**Latent Growth Curve Model Write-up**

**Analysis Plan**

In order to examine participants’ response to treatment we ran a series of latent growth curve models (LGCMs; Curran & Hussong, 2003) using Mplus version 7.2 (Muthén & Muthén, 1998-2012). LGCMs are constructed in a structural equation modeling framework where a latent intercept and slope are derived from repeated measures of observed variables. The latent intercept variables reflect the initial level of growth curve. In the current analyses, the intercept represented the intake value for all constructs (i.e., abstinent and light drinking days, heavy drinking days, alcohol consequences, and situational confidence), with the exception of the strategy use variable, which was not measured until the first posttreatment assessment. Thus, the intercept for the strategy use items represents the level of the growth curve at the first posttreatment assessment. The latent slope was created to reflect the rate of change in the constructs examined across the 12 months of data collection. There are a variety of ways to specify rate of change with the slope parameter (e.g., linear, quadratic, log). In the current analyses we chose to fit linear growth models to the data. Specifying linear growth is the most common approach used in LGCMs, in part because of a lack of theoretical justification for non-linear growth and for ease of interpretation. Employing LGCMs to model change overtime allows us to examine treatment effects on the rate of change of important constructs, as well as to test for any initial differences among the treatment conditions.

There were a few statistical considerations we needed to address when running LGCMs. First, because there are three treatment conditions we created dummy codes to examine treatment effects on the rate of change and to test for initial differences among treatment conditions. The use of dummy codes necessitates running each LGCM twice to gain access to all pairwise comparisons among the treatment conditions. Second, three of our primary outcomes were not normally distributed (i.e., abstinent and light drinking days, heavy drinking days, and alcohol consequences). The alcohol consequences variables were amenable to a square root transformation, and the LGCM for alcohol consequences was run with the square root transformed variables. The abstinent and light drinking days variables and the heavy drinking days variables had ceiling and floor effects, respectively. These variables were most appropriately modeled in the LGCMs as censored from above or below, accordingly. Censored variables are semicontinuous with a portion of responses equal to a single value (e.g., the floor or ceiling value) and a continuous, often skewed, distribution among the remaining values (Olsen & Schafer, 2001). Censored regression can be thought of as a two-part regression model with a probability of giving a response at the censored value and a conditional linear model for the mean response given it is nonzero (Olsen & Schafer, 2001). Censored regression models have long been applied to alcohol use data (cf. Hansen & Graham, 1991).

LGCMs were estimated using Full Information Maximum Likelihood (FIML) for models where the variables were normally distributed (Enders, 2001). In addition to providing parameter estimates for the LCGMs, Schafer and Graham (2002) recognize FIML as a best practice strategy for modeling missing data. For LGCMs that included censored variables we utilized maximum likelihood estimation with robust standard errors and chi-square (MLR). The MLR estimator is recommended over the default maximum likelihood (ML) estimator when data are both missing at random and non-normally distributed because ML estimation tends to produce low standard errors and inflated model rejection rates with non-normal data (Enders, 2001; Muthén, & Asparouhov, 2002; Schafer & Graham, 2002). Overall model fit for models with normally distributed variables was evaluated following recommendations by Hu and Bentler (1999). Specifically we chose to focus on the Comparative Fit Index (CFI; Bentler, 1990) and the Standardized Root Mean Residual (SRMR; Bentler, 1995). Hu and Bentler (1999) recommend cutoffs values close to .95 for CFI and values close to .08 for SRMR. Overall model fit is not available for LGCMs run with censored variables. MLR with censored variables relies on raw data rather than means, variances, and covariances, which precludes the estimation of typical tests of overall model fit (Simons et al., 2014).

**Results**

Figure 1 presents changes in abstinent and light drinking days (upper panel) and heavy drinking days (lower panel) over the course of the study, by treatment condition.

