BIS Behavioral Interventions Scholars

# Optimizing the Amount and Type of Practitioner Contact in Online Relationship Education for Couples With Low Incomes: Deploying Machine Learning Models to the Web

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## Background and Objectives

Since 2005, the federal **Healthy Marriage and Responsible Fatherhood** program, funded and administered by the Office of Family Assistance within the Administration for Children and Families, has awarded grants to organizations to support healthy relationships, parenting, and economic stability among families with low incomes. As part of this program, healthy marriage and relationship education services aim to promote healthy relationships among adult couples, adult individuals, and youth.

There has been attention within the research and evaluation literature on whether relationship education programs improve relationship satisfaction among couples who have low incomes (Hawkins & Erikson, 2015). However, some research has shown these programs experience problematic attrition rates and effect sizes are small and often non-significant (Johnson, 2012; 2013), although the extent to which these two problems are related remains unclear. There is some evidence that programs serving couples with low incomes that made adaptations, such as making programs briefer and web-based, increased completion rates, and improved relationship satisfaction (Doss et al., 2020). However, some couples still do not benefit from these programs as much as they could. Indeed, the level of support couples require (i.e., the types of adaptations needed to improve their likelihood of program completion and success) are likely affected by demographic variables, couples' current level of relationship functioning, individual distress, and motivation (as an individual and as a couple) to succeed and change their relationship (Mohr et al., 2011).

**This study aimed to:**

1. determine how accurately demographics, baseline relationship functioning, individual distress, and the motivation to succeed and change behavior predict program completion and changes in relationship satisfaction;
2. identify what predicts success within three different levels of relationship coaching;
3. examine what predicts differences in program attendance and gains in relationship satisfaction *between* three levels of coaching and a waitlist condition; and
4. translate the complex findings into a web-based dashboard to assist practitioners in matching couples to a unique level of coaching based on couple-level characteristics.

The current study utilized machine learning and web development to create a tool for practitioners to assign couples to a level of coach support based on their unique baseline characteristics.

Data for this study come from a large web-based **Sequential Multiple Assignment Randomized Trial (SMART),** which varies the levels and types of relationship coach contact that a couple receives. In the current study, couples were initially assigned to one of three levels of coaching (Full Coach, Automated Coach, and Contingent Coach conditions), or the waitlist control condition. Couples who were non-adherent to the Automated Coach condition (i.e., did not complete an activity for 11 days) were then randomly reassigned either to remain in the same (Automated Coach) condition or to work with a coach.

## Findings and Takeaways

| Result | Takeaway |
|---|---|
| The model correctly predicted which couples would complete the program and which were likely to drop out (nearly 65% of the time). We were able to explain a large part of documented changes in relationship satisfaction. | We were able to better predict gains in relationship satisfaction than other machine learning studies in this area. Expanding efforts to include information from coaches, behavioral observations, physiological measures, and genetics could result in better predictions. |
| Many demographic variables (e.g., age, race, ethnicity) as well as baseline measures of relationship functioning, individual distress, and motivation to succeed and change behavior predicted program completion and changes in relationship satisfaction. Seven out of the 78 tests performed were significant when predicting program completion, and 60 out of the 102 tests performed were significant when predicting changes in relationship satisfaction. However, these predictions were complex and non-linear. | We used robust methods (i.e., bootstrapped permutations of the data and cross validation) to test for significance, which gives us confidence in these results given the number of tests conducted. Models relying on non-linear approaches (i.e., random forests) provided the most trustworthy results, but are complicated for many non-researchers to understand and use. To translate these complex findings into guidance for practitioners, web-based tools are needed to assist practitioners in using these variables to predict program completion. |
| Using predicted individual treatment effects that were estimated in the previous two aims, we were able to explain between 41.6-84.9% of the between coaching-level variance. Over one hundred variables were identified as having significant between coaching-level implications (see Figure 1 - Appendix). Predicted individual treatment effects indicated that some couples fared better in some conditions over others (e.g., up to 69.02% of couples fared better in the full coaching over the waitlist condition; see Figure 2 - Appendix). | Different from the within-group analysis, the between group analyses show that many variables were important predictors, and predictor variables interact in a multivariable fashion. Baseline relationship satisfaction and household income were especially important predictors. In addition, some couples fare better with certain levels of coaching (i.e., intervention versus control) than other couples. Uncovering how these variables react in a non-linear context would be an exciting area for future research. |

Utilizing web-based technologies, practitioners now have an easy way to match unique couples to a level of coaching that would best meet their needs at the web address provided. Please note, these analyses are computationally intensive, and *it will take a few minutes to load* (**https://gabe-hatch.shinyapps.io/hatchdamh/**).

