPTOMS WV3 (2015)
              CARDIOMETABOLIC RISK: WV3 (2015)
T3: OUTCOME: DEMENTIA WV4 (2018)

COVARIATES ADJUSTMENT FOR PATH MODELS: WV1


*/


* KEEP NECESSARY VARIABLES

keep ID id_12char bloodweight ///
C_sex C_age C_eduaction C_maritalstatus_4cat Cwv1_netwealth_quintiles ///
Cwv1_smoking_3cat Cwv1_alcohol_status C_cvd_comorbidity Cwv1_memory_wordrecall ///
Cwv1_cesd_score Cwv1_depressive_symptoms ///
Cwv1_cesd_depressed Cwv1_cesd_effort Cwv1_cesd_sleep ///
Cwv1_cesd_lonely Cwv1_cesd_bother Cwv1_cesd_going ///
Cwv1_cesd_mind Cwv1_cesd_fear Cwv1_cesd_happy Cwv1_cesd_hope ///
Cwv3_cesd_score Cwv3_depressive_symptoms ///
Cwv3_cesd_depressed Cwv3_cesd_effort Cwv3_cesd_sleep ///
Cwv3_cesd_lonely Cwv3_cesd_bother Cwv3_cesd_going ///
Cwv3_cesd_mind Cwv3_cesd_fear Cwv3_cesd_happy Cwv3_cesd_hope ///
Cwv1_crp_level Cwv1_crp Cwv1_hdl_level Cwv1_hdl_cholesterol ///
Cwv1_waist Cwv1_obesity_waist Cwv1_bmi_score ///
Cwv1_systolic_mean Cwv1_diastolic_mean Cwv1_systolic_bp Cwv1_diastolic_bp ///
Cwv1_HbA1c_level Cwv1_HbA1c Cwv1_diabetes_report ///
Cwv3_crp_level Cwv3_crp Cwv3_hdl_level Cwv3_hdl_cholesterol ///
Cwv3_waist Cwv3_obesity_waist Cwv3_bmi_score Cwv3_systolic_mean ///
Cwv3_diastolic_mean Cwv3_systolic_bp Cwv3_diastolic_bp ///
Cwv3_HbA1c_level Cwv3_HbA1c Cwv3_diabetes_report ///
Cwv1_dementia_report Cwv2_dementia_report ///
Cwv3_dementia_report Cwv4_self_info_dementia







/* Prepare variables for SEM dataset

Variables of depressive symptoms and binary and continous cardiometabolic markers at wave 1 and 3

EXPOSURE

DEPRESSION T1 (4 CATEG)

Cwv1_cesd_depressed Cwv1_cesd_effort Cwv1_cesd_sleep Cwv1_cesd_lonely Cwv1_cesd_bother Cwv1_cesd_going Cwv1_cesd_mind Cwv1_cesd_fear
Cwv1_cesd_happy Cwv1_cesd_hope


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```
66
67  CARDIO HEALTH T1
68
69  CRP: Cwv1_crp_level Cwv1_crp
70  HDL cholesterol: Cwv1_hdl_level Cwv1_hdl_cholesterol
71  Obesity by waist cir: Cwv1_waist Cwv1_obesity_waist
72  SBP: Cwv1_systolic_mean Cwv1_systolic_bp
73  DBP: Cwv1_diastolic_mean Cwv1_diastolic_bp
74  Diabetes: Cwv1_diabetes_report
75  HbA1c: Cwv1_HbA1c_level Cwv1_HbA1c
76
77
78
79  MEDIATORS
80
81  DEPRESSION T2 (4 CATEG)
82
83  Cwv3_cesd_depressed Cwv3_cesd_effort Cwv3_cesd_sleep Cwv3_cesd_lonely Cwv3_cesd_bother
    Cwv3_cesd_going Cwv3_cesd_mind Cwv3_cesd_fear Cwv3_cesd_happy Cwv3_cesd_hope
84
85
86
87  CARDIO HEALTH T2
88
89  CRP: Cwv3_crp_level Cwv3_crp
90  HDL cholesterol: Cwv3_hdl_level Cwv3_hdl_cholesterol
91  Obesity by waist cir: Cwv3_waist Cwv3_obesity_waist
92  SBP: Cwv3_systolic_mean Cwv3_systolic_bp
93  DBP: Cwv3_diastolic_mean Cwv3_diastolic_bp
94  Diabetes: Cwv3_diabetes_report
95  HbA1c: Cwv3_HbA1c_level Cwv3_HbA1c
96
97
98  OUTCOME
99  Dementia incidence: Cwv4_self_info_dementia (binary)
100
101
102 */
103
104
105
106
107
108
109
110 *** Descriptive stats of Exposure, Mediator and Outcome at time 1 (wave 1 baseline)
111
112 * depression
113
114
115 tabulate Cwv1_depressive_symptoms
116 summarize Cwv1_depressive_symptoms
117
118 misstable summarize Cwv1_depressive_symptoms
119 misstable patterns Cwv1_depressive_symptoms
120
121
122 *crp
123
124 tabulate Cwv1_crp_level
125 summarize Cwv1_crp_level
126
127 tabulate Cwv1_crp
128 summarize Cwv1_crp
129
130 misstable summarize Cwv1_crp
131 misstable patterns Cwv1_crp
132
```

