# README: miWQS

### Introduction

We have integrated WQS regression into the MI framework in a flexible  $\mathcal{R}$  package called  $\mathbf{miWQS}$  to meet a wide variety of needs (Figure 1). The data used in this package consist of a mixture of correlated components that share a common outcome while adjusting for other covariates. The correlated components in the set, X, may be complete or interval-censored between zero and low thresholds, or detection limits, that may be different across the components. The common outcome, y, may be modeled as binary, continuous, count-based, or rate-based and can be adjusted by the family and offset arguments of estimate.wqs(). Additional covariates, Z, may be used in the bootstrap imputation and WQS models.

If X is interval-censored, the choice of the imputation technique depends on the majority vote of BDL values among the components [1]. When most chemicals have 80% of its values BDL, we suggest to use the BDLQ1 approach. When most chemicals have less than 80% of its values BDL, the user should perform Bayesian or bootstrapping multiple imputation. Previous literature suggests to ignore any chemicals that have greater than 80% of its values BDL. The  $\mathbf{miWQS}$  package, though, still allows the user to perform single imputation. Regardless of the technique used, researchers may use the  $\mathbf{miWQS}$  package in order to detect an association between the mixture and the outcome and to identify the important components in that mixture.

#### Installation

You can install the released version of miWQS from CRAN with:

install.packages("miWQS")

## Example

Please see the vignette (that will soon be published)[2] for a detailed step-by-step guide in using this package.

#### References

- Hargarten, P.M.; Wheeler, D.C. (2020). Accounting for the Uncertainty Due to Chemicals below the Detection Limit in Mixture Analysis. Environmental Research, 186: 109466. https://doi.org/10.1016/j. envres.2020.109466.
- 2. Hargarten, P.M. & Wheeler, D.C. (2021). miWQS: Multiple Imputation Using Weighted Quantile Sum Regression. The R Journal, Vol(No),

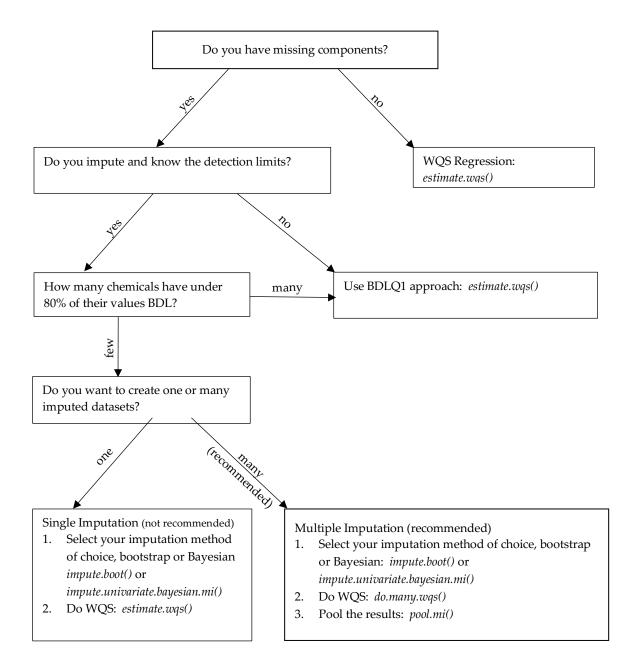


Figure 1: A decision tree to help researchers in using the miWQS package. The package is flexible and can meet a wide range of needs.