Overall model fit. Overall model fit was not available for the LGCMs examining changes in abstinent and light drinking days, or heavy drinking days due to the censored distribution of the data. Overall model fit for the LGCM examining changes in alcohol consequences and strategy use over the course of the study were excellent (alcohol consequences: CFI = .96; SRMR = .06; strategy use: CFI = 1.00; SRMR = .02), and was acceptable for changes in situational confidence for avoiding heavy drinking (CFI = .87; SRMR = .05).

Intercept and slope. The intercept and slope parameter estimates, standard errors, and p-values are presented in Table 1. All intercepts were positive and statistically significant, with the exception of heavy drinking days, which was positive but not statistically significant. Interpretation of the intercepts reveals that participants reported, 18 abstinent days, 1.55 heavy drinking days, 12.89 alcohol related consequences (note that alcohol related consequences was square-root transformed so the estimate needs to be squared to interpret correctly), high levels of situational confidence, and moderate levels of strategy use at the first assessment. The slopes for heavy drinking days, alcohol related consequences, and strategy use were negative, but only the slope for heavy drinking days was statistically significant. This suggests that while heavy drinking days reduced over the course of the study, alcohol related consequences and strategy use remained stable. The slopes for abstinent and light days and situational confidence were positive, but only the slope for abstinent and light days was significant. This indicates that participants increased abstinent and light days over the course of the study, but situational confidence remained stable.

Treatment condition. Treatment condition did not predict either the intercept or slope parameters in any of the models. This suggests that the treatment group reported similar levels of abstinent and light days, heavy drinking days, alcohol related consequences, situational confidence, and strategy use.

**Discussion**

The rural drinking problem of men and women in this study overall exhibited medium sized increases in abstinent and light drinking days and small sized decreases in heavy drinking days from before to after participation in these secondary prevention intervention conditions focused on drinking reduction. Further, these changes in drinking continued to improve over the course of a 12-month follow-up period. Specifically, participants continued to increase abstinent and light days and decrease heavy days linearly across the 12-month follow-up period. These reductions are consistent with previous research showing that secondary prevention interventions with persons not severely dependent on alcohol can be beneficially applied in service of reducing alcohol consumption (e.g., Apodaca & Miller, 2003; van Amsterdam & van den Brink, 2013), including to persons living in rural areas. In addition, following moderate reductions in alcohol consequences and increases in confidence not to drink heavily across a variety of situations from pre- to posttreatment, consequences and confidence levels remained stable across the course of the study. Use of the drinking reduction strategies also remained stable from posttreatment to the 12-month follow-up.

The results did not suggest that the addition of a telephone motivational interview or a telephone motivational interview combined with biweekly telephone sessions over the 12-week intervention period overall provided further benefit to the participants. For each outcome variable assessed, the initial levels and changes across time did not vary as a function of the respective treatment conditions. Indeed, participants who only received the self-directed manual did as well as those who in addition received the treatment enhancements. It is not known why the enhancements did not provide the anticipated additional benefit. Perhaps the most plausible reason is that this group of self-referred individuals, responding to an advertisement for the project and initiating the process of their participation, already were sufficiently engaged and motivated to pursue the process of changing their drinking through use of the self-directed manual. This possibility would be consistent with past research on the use of bibliotherapy interventions with problem drinkers that has shown benefit (Apodaca & Miller, 2003).

Table 1. Latent Growth Curve Model intercept and slope estimates.

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| --- | --- | --- | --- | --- | --- | --- |
|  | Intercept | | | Slope | | |
|  | Estimate | SE | p | Estimate | SE | p |
| Abstinent and Light Days | 18.24 | 1.62 | <.001 | 2.36 | .57 | <.001 |
| Heavy Drinking Days | 1.55 | 1.17 | .19 | -1.41 | .35 | <.001 |
| Alcohol Related Consequences | 3.59 | .39 | <.001 | -1.02 | .81 | .21 |
| Situational Confidence | 69.49 | 3.65 | <.001 | .52 | .57 | .36 |
| Strategy Use | 5.09 | .25 | <.001 | -.10 | .11 | .39 |