```
133
134
135   *hdl
136
137   tabulate Cwv1_hdl_level
138   summarize Cwv1_hdl_level
139
140   tabulate Cwv1_hdl_cholesterol
141   summarize Cwv1_hdl_cholesterol
142
143   misstable summarize Cwv1_hdl_cholesterol
144   misstable patterns Cwv1_hdl_cholesterol
145
146
147
148   *obesity waist
149
150   tabulate Cwv1_waist
151   summarize Cwv1_waist
152
153   tabulate Cwv1_obesity_waist
154   summarize Cwv1_obesity_waist
155
156   misstable summarize Cwv1_obesity_waist
157   misstable patterns Cwv1_obesity_waist
158
159
160   *sbp
161
162   tabulate Cwv1_systolic_mean
163   summarize Cwv1_systolic_mean
164
165   tabulate Cwv1_systolic_bp
166   summarize Cwv1_systolic_bp
167
168   misstable summarize Cwv1_systolic_bp
169   misstable patterns Cwv1_systolic_bp
170
171
172   *dbp
173
174   tabulate  Cwv1_diastolic_mean
175   summarize  Cwv1_diastolic_mean
176
177   tabulate  Cwv1_diastolic_bp
178   summarize  Cwv1_diastolic_bp
179
180   misstable summarize  Cwv1_diastolic_bp
181   misstable patterns  Cwv1_diastolic_bp
182
183
184   * diabetes
185
186   tabulate Cwv1_diabetes_report
187   summarize Cwv1_diabetes_report
188
189   misstable summarize Cwv1_diabetes_report
190   misstable patterns Cwv1_diabetes_report
191
192
193   * HbA1c
194
195   tabulate Cwv1_HbA1c_level
196   summarize Cwv1_HbA1c_level
197
198   tabulate Cwv1_HbA1c
199   summarize Cwv1_HbA1c
200
```

```
misstable summarize Cwv1_HbA1c
misstable patterns Cwv1_HbA1c



* dementia wave 1

tabulate Cwv1_dementia_report
summarize Cwv1_dementia_report

misstable summarize Cwv1_dementia_report
misstable patterns Cwv1_dementia_report









*** Descriptive stats of Exposure, Mediator and Outcome at time 2 (wave 3)

*depression

tabulate Cwv3_depressive_symptoms
summarize Cwv3_depressive_symptoms

misstable summarize Cwv3_depressive_symptoms
misstable patterns Cwv3_depressive_symptoms


