MODMED

Note: this document refers to version 2.0 of the MODMED macro. The syntax structure differs somewhat from instructions provided in Preacher, Rucker, and Hayes (2007). MODMED allows covariates, rendering the earlier MODMEDC obsolete. MODMEDC has been discontinued and is no longer distributed.

```
MODMED VARS = variablelist/DV = dep/MED = mediator
                              /DVMODEL = mediator [dvmodvar]
                              /MMODEL = indep [mmodvar]
                              [/MMODV = {mval}]
                              [/DVMODV = {dvval}]
                              [/VARORD = {var}(2**)]
                              [/COVMAT = {z}(0**)]
                              [/BOOT = {bootn}(0**)]
                              [/JN = {j}(0**)].
```

** Default if subcommand is omitted

Overview

MODMED estimates the conditional indirect effect of a single causal independent variable indep on outcome variable dep through a proposed mediator variable mediator, conditional on a moderator of the path from indep to mediator and/or the path from mediator to dep. It calculates the Sobel test for the conditional indirect effect as well as percentile-based, bias-corrected, and bias-corrected and accelerated bootstrap confidence intervals for the conditional indirect effect. It will also produce regions of significance for the conditional indirect effect at value(s) of the moderator(s) using the Johnson-Neyman technique. By properly specifying the command syntax, it can estimate conditional indirect effects for any of the five models (see "Notes" below) described in Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Assessing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research*, *42*, 185-227. Estimates of all paths are calculated using OLS regression and are in unstandardized form.

Instructions for Use

The MODMED.sps file should be opened as a syntax file in SPSS. Once it has been opened, execute the entire file exactly as is. Do not modify the code at all. Once the program is executed, the MODMED program window can be closed. You then have access to the MODMED command until you quit SPSS. See below for some example commands. The MODMED.sps file must be loaded and reexecuted each time to open SPSS. Please read the "Notes" section below for important details pertinent to execution.

Examples

```
MODMED VARS = happy shyness attitude/DV = happy/MED = shyness/DVMODEL = shyness
attitude/MMODEL = attitude.
```

- Estimates Model 1 (see "Notes"), in which the indirect effect of attitude on happy through shyness is moderated by attitude. In addition to attitude functioning as the independent variable, attitude is proposed to moderate the path from shyness to happy.

```
MODMED VARS = happy shyness attitude activity/DV = happy/MED = shyness/DVMODEL =
shyness/MMODEL = attitude activity.
```

- Estimates Model 2 (see "Notes"), in which the indirect effect of `attitude` on `happy` through `shyness` is moderated by `activity`. This model specifies the path from `attitude` to `shyness` as moderated by `activity`.

```
MODMED VARS = happy shyness activity attitude/DV = happy/MED = shyness/DVMODEL =
shyness activity/MMODEL = attitude.
```

- Estimates Model 3 (see "Notes"), in which the indirect effect of `attitude` on `happy` through `shyness` is moderated by `activity`. In comparison to Model 2 in the example above, this model specifies the path from `shyness` to `happy` as moderated by `activity`.

```
MODMED VARS = happy shyness iq attitude activity/DV = happy/MED = shyness/DVMODEL =
shyness iq/MMODEL = attitude activity.
```

- Estimates Model 4 (see "Notes"), in which the indirect effect of `attitude` on `happy` through `shyness` is moderated by both `iq` and `activity`. In this model, the path from `attitude` to `shyness` is proposed as moderated by `activity`, and the path from `shyness` to `happy` is proposed as moderated by `iq`.

```
MODMED VARS = happy shyness activity attitude/DV = happy/MED = shyness/DVMODEL =
shyness activity/MMODEL = attitude activity.
```

- Estimates Model 5 (see "Notes"), in which the indirect effect of `attitude` on `happy` through `shyness` is moderated by `activity`. This is a combination of models 2 and 3, in which the path from `attitude` to `shyness` *and* the path from `shyness` to `happy` are both proposed as moderated by `activity`.

Specifying the Variables in the Model

Any moderated mediation model will include at least four variables (`indep`, `dep`, `mediator`, and either `dvmodvar` or `mmodvar`), depending on the number of moderators and covariates. All variables in the model must be listed, in any order, in `variableslist`. A failure to do will produce errors.

Specifying the Mediator Variable Model

The /`MMODEL` subcommand is required and specifies the model of the mediator variable. All variables listed in /`MMODEL` must also be listed in `variableslist` in the `VARS` section of the command. In a simple moderated mediation model, the independent variable is required and must be listed first in the /`MMODEL` list of variables. If the path from `indep` to `mediator` is proposed to be moderated, then a single proposed moderator variable should be listed next in variable list, after `indep`. No more than two variables can be listed in /`MMODEL`. The inclusion of a proposed moderator will automatically generate a new variable in the mediator model defined as the product of `indep` and `mmodvar`. To include statistical controls in the model of the mediator, see the "Covariates" section below.