# Appendix

**Figure 1.** Using random forests, hundreds of significant effects emerged when investigating differences between coaching changes in relationship satisfaction. Nearly all demographic variables, measures of relationship/individual functioning, and motivation are significant predictors of changes in relationship satisfaction or program completion between different levels of coaching.

This figure (an illustration of the random forest non-parametric modeling) illustrates that matching unique couples to unique levels of coaching is a complex multivariable process. It demonstrates that relying on a single metric (e.g., demographic variables, measures of relationship/individual functioning, and motivation) is likely insufficient to explain program success. Variables that may not be immediately obvious (e.g., perceptions of chaotic living) play a role in matching unique couples to a level of coaching that would meet their unique needs.

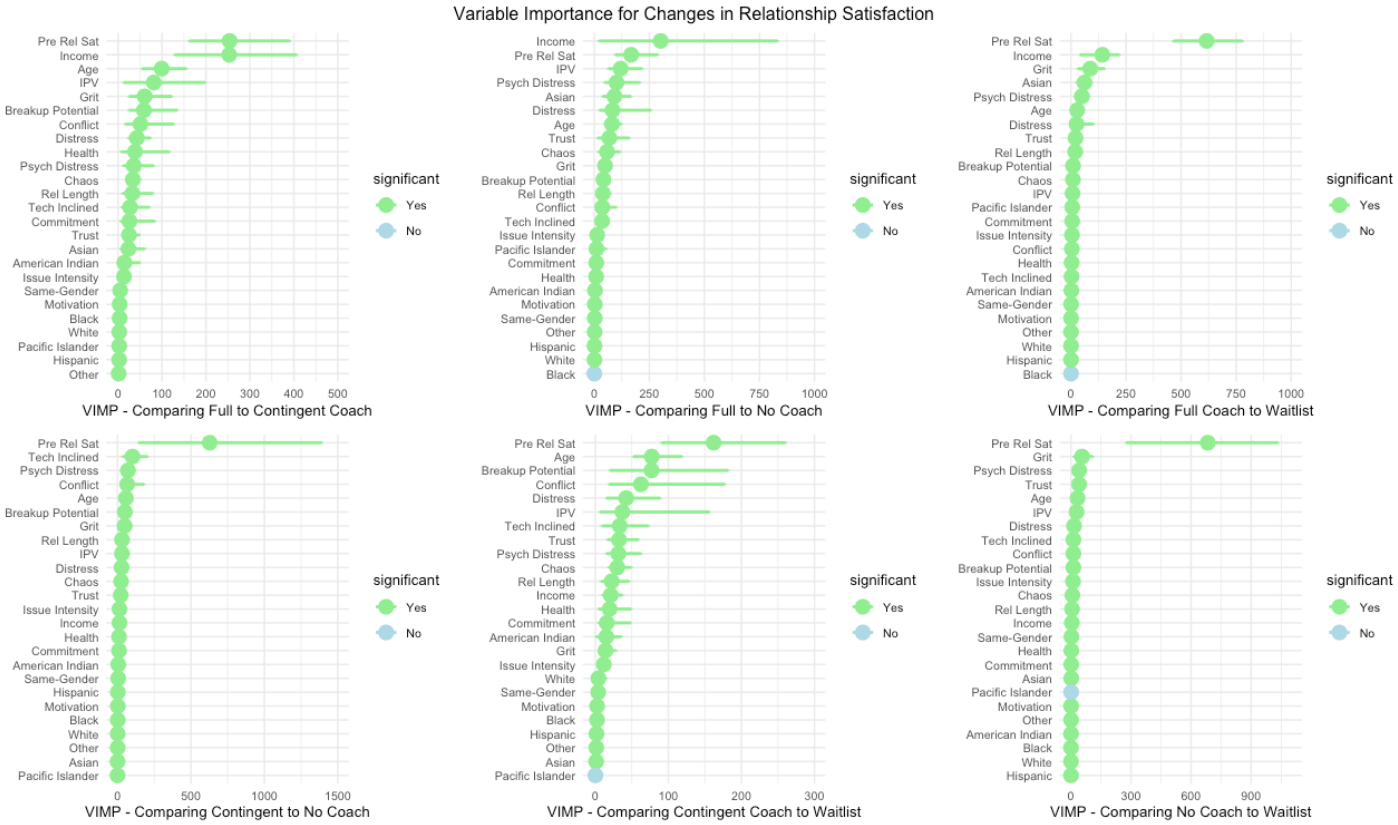
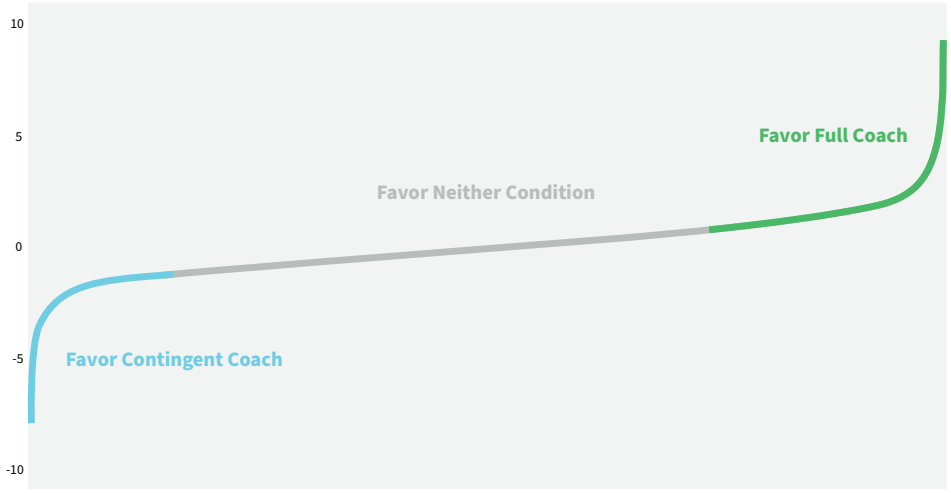