*crp

tabulate Cwv3_crp_level
summarize Cwv3_crp_level

tabulate Cwv3_crp
summarize Cwv3_crp

misstable summarize Cwv3_crp
misstable patterns Cwv3_crp


*hdl

tabulate Cwv3_hdl_level
summarize Cwv3_hdl_level

tabulate Cwv3_hdl_cholesterol
summarize Cwv3_hdl_cholesterol

misstable summarize Cwv3_hdl_cholesterol
misstable patterns Cwv3_hdl_cholesterol


*obesity waist

tabulate Cwv3_waist
summarize Cwv3_waist

tabulate Cwv3_obesity_waist
summarize Cwv3_obesity_waist

misstable summarize Cwv3_obesity_waist
misstable patterns Cwv3_obesity_waist


*sbp

```

```
tabulate Cwv3_systolic_mean
summarize Cwv3_systolic_mean

tabulate Cwv3_systolic_bp
summarize Cwv3_systolic_bp

misstable summarize Cwv3_systolic_bp
misstable patterns Cwv3_systolic_bp



*dbp

tabulate Cwv3_diastolic_mean
summarize Cwv3_diastolic_mean

tabulate Cwv3_diastolic_bp
summarize Cwv3_diastolic_bp

misstable summarize Cwv3_diastolic_bp
misstable patterns Cwv3_diastolic_bp


*diabetes

tabulate Cwv3_diabetes_report
summarize Cwv3_diabetes_report

misstable summarize Cwv3_diabetes_report
misstable patterns Cwv3_diabetes_report


*HbA1c

tabulate Cwv3_HbA1c_level
summarize Cwv3_HbA1c_level

tabulate Cwv3_HbA1c
summarize Cwv3_HbA1c

misstable summarize Cwv3_HbA1c
misstable patterns Cwv3_HbA1c


*dementia wave 2 and 3


tabulate Cwv2_dementia_report
summarize Cwv2_dementia_report

misstable summarize Cwv2_dementia_report
misstable patterns Cwv2_dementia_report


tabulate Cwv3_dementia_report
summarize Cwv3_dementia_report

misstable summarize Cwv3_dementia_report
misstable patterns Cwv3_dementia_report









*** CLEANING DATA

```

```
337
338   * drop dementia cases at wv1,2 and 3 and missing data at baseline
339
340   drop if Cwv1_dementia_report==1
341   * (267 observations deleted)
342
343   drop if Cwv1_dementia_report== .
344   * (88 observations deleted)
345
346   * drop dementia cases at wave 3 and 4
347
348   drop if Cwv2_dementia_report==1
349   * (80 observations deleted)
350
351   drop if Cwv3_dementia_report==1
352   * (101 observations deleted)
353
354
355
356
357   * drop invalid ca cases t1 and t2
358
359   * drop CRP > 100
360
361   drop if Cwv1_crp_level > 100 & Cwv1_crp_level < 300
362   * (13 observations deleted)
363
364
365   drop if Cwv3_crp_level > 100 & Cwv3_crp_level < 300
366   * (4 observations deleted)
367
368
369   * drop sbp > 900
370
371   drop if Cwv1_systolic_mean > 900 & Cwv1_systolic_mean < 999
372   * (14 observations deleted)
373
374
375   drop if Cwv3_systolic_mean > 900 & Cwv3_systolic_mean < 999
376   * (22 observations deleted)
377
378
379   * drop obesity > 200
380
381   drop if Cwv3_waist > 200 & Cwv3_waist < 900
382   * (0 observations deleted)
383
384
385
386
387   * drop obs with no records on dementia at follow-up wave 4
388
389   drop if Cwv4_self_info_dementia== .
390   * (5393 observations deleted)
391
392
393   * ANALYTIC SAMPLE -> 5865
394
395
396
397
398   *** Recoding crp and hdl of interest
399
400
401   * log transform crp (left-skewed)
402
403   gen log_Cwv1_crp_level=log(Cwv1_crp_level)
404   gen log_Cwv3_crp_level=log(Cwv3_crp_level)
```