Specifying the Dependent Variable Model

The syntax conventions for `/DVMODEL`, which is required, is the same as for `/MMODEL`. `/DVMODEL` specifies the model of the dependent variable, `dep`. All variables listed in `/DVMODEL` must also be listed in the `variableslist` in the `VARS` section of the command. In a simple moderated mediation model, the mediator variable `mediator` is required and must be listed first in the `/DVMODEL` list of variables. If the path from `mediator` to `dep` is proposed to be moderated, then a single proposed moderator variable should be listed next in variable list, after `mediator`. No more than two variables can be listed in `/MMODEL`. The inclusion of a proposed moderator will automatically generate a new variable in the dependent variable model defined as the product of `mediator` and `dvmodvar`. There is no need to specify the independent variable in the model of the dependent variable, as `indep` is automatically included in the model of the dependent variable, and it is not possible to override this setting. To include statistical controls in the model of the dependent variable, see the "Covariates" section below

Probing Moderated Indirect Effects

If a variable listed as a moderator of either of the paths comprising the indirect effect from `indep` to `dep` through `mediator` is quantitative, `MODMED` by default produces the conditional indirect effect for values of the moderator or moderators equal to the sample mean as well as one standard deviation above and below the sample mean. If a moderator variable is dichotomous, the conditional indirect effect for the two categories of the moderator variable are produced. The user can request conditional indirect effects at specific values of the moderator of moderator variables using the `/DVMODV` (for models 1, 3, 4, and 5) and `/MMODV` (for models 2, 4, and 5) subcommands, which refer to "dependent variable model moderator value" and "mediator variable model moderator value" respectively. For instance, if `mmodvar` is listed as the moderator of the effect of `indep` on `mediator` and the user desired the conditional indirect effect when `mmodvar` is equal to 4, the subcommand `/MMODV = 4` would produce the conditional indirect effect of `indep` on `dep` through `mediator` when `mmodvar` is at the value of 4. `/DVMODV` and `/MMODV` can be used in conjunction when models 4 is estimated.

Example:

```
MODMED VARS = happy shyness attitude activity/DV = happy/MED = shyness/DVMODEL =
shyness/MMODEL = attitude activity/MMODV =2.
```

This command estimates the conditional indirect effect of `attitude` on `happy` through `shyness` when `activity` is equal to 2, with `activity` proposed as moderating the effect of `attitude` on `shyness` (model 2).

Regions of Significance

An alternative approach to probing moderated indirect effects is the Johnson-Neyman technique. This approach estimates the value or values of the moderator where the conditional indirect effect transitions between statistically significant (using $\alpha = 0.05$ level of significance) and nonsignificant. This approach can only be used for quantitative moderators and is turned on using the `/JN` subcommand and setting `j` to 1. `MODMED` will produce a table of conditional indirect effects, with normal theory hypothesis tests and confidence intervals, across the range of the moderator, inserting the points defining the region(s) of significance into the table if those points exist.

Example:

```
MODMED VARS = happy shyness attitude activity/DV = happy/MED = shyness/DVMODEL =
shyness/MMODEL = attitude activity/JN = 1.
```

This command estimates the conditional indirect effect of attitude on happy through shyness as a function of activity (model 2) and estimates the values of activity at which the indirect effect transitions between statistically significant and nonsignificant.

The Johnson-Neyman method assumes the sampling distribution of the conditional indirect effect is normal. This assumption is difficult to justify in all but large samples. This method is useful for honing in on regions of significance, but the use of bootstrap confidence intervals for inference is recommended for reporting in scientific reports.

Regions of significance are not generated when the user requests the conditional indirect effect for a specific value or values of a moderator using the /MMODV or /DVMODV commands.

Bootstrapping

The /BOOT subcommand, when used in conjunction with the /DVMODV or /MMODV subcommands, generates a bootstrap confidence interval for the conditional indirect effect at a value of the moderator(s) specified in mval and/or dvval. Because the sampling distribution of the indirect effect is rarely symmetrical, bootstrap confidence intervals are a preferred inferential method. See Preacher, Rucker, and Hayes (2007) for a discussion. Bootstrapping is turned on by specifying the /BOOT subcommand and setting bootn to any interval of 1000 corresponding to the number of bootstrap samples requested (e.g., 3000 for 3000 bootstrap samples)

Example:

```
MODMED VARS = happy shyness attitude activity/DV = happy/MED = shyness/DVMODEL =
shyness/MMODEL = attitude activity /MMODV =4/BOOT = 5000.
```

This command estimates the conditional indirect effect of attitude on happy through shyness when activity is equal to 4, with activity proposed as moderating the effect of attitude on shyness (model 2), while producing a 95% bootstrap confidence interval for this conditional indirect effect based on 5000 bootstrap samples.

Covariates

Any variable in variablelist that is not specified as mediator, dep, indep, dvmodvar, or mmodvar is treated as a covariate. Covariates are included in the models of mediator and dep. So paths (conditional and unconditional) between indep and mediator and mediator and dep control for those covariates

VARODER subcommand

The /VARORDER subcommand is used to request first or second order variance estimates for computation of standard errors of indirect effects. By setting var to 1, first order variance estimates are

used. The default for `var` is 2 when this subcommand is omitted, which specifies second order variance estimates.

COVMAT subcommand

The /COVMAT subcommand is used to request the covariance matrix of the coefficients for the model. By default, `c` is set to 0, which suppresses printing of the covariance matrix. To print these covariances, set `c` to 1.

PROCESS as a substitute for MODMED

PROCESS is capable of almost everything that MODMED can do, but PROCESS has many more features not available in MODMED and it is much easier to use. PROCESS is introduced in Hayes (2018) *An Introduction to mediation, moderation, and conditional process analysis* (http://www.guilford.com/p/hayes3). Any model that MODMED can estimate can also be estimated by PROCESS.

Notes

- MODMED can *only* estimate one of the five models described in Preacher et al. (2007). If you have correctly specified one of the five models, the output will specify which model you have specified.

- A case will be deleted from the analysis if missing on any of the variables listed in `variableslist`.

- All path coefficients in the output are unstandardized.

- Do not use STRING formatted variables in any of your models. Doing so will produce errors. All variables should be NUMERIC format.

- The dependent (dep) and mediator (mediator) variables cannot be dichotomous or categorical. MODMED should not be used for modeling dichotomous outcomes or mediators. For a dichotomous outcome, use PROCESS.