

The model discussed in this article can be defined using LATENT GOLD software 4.5 (Vermunt JK, Magidson J. LATENT GOLD User's Manual. Statistical Innovations Inc: Boston, 2000), a latent class software that finds the ML estimates through the EM and Newton–Raphson algorithms. What we need is to define in the syntax module a series of regression equations for the latent and/or the response variables, and settings for the variances and covariances.

Before defining the regression equations, we have to specify the technical and output options, as well as the names and scale types of the latent, dependent variables that play a role in the model. The model definition for the specification of the BM and LCBM consists of simple commands on the syntax module of the software.

We specify the initial set of parameters, although local maxima and lack of convergence are avoided with the reported algorithm options.

```

//Bivariate Model
model
title 'BM test';
options
  algorithm
    tolerance=1e-008 emtolerance=0.01 emiterations=500 nriterations=50;
startvalues
  seed=0 sets=50 tolerance=1e-005 iterations=150;
bayes
  categorical=1 variances=1 latent=1 poisson=1;
quadrature
  nodes=10;
output
  parameters=effect standarderrors profile estimatedvalues
  iterationdetails;
variables
  dependent tp binomial exposure=disease, tn binomial exposure=healthy, test;
  latent t nominal 2, mu continuous, vu continuous;

equations
  t <- (0.772188) 1;
  test <- (d~wei) t;
  eta <- t;
  vu <- t;
  tp <- 1 + (1) mu; // regression equation for sensitivity
  tn <- 1 + (1) vu; // regression equation for specificity
  mu; // variance mu
  vu; // variance vu
  mu <-> vu; // covariance mu-vu
  d = {1 0 0 1};

{
  0.6118007596941656 // set of initial parameters
  0.3767547470430903
  2.794938780667029
  1.453721147015295
  1.039332760965706
  0.991318408692061
  0.1325671272119704
}
end model

```

```

//Latent Class Bivariate Model
model
title 'LCBM test';
options
  algorithm
    tolerance=1e-008 emtolerance=0.01 emiterations=500 nriterations=50;
  startvalues
    seed=0 sets=50 tolerance=1e-005 iterations=150;
  bayes
    categorical=1 variances=1 latent=1 poisson=1;
  quadrature
    nodes=10;
  output
    parameters=effect standarderrors profile estimatedvalues iterationdetails;
variables
  dependent tp binomial exposure=disease, tn binomial exposure=healthy, test;
  latent t nominal 2, c nominal 2, mu continuous, vu continuous;
equations
  t <- (0.772188) 1;
  test <- (d~wei) t;
  c <- 1 + t;
  tp <- 1 | c + (1) mu;    // regression equation for sensitivity
  tn <- 1 | c + (1) vu;    // regression equation for specificity
  mu | c;                  // variance mu
  vu | c;                  // variance vu
  mu <-> vu | c;          // covariance mu-vu

  d = {1 0 0 1};
{
  0.4735558360355783      // set of initial parameters
  -1.358539194847309
  1.872369397280165
  3.831519465879959
  0.9143078109545019
  2.038997362223336
  0.1179006113871694
  0.7726622307426895
  1.268099770282355e-015
  0.9852456523927696
  -0.8075096254972372
  -0.2056679110205493
}
end model

```