```
405
406
407   * reverse HDL scores
408
409   findit revrs
410
411   revrs Cwv1_hdl_level Cwv3_hdl_level
412
413   * ---------------- *
414
415
416
417   * rename var of interest to shorter names (max 8 characters)
418
419   * multiple renaming
420   findit renvars
421
422   renvars Cwv1_cesd_score Cwv1_depressive_symptoms Cwv1_cesd_depressed Cwv1_cesd_effort
      Cwv1_cesd_sleep Cwv1_cesd_lonely Cwv1_cesd_bother Cwv1_cesd_going Cwv1_cesd_mind Cwv1_cesd_fear
      Cwv1_cesd_happy Cwv1_cesd_hope log_Cwv1_crp_level Cwv1_crp revCwv1_hdl_level Cwv1_hdl_cholesterol
      Cwv1_waist Cwv1_obesity_waist Cwv1_systolic_mean Cwv1_systolic_bp Cwv1_diastolic_mean
      Cwv1_diastolic_bp Cwv1_diabetes_report Cwv1_HbA1c_level Cwv1_HbA1c Cwv3_cesd_score
      Cwv3_depressive_symptoms Cwv3_cesd_depressed Cwv3_cesd_effort Cwv3_cesd_sleep Cwv3_cesd_lonely
      Cwv3_cesd_bother Cwv3_cesd_going Cwv3_cesd_mind Cwv3_cesd_fear Cwv3_cesd_happy Cwv3_cesd_hope
      log_Cwv3_crp_level Cwv3_crp revCwv3_hdl_level Cwv3_hdl_cholesterol Cwv3_waist Cwv3_obesity_waist
      Cwv3_systolic_mean Cwv3_systolic_bp Cwv3_diastolic_mean Cwv3_diastolic_bp Cwv3_diabetes_report
      Cwv3_HbA1c_level Cwv3_HbA1c Cwv4_self_info_dementia C_age C_sex C_eduaction C_maritalstatus_4cat
      Cwv1_netwealth_quintiles Cwv1_smoking_3cat Cwv1_alcohol_status C_cvd_comorbidity \ cesdsc1 cesddr1
       depress1 effort1 sleep1 lonely1 bother1 going1 mind1 fear1 happy1 hope1 lcrp1 crp1 lhdl1 hdl1
      lobese1 obese1 lsbp1 sbp1 ldbp1 dbp1 diab1 lhba1c1 hba1c1 cesdsc2 cesddr2 depress2 effort2 sleep2
      lonely2 bother2 going2 mind2 fear2 happy2 hope2 lcrp2 crp2 lhdl2 hdl2 lobese2 obese2 lsbp2 sbp2
      ldbp2 dbp2 diab2 lhba1c2 hba1c2 dem age sex educ marital wealth smoke alcohol cvd
423
424
425   * Corrrelation matrix of the CM and depression variables
426
427   * to create quality table in word - asdoc -
428   * https://www.youtube.com/watch?v=XHBl6PHfOzs&ab_channel=StataProfessor
429
430   help asdoc
431
432   asdoc pwcorr depress1 effort1 sleep1 lonely1 bother1 going1 mind1 fear1 happy1 hope1 crp2 hdl2
      obese2 sbp2 dbp2 diab2 hba1c2, star(.05)
433
434   asdoc pwcorr crp1 hdl1 obese1 sbp1 dbp1 diab1 hba1c1 depress2 effort2 sleep2 lonely2 bother2
      going2 mind2 fear2 happy2 hope2, star(.05)
435
436
437
438   * Corrrelation matrix of the categorical (ordinal) Cardiometabolic and depression domains
439
440   /*
441
442   There are three metrics that are commonly used to calculate the correlation between categorical
      variables:
443
444   1. Tetrachoric Correlation: Used to calculate the correlation between binary categorical variables.
445
446   2. Polychoric Correlation: Used to calculate the correlation between ordinal categorical variables.
447
448   3. Cramer's V: Used to calculate the correlation between nominal categorical variables.
449
450   tetrachoric computes estimates of the tetrachoric correlation coefficients of the binary
      variables in varlist. All of these variables should be 0, 1, or missing values.
451
452   */
453
454   findit polychoric
```

