**Multilevel Structural Equation Modeling**

**Analysis Plan**

A multilevel structural equation model (MSEM) was run to test the following study hypotheses:

H1: Suggesting exercise as an alternative to marijuana use enhances the effect of traditional Motivational Interviewing (MI).

H2: For the typical person, the use of marijuana protective strategies (MPS) and the perceived helpfulness of MPS are associated with less marijuana use (MU).

H3: During a given MU episode, the use of strategies and the helpfulness of strategies are associated with less MU.

All study variables were treated as continuous and normally distributed. Treatment condition (i.e., MI vs. MI+exercise) was coded 0 = MI, 1 = MI+exercise. Use of strategies, helpfulness of strategies, and MU were examined on both the within and between levels. Treatment condition was specified as a between only variable model. A path model is presented in Figure 1.

Analyses were conducted using Mplus 7.4 (Muthén & Muthén, 1998–2012). The model was run as a fixed effects model (i.e., intercepts and slopes were not free to vary). This approach utilizes the repeated assessments of the data to provide a more robust point estimate.

Hypothesis 1 was tested by examining the between level effect of treatment condition predicting MU.

Hypothesis 2 was tested by examining the regression paths on the between level.

Hypothesis 3 was tested by examining the regression paths on the within level.

To evaluate overall model fit, we used model fit criteria suggested by Hu and Bentler (1999) including the comparative fit index (CFI) > .95, Tucker–Lewis Index (TLI) > .95, root mean square error of approximation (RMSEA) < .06, and standardized root mean square residual (SRMR) < .08. In addition, we evaluated the Chi-Square test of model fit, where a non-significant test indicates perfect fit of the model to the data.

**Results**

*Overall Model Fit.* The MSEM resulted in excellent model fit. The Chi-Square test of model fit was not significant (χ2(1) = .378, p = .89). Overall fit indices were all in the excellent range (RMSEA = .00; CFI = 1.00; TLI = 1.00; SRMRwithin < .001; SRMRbetween = .023).

*Within level.* During a given use episode, the helpfulness of protective strategies was negatively

associated with marijuana use (b = -.06, SE = .03, p = .03), but the sheer use of strategies was not (b = .11, SE = .18, p = .54).

*Between level.* For the average person, across episodes neither having a tendency to use strategies or having a tendency to rate strategies as helpful were predictive of marijuana use (Strategy use: b = .09, SE = .66, p = .89; Helpfulness of strategies: b = .02, SE = .11, p = .88). Adding the suggestion of exercise as a supplement to MI did not have an effect on marijuana use (b = .05, SE = .26, p = .86).

**Discussion**

The present study examined between and within person effects of MPS use and perceived helpfulness of MPS on MU, as well as the effect of adding the suggestion of exercise as a supplement to MI. There was no added effect of adding an exercise module to the MI intervention. Examination of the between and within level MPS effects revealed that reductions in MU are the result of choosing helpful strategies during a given episode, not the sheer use of strategies, or having a tendency to use strategies. This suggests that clinicians should identify strategies clients view as helpful and that clinicians should consider setting-specific strategies, as what works in one setting may not work well in another setting.