**Figure 2.** Predicted individual treatment effects indicated that some couples fared better with less coaching (Favor Contingent Coach), for some it does not make a difference (Favor Neither Condition), while some couples find more coaching beneficial (Favor Full Coach). Some couples respond better to one level of coaching over another. However, these relationships are complex, involve a lot of variables, and are non-linear (or non-parametric). Web-based applications can perform these computations quickly and efficiently, much more quickly and efficiently than an individual practitioner could in deciding which approach to use with which clients, based on their characteristics. This points to the value of web-based assessment devices in the field of relationship education.




**80% Prediction Intervals for Full Versus Contingent Coach:**
**Comparing Differences in Relationship Satisfaction**

## References

Doss, B. D., Knopp, K., Roddy, M. K., Rothman, K., Hatch, S. G., & Rhoades, G. K. (2020). Online programs improve relationship functioning for distressed low-income couples: Results from a nationwide randomized controlled trial. *Journal of Consulting and Clinical Psychology*, 88(4), 283–294. https://doi.org/10.1037/ccp0000479

Hawkins, A. J., & Erickson, S. E. (2015). Is couple and relationship education effective for lower income participants? A meta-analytic study. *Journal of Family Psychology*, 29(1), 59–68. https://doi.org/10.1037/fam0000045

Johnson, M. D. (2012). Healthy marriage initiatives: On the need for empiricism in policy implementation. *American Psychologist*, 67(4), 296–308. https://doi.org/10.1037/a0027743

Johnson, M. D. (2013). Optimistic or quixotic? More data on marriage and relationship education programs for lower income couples. *American Psychologist*, 68(2), 111–112. https://doi.org/10.1037/a0031793

Mohr, D. C., Cuijpers, P., & Lehman, K. (2011). Supportive accountability: a model for providing human support to enhance adherence to eHealth interventions. *Journal of Medical Internet Research*, 13(1), e30. https://doi.org/10.2196/jmir.1602

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