name: <unnamed> log: \med-fs1.med.ualberta.ca\Pediatrics\Symbiota\SyMBIOTA\Datasets\Charlene-Vienna nature > 19 2022.smcl log type: smcl opened on: 19 Jan 2022, 13:57:39 1 . do "C:\Users\SARAHC~1\AppData\Local\Temp\STD1ac0 000000.tmp" 2 . /*Do-file for testing a single mediator model involving binary dependent variable > in Stata > version 1.0 > do file was written using Stata Version 17 > by Mike Crowson, Ph.D., The University of Oklahoma > This work is licensed under the Creative Commons Attribution 4.0 International > License. To view a copy of this license, visit > http://creativecommons.org/licenses/by/4.0/. > General information: > This do-file was created to allow one to test the indirect effect of a continuous > IV/X variable on a binary DV/Y through a single continuous mediator (Med). It was > designed to produce output consistent with Model 4 (involving a single mediator) > from Andrew Hayes (see https://www.processmacro.org/index.html) Process macro. > Professor Hayes was not involved in the creation of this do-file. > How to use the do-file: > The next section allows you to specify your model and request the number of > bootstrap replications you desire for testing the indirect effect. DO NOT make > any modifications to any of the code in any of the remaining portions in this > file, or you risk output containing errors or error messages. > A dummy coded (binary) IV/X is permitted, but DO NOT use the i.prefix > you may be used to when performing regression with factor variables. > When you run the code the the indirect effect will be calculated, and 95% > bootstrap confidence intervals will be produced in the output. [Included are > normal theory; percentile; and bias-corrected confidence intervals.] > The output will also contain the individual regression models comprising the > full mediation model. This code permits you to include a binary DV coded as 0 > (e.g. 'failure' or 'no'') and 1 (e.g., 'success' or 'yes''). Your binary DV can > also be coded as 1 and 2 (instead of 0 and 1); but no other codings are permissible. > The regression output will refer to IV (for your independent variable, or X), Med > (for your mediating variable, or M), and DV (for your dependent variable, or Y). > The additional covariates you include in your model specification will be listed > as named in your dataset. The initial output will be broken down into two > regression 'sub-models'. Model 1 is an OLS regression where the mediator is > regressed onto your IV and any covariates. Model 2 is a binary logistic > regression, where the DV is regressed onto your IV, mediator, and any covariates. > Cases with missing data on any of the variables included in your analysis will be > discarded (i.e., listwise deleted). However, those cases will not be eliminated > from your dataset. > Standardized regression coefficients from the OLS regression (Model 1) > and odds ratios (associated with the logitistic regression (Model 2) can be found > in the SUPPLEMENTAL portion of the output. Descriptive statistics and > correlations (based on the total effective sample size associated with > your mediation analysis) are also provided in this section.

> Assumptions: The single mediator model here assumes correct model specification: > (a) You have correctly specified the order of the temporal relations among the X, M, > and Y; (b) Your specification of the model does not omit important variables that > might alter the relations among the X, M, and Y variables; (c) The specification

```
> reflects the true causal relations among the variables (MacKinnon, 2008).
  > In addition to the assumptions above, aach regression model (i.e., Model 1 OLS
  > regression and Model 2 logistic regression) comprising the full mediation model
   > has have their own assumptions that must be met (MacKinnon, 2008). Failure to
  > meet the assumptions in those models can result in incorrect judgements concerning
  > population parameters associated with those models, and could impact the estimated
   > indirect effect and any inference you draw from it.
  > Included in the options in the next section is the option to obtain various
   > regression diagnostics for models 1 and 2. The available diagnostics are not
  > exhaustive, but should provide you with some means for evaluating the individual
  > regression models. Included in the output that is generated are general
  > descriptions for how you might use the information generated in diagnosing
  > potential problems.
  > */
3.
 4 . cls
 5 . capture drop IV DV Med
 6 . capture macro drop covs reps diagnostics
 7 . capture graph drop graph1 graph2
 8 . preserve
 11 . /*ENTER YOUR MODEL SPECIFICATIONS AND OPTIONS IN THIS SECTION. DO NOT CHANGE
  > OTHER SECTIONS OF THE DO-FILE*/
12 .
13 . /*Specify your IV, Med, and DV (binary) here. Use the exact variable names from
   > your data file.*/
15 . generate IV = u any nat 500
16 . generate Med = simpson actino
   (314 missing values generated)
17 . generate DV = inhalant3y2mm 2
   (211 missing values generated)
18 .
19 . *Indicate any covariates you wish to include in your model here.
20 .
21 . global covs = ""
23 . /*Indicate the number of bootstrap replications you wish here. (The default
   > when you download this Do-file is set at 50. You will want to raise this when
  > carrying out your own analysis; e.g., 1000 or 2000 or >)
  > NOTE: It may take some time for the bootstrap replications to complete, especially
   > if you request a large number of replications. You will need to be patient! */
```

```
24 .
25 . global reps = 5000
26 .
27 . /*Provide regression diagnostics? Type 0 if no; 1 if yes.*/
28 .
29 . global diagnostics=1
33 . keep if !missing(IV)
  (0 observations deleted)
34 . keep if !missing(DV)
  (211 observations deleted)
35 . keep if !missing(Med)
  (171 observations deleted)
37 . foreach x in $covs{
         drop if `x'==.
   2.
   3. }
38 .
39 .
40 . quietly sum DV
41 . if r(min) == 1{
42 . recode DV (1=0) (else=1)
43 . }
44 .
45 .
46 . *Equation 1: Multiple regression with mediator regressed onto IV and covs.
48 . reg Med IV $covs
```