```
455
456  polychoric depress1 effort1 sleep1 lonely1 bother1 going1 mind1 fear1 happy1 hope1 crp2 hdl2
     obese2 sbp2 dbp2 diab2 hba1c2
457
458
459  polychoric crp1 hdl1 obese1 sbp1 dbp1 diab1 hba1c1 depress2 effort2 sleep2 lonely2 bother2 going2
     mind2 fear2 happy2 hope2
460
461
462  * KEEP SEM MODEL VARIABLES
463
464  keep ID id_12char bloodweight ///
465  cesdsc1 cesddr1 depress1 effort1 sleep1 lonely1 bother1 ///
466  going1 mind1 fear1 happy1 hope1 ///
467  lcrp1 crp1 lhdl1 hdl1 lobese1 obese1 lsbp1 sbp1 ldbp1 dbp1 ///
468  diab1 lhba1c1 hba1c1 ///
469  cesdsc2 cesddr2 depress2 effort2 sleep2 lonely2 bother2 ///
470  going2 mind2 fear2 happy2 hope2 ///
471  lcrp2 crp2 lhdl2 hdl2 lobese2 obese2 lsbp2 sbp2 ldbp2 dbp2 ///
472  diab2 lhba1c2 hba1c2 ///
473  dem age sex educ marital wealth smoke alcohol cvd
474
475  *** drop ID, id_12char and bloodweight as these cannot be read by mplus
476
477  keep cesdsc1 cesddr1 depress1 effort1 sleep1 lonely1 bother1 ///
478  going1 mind1 fear1 happy1 hope1 ///
479  lcrp1 crp1 lhdl1 hdl1 lobese1 obese1 lsbp1 sbp1 ldbp1 dbp1 ///
480  diab1 lhba1c1 hba1c1 ///
481  cesdsc2 cesddr2 depress2 effort2 sleep2 lonely2 bother2 ///
482  going2 mind2 fear2 happy2 hope2 ///
483  lcrp2 crp2 lhdl2 hdl2 lobese2 obese2 lsbp2 sbp2 ldbp2 dbp2 ///
484  diab2 lhba1c2 hba1c2 ///
485  dem age sex educ marital wealth smoke alcohol cvd
486
487
488
489  *** To read by Mplus -> Open in spss - missing data (-99) - save as csv - tab delimited - tick do
     not write var names on the first linear
490
491
492
493  *** convert from stata (dat) to mplus (dta)
494
495  help stata2mplus
496
497
498  stata2mplus using S:\Research\pkstudies\Study4_depr_cardio_path\CHARLS\charls_sem_complete,
     missing (-99) replace
499
500
501
502
503
504  * General baseline characteristics of ELSA participants by dementia status
505  * crosstabs categ var (frequencies and chi2) !report column percentage!
506  * oneway ANOVA cont var (mean, sd)
507
508
509  * Socio-demographics
510  ttest age, by(dem)
511  ta sex dem, chi2 column row
512  ta educ dem, chi2 column row
513  ta marital dem, chi2 column row
514  ta wealth dem, chi2 column row
515  * Cardiometabolic factors
516  ta crp1 dem, chi2 column row
517  ta hdl1 dem, chi2 column row
518  ta obese1 dem, chi2 column row
```

```
ta sbp1 dem, chi2 column row
ta dbp1 dem, chi2 column row
ta diab1 dem, chi2 column row
ta hba1c1 dem, chi2 column row
* Lifestyle/health factors
ta smoke dem, chi2 column row
ta Cwv1_physicalactivity Cwv4_self_info_dementia, chi2 column row
ta alcohol dem, chi2 column row
ta cvd dem, chi2 column row
* Mental health
ttest cesdsc1, by(dem)
ta cesddr1 dem, chi2 column row



*** SENSITIVITY ANALYSES ***


/*

1) Stratify by age
generate age group variable
Age groups: 1) young old (< 70) 2) old old (>= 70)

2) Exclude those with CVDs at baseline

3) Mediation analysis on complete cases

*/



* Stratify by age


gen age70=1 if age < 70
replace age70=2 if age >=70 & !missing(age)

label var age70 "Age groups <70 young-old / 70 old-old"
lab def age_group 1 "young" 2 "old"
lab val age70 age_group

tab age70




*** MISSING DATA ***


search mdesc


* examining number of missing values vs non-missing in each variable

mdesc age sex educ marital wealth smoke alcohol cvd depress1 effort1 sleep1 lonely1 bother1 going1
 mind1 fear1 happy1 hope1 depress2 effort2 sleep2 lonely2 bother2 going2 mind2 fear2 happy2 hope2
crp1 hdl1 obese1 sbp1 dbp1 diab1 hba1c1 crp2 hdl2 obese2 sbp2 dbp2 diab2 hba1c2


```