Prototype Model Library for Bayesian Pharmacokinetic/Pharmacodynamic (PKPD) Modeling in Winbugs
William R Gillespie and Marc R Gastonguay
Metrum Institute, Tariffville, CT 06081 USA

Background
- There is increasing interest in and use of Bayesian methods for PKPD modeling.
- A barrier to wider use of Bayesian PKPD modeling is the amount of custom programming required for each application.
- WinBUGS and Pharmica (1) partially address this problem by providing functions for linear, 1, 2 and 3 compartment PK models and data management tools for WinBUGS (2).
- But they are limited to a small number of models and do not properly handle time-varying covariates.
- There is a need for a more comprehensive model library comparable in scope to NONMEM/PREDPP (3).

Implemented PKPD Models
- The current prototype BUGS PKPD model library contains functions implementing:
  - Specific linear compartmental models
  - General linear compartmental models described by a system of first order ODE's
  - General linear compartmental models described by a matrix exponential function

Simulation Details
- Core model library procedures are programmed in Component Pascal and compiled with the BlackBox Component Builder (4).
- An extensible object-oriented programming approach is used to facilitate development of additional models.
- The BUGS language interface in WinBUGS 1.4.3 is implemented using WBDev (5).
- Two and three compartment models.

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  - One compartment model with first order absorption
  - Two compartment model with elimination from and first order absorption into central compartment
  - General linear compartmental models described by a system of first order ODE's

Example 1
- Two compartment PK model with first order absorption

Example 2
- Two compartment PK model with first order absorption + effect

Example 3
- Two compartment PK model with first order absorption + indirect action PKPD model

References
8. RJ Campbell. Lsolve (http://www.cimmsolutions.com/common/COMMON.htm)

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