SS	df	MS	Number of obs	=	287
			F(1, 285)	=	6.76
.188421076	1	.188421076	Prob > F	=	0.0098
7.94308163	285	.027870462	R-squared	=	0.0232
			Adj R-squared	=	0.0197
8.1315027	286	.028431828	Root MSE	=	.16694
	.188421076 7.94308163	.188421076 1 7.94308163 285	.188421076 1 .188421076 7.94308163 285 .027870462	F(1, 285) .188421076 1 .188421076 Prob > F 7.94308163 285 .027870462 R-squared Adj R-squared	F(1, 285) = .188421076

Med	Coefficient	Std. err.	t	P> t	[95% conf. ir	nterval]
IV _cons	0514408 .4903036		-2.60 33.61		0903822 .4615936	0124994 .5190136

⁴⁹

^{50 . *}Path a coefficient

```
51 \cdot di e(b)[1,1]
  -.0514408
52 .
53 . /*Equation 2: Logistic regression results. Unstandardized regression
  > coefficients, confidence intervals (for b) and tests are provided. */
55 . logistic DV IV Med $covs, coef
  Logistic regression
                                               Number of obs =
                                                                 287
                                               LR chi2( 2)
                                                                 8.53
                                               Prob > chi2 =
                                                               0.0141
  Log likelihood = -35.755018
                                                Pseudo R2
                                                               0.1065
          DV
               Coefficient Std. err.
                                                 [95% conf. interval]
                                         P > |z|
                                     Z
                          .8270381
               -1.208572
                                    -1.46
                                           0.144
                                                  -2.829537
                                                             .4123925
          ΤV
                4.405875
                          2.195819
                                    2.01
                                           0.045
                                                   .1021485
                                                             8.709601
         Med
        _cons
                -5.299851
                          1.386639
                                    -3.82
                                           0.000
                                                  -8.017614
                                                            -2.582089
56 .
57 . *Path b coefficient
58 . di e(b)[1,2]
  4.4058749
59 .
60 . *Path c-prime coefficient
61 . di e(b)[1,1]
  -1.2085724
63 . capture program drop medDO
64 . program medDO, rclass
   1.
65 . reg Med IV $covs
    2. scalar pa = _b[IV]
66 . logistic DV IV Med $covs, coef
    4. scalar pb = b[Med]
    5.
67 . return scalar IE = pa*pb
   6.
68 . end
70 . bootstrap Ind Eff=r(IE), reps($reps): medDO
  (running medDO on estimation sample)
  Bootstrap replications ( 5,000)
  50
  ..... x.x...x....x..... x..... x..... x...
  ....x...x....xx....xx
                                               150
                                              200
  250
  ..... x.xx.... x.xx.... x.x.x.x.x.x.....
                                              300
                                              350
  ...x.....x.....x.....x....x....x.
                                              400
  450
  ..... xx.... x..... x... x..x.x......
                                              500
  .xx..... xx..... xx.... x.... x....
                                               550
  x..... xx..x... xx..x...
```

600

650

..... x.... x.x.... x.... x.... x.... x.x.x... xx...

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..x.x..xx..... x.... x.... x...

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x x x x x x x 1,7	00
.x.xxxxxxx.xx	50
x x 1,8	00
x xx xx xx 1,8	
x x x x x 1,90	
·	
x	
xxxxxxxxx	00
.x.x.x x x x x x 2,0)50
xxx xx xx 2,1	0.0
x x x 2,1	
x	
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x.x. x.x. x. 2,2	
xx x x 2,3	00
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x x xx 2,50	
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xxxxx2,80	
x.x 2,8	50
x.xx	00
x .x	50
x x x x x 3,0	
x.xx.xxxxx 3,0	
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xxxxxxx	
.xxxxxxxxx	00
xx	50
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xxxxxxx 3,4	50
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xxxxxx	50
	
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x.x.x x 3,650	
x.xxxxxx.xxx	00
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. x x x		4 250
x x		4 400
		4 4 5 0
xxxx.		4 500
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x x		4 (00
${\tt x}\ldots\ldots {\tt x}\ldots {\tt x}\ldots {\tt x}\ldots {\tt x}\ldots$		
	xxx.x.x	xx 4,700
x.x xx	xxxxx	4 , 750
xxxxx	x	xx 4,800
x		
xxx.		
• • • • • • • • • • • • • • • • • • • •		4 0 0 0
x x x		E 000

Number of obs = 287 Replications = 4,345287 Bootstrap results

Command: medDO Ind Eff: r(IE)

		Observed coefficient	Bootstrap std. err.	Z	P> z	Normal-b [95% conf. i	
Ind_E	ff	2266417	.1603321	-1.4	1 0.157	5408869	.0876035

Note: One or more parameters could not be estimated in 655 bootstrap replicates; standard-error estimates include only complete replications.

71 . estat bootstrap, percentile bc

Number of obs = Replications = 287 Bootstrap results

4345

Command: medDO
Ind_Eff: r(IE)

	Observed coefficient	Bias	Bootstrap std. err.	[95% conf. interval]	
Ind_Eff	22664174	0103938	.16033213	62291640036841 68819570195255	` '

Key: P: Percentile

BC: Bias-corrected

Note: One or more parameters could not be estimated in 655 bootstrap replicates; standard-error estimates include only complete replications. 72 .

74 . /*SUPPLEMENTAL:STANDARDIZED REGRESSION WEIGHTS PRODUCED FOR MULTIPLE REGRESSION

> OUTPUT & ODDS RATIOS PRODUCED FOR LOGISTIC REGRESSION OUTPUT*/

75 .

76 . reg Med IV \$covs, beta

Source	SS	df	MS	Number of obs	=	287
Model	.188421076	1	.188421076	F(1, 285) Prob > F	=	6.76 0.0098
Residual	7.94308163	285	.027870462	R-squared	_	0.0098
	7.54500105	203	.027070402	Adj R-squared	=	0.0197
Total	8.1315027	286	.028431828	Root MSE	=	.16694

Med	Coefficient	Std. err.	t P> t	Beta
IV _cons			-2.60 0.0 33.61 0.0	

77 .

78 . * Logistic regression results: Odds ratios (OR's) and confidence intervals

79 . logistic DV IV Med \$covs

Logistic regression

Number of obs = 287 LR chi2(2) = 8.53 Prob > chi2 = 0.0141 Pseudo R2 = 0.1065

Log likelihood = -35.755018

DV	Odds ratio	Std. err.	Z	P> z	[95% conf. in	terval]
IV	.2986233	.2469728	-1.46	0.144	.0590402	1.510427
Med	81.93079	179.9052	2.01	0.045	1.107548	6060.825
_cons	.0049923	.0069226	-3.82	0.000	.0003296	.0756159

Note: _cons estimates baseline odds.

80 .

82 . /*SUPPLEMENTAL: DESCRIPTIVE STATISTICS AND CORRELATIONS AMONG VARIABLES BASED

> ON TOTAL EFFECTIVE SAMPLE SIZE ASSOCIATED WITH THE MEDIATION ANALYSES*/

83 .

84 . summarize IV DV Med \$covs

Variable	Obs	Mean	Std. dev.	Min	Max
IV	287	.543554	.4989695	0	1
DV	287	.0313589	.1745901	0	1
Med	287	.4623427	.1686174	0	. 835

85 .

86 . pwcorr IV DV Med \$covs, obs sig

	IV	DV	Med
IV	1.0000		
	287		
DV	-0.1161 0.0495	1.0000	
	287	287	
Med	-0.1522	0.1443	1.0000
	0.0098	0.0144	

287 287 287

```
88 . if $diagnostics==1{
89
90 . *REGRESSION DIAGNOSTICS FOR OLS REGRESSION/MODEL 1
 92 . quietly reg Med IV $covs
93 .
 94 . predict r, residuals
 95 . predict fit, xb
 96 . predict studentized, rstudent
 97 . predict cook, cooksd
 98 . /*Breusch-Pagan test for linear heteroskedasticity/ Koenker (1981) version.
   > Statistical significance is considered an indicator of a violation of the
   > assumption of constant variance (i.e., homoskedasticity).*/
99 .
100 . estat hettest, iid
   Breuschâ€"Pagan/Cookâ€"Weisberg test for heteroskedasticity
   Assumption: i.i.d. error terms
   Variable: Fitted values of Med
   HO: Constant variance
       chi2(1) = 4.11
   Prob > chi2 = 0.0425
101 .
102 . /*White's test for heteroskedasticity of more general functional form.
   > Statistical significance is considered an indicator of a violation of the
   > assumption of constant variance (i.e., homoskedasticity).*/
103 .
104 . imtest, white
   White's test
   HO: Homoskedasticity
   Ha: Unrestricted heteroskedasticity
       chi2(1) = 4.11
   Prob > chi2 = 0.0425
```

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	р
Heteroskedasticity Skewness Kurtosis	4.11 0.98 3.75	1 1 1	0.0425 0.3231 0.0529
Total	8.84	3	0.0315

105 .

107 .

108 . estat vif

Variable	VIF	1/VIF
IV	1.00	1.000000
Mean VIF	1.00	

109 .

110 . /*Skewness and kurtosis of residuals. A skewness and/or kurtosis value greater
 > than 2 in absolute value is often regarded as an indication of more substantial
 > departure from normality. See Lomax & Hahs-Vaughn (2012).*/

111 .

112 . tabstat r, statistics (skewness kurtosis)

Vari	lable	Skewness	Kurtosis
	r	.0598029	2.580515

113 .

115 .

116 . sktest r

Skewness and kurtosis tests for normality

r	287	0.6720	0.0948	3 2	. 99	0.2244
Variable	Obs	Pr(skewness)	Pr(kurtosis)			
onomicoo ana m	***************************************	ioi noimalioj		Joi	: +-	a+

117 .

118 . /*List of cases with studentized residuals > 3 in absolute value. These are > potential residual outliers.*/

119 .

120 . list studentized if abs(studentized) >=3

121 .

122 . /*List of cases with Cook's d values >= 4/n

> (see https://www.stata.com/manuals/rregresspostestimation.pdf).

> Useful for identifying cases that are of high influence on the regression model.*/

123 .

124 . list cook if cook >= 4/e(N)

	cook
32. 43. 68. 73.	.022436 .0150248 .0206549 .0152909 .0169219
112. 195. 214. 275. 281.	.0334303 .0334303 .0165228 .0180425 .0153337

```
125 .
126 . /*Listing cases with Cook's d values > 1 (a fairly common threshold for
   > identifying high influence cases; see e.g., Lomax & Hahs-Vaughn, 2012)*/
127 .
128 . list cook if cook >= 1
129
131 . *REGRESSION DIAGNOSTICS FOR LOGISTIC REGRESSION/MODEL 2
132 .
133 . quietly reg DV IV Med $covs
134 . *Collinearity diagnostics / Tolerance and Variance inflation factors
135 . estat vif
      Variable
                    VIF
                             1/VIF
                     1.02
                            0.976828
           ΙV
                     1.02
                            0.976828
          Med
      Mean VIF
                     1.02
136 .
```

137 . quietly logistic DV IV Med \$covs, coef

138 . predict p

(option **pr** assumed; Pr(DV))

139 . predict pearsonres, residuals

140 . generate logit=ln(p/(1-p))

141 . predict db, dbeta

142 .

143 . /*Below is a List of cases with Pearson residuals > 2.5. According to Pituch & > Stevens (2016), a case with a Pearson residual > |2.5| or |3.0| indicates it > is not adequately fit by the model (making it a potential outlier).*/

145 . list pearsonres if abs(pearsonres) >=2.5

	pearso~s
31. 36. 54. 71.	4.704206 3.011036 8.994146 2.500748 6.03278
202. 205. 223. 232. 249.	2.834261 4.128695 8.994146 5.992768 2.861295

146 .

147 . /*Identifying potential cases having an undue influence on the regression > parameters in the logistic regression model.

> Here, we will use Pregibon (1981) dbeta values to identify cases that may be > exerting undue influence on the logistic regression model parameters. In the > Stata rlogisticpostestimation manual

> [https://www.stata.com/manuals/rlogisticpostestimation.pdf], these values are > described as "the difference in the coefficient vector that is due to deletion > of the observation along with all others that share the same covariate pattern" > (p. 2).

> In the output below, you will find Pregibon (1981) values for cases exceeding the > 95th percentile on the index which can aid in the identification of those cases > that are exerting greater influence on the logistic model. My recommendation is > to use these in conjunction with the scatterplot and index plot that have been > generated to determine which, if any, cases are exerting undue influence on the > model parameters.*/

```
148 .
149 . quietly summarize db, detail
150 . list db if db \geq r(p95)
     31.
            .194689
           .1689801
     36.
     54.
           .7465738
     71.
           .2519116
    117.
           .5633729
    202.
          .1906338
   205.
          .1504559
    214.
          .0125348
    220.
           .0230089
   223.
          .7465738
    232.
          .3660031
          .0230089
    235.
           .0230089
    242.
    249.
           .1868844
           .0230089
   272.
151 .
152 . twoway (scatter db p), name(graph1)
153 . gen case_id = _n
154 . twoway (scatter db case id), name(graph2)
155 . graph combine graph1 graph2, holes(2)
156 . }
157 . macro drop covs reps diagnostics
158 . capture graph drop graph1 graph2
160 .
161 . /*
   > References and suggested readings
   > Cohen, J., Cohen, P., West, S.G., & Aiken, L.S. (2003). Applied multiple
   > regression/correlation analysis for the behavioral sciences (3rd Ed).
   > Mahwah, NJ: Lawrence Erlbaum Associates.
   > Hayes, A.F. (2018). Introduction to mediation, moderation, and conditional
   > process analysis: A regression-based approach (2nd edition). New York: The
   > Guilford Press.
   > Field, A. (2018). Discovering statistics using IBM SPSS statistics (5th ed).
   > Los Angeles: Sage.
   > Koenker, R. (1981). A note on studentizing a test for heteroskedasticity.
   > Journal of Economics, 17, 107-112.
   > Lomax, R.G., & Hahs-Vaughn, D.L. (2012). An introduction to statistical
   > concepts (3rd ed). New York: Routledge.
   > MacKinnon, D.P. (2008). Introduction to statistical mediation analysis. New York:
   > Lawrence Erlbaum Associates.
   > Osborne, J.W. (2015). Best practices in logistic regression. Los Angeles: Sage.
   > Pituch, K.A., & Stevens, J.P. (2016). Applied multivariate statistics for the
   > social sciences (6th ed). Thousand Oaks, CA: Sage.
```

> Pregibon, D. (1981). Logistic regression diagnostics. The Annals of Statistics,

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    > 9, 705-724.
   > Tabachnick, B.G., & Fidell, L.S. (2013). Using multivariate statistics
    > (6th ed.). New York: Pearson.
   end of do-file
162 . save "\med-fs1.med.ualberta.ca\Pediatrics\Symbiota\SyMBIOTA\Datasets\Charlene-Vienna nature project\Br
```

> rged_SBJan182022.dta", replace file \\med-fs1.med.ualberta.ca\Pediatrics\Symbiota\SyMBIOTA\Datasets\Charlene-Vienna nature project

analysis\210726_CLEANED_child_uplvi_npri_cimd_Nielsen_allergens_metadata_merged_SBJan182022.dta

163 . exit