1. Fit model with logit from a loglinear
   1. Misc. Notes
      1. General linear models (GLMs)
         1. Logistic regression (Logit model): *Y* is a Bernoulli r.v.
            1. or

: tells whether the relationship is positive or negative.

* + - 1. Loglinear model: *Y* is a Poisson r.v. with mean *µ*.
         1. or
      2. Probit model: another link function, using probability units from the *CDF* of the standard normal.
         1. or
    1. Wald and LRT tests
       1. Wald (*from software*):
          1. *H0*:
          2. *Ha*:
       2. LRT:
          1. *H0*:
          2. *Ha*:
    2. Model residuals
       1. Pearson residuals:
       2. Standardized Pearson residuals for Poisson regression models: , where is *i*th diagonal of hat matrix.
  1. Loglinear models
     1. Tests
        1. Goodness-of-fit test: , where is Residual Deviance and *df* is Residual Degrees of Freedom.
     2. Models for 2-Way Tables
        1. Independence model:
           1. Constraint: set *I­* – 1 coefficients and *J* – 1 coefficients equal to 0.
           2. Odds: odds of *Y* being at *j* as opposed to *k* when *X* = *i*.
        2. Saturated model (*IJ* parameters, perfect fit):
           1. Constraint: set or
           2. Local Odds Ratio: Compute for all possible partial 2 × 2 tables.

; matches odds ratio by observed frequencies.

* + 1. Models for 3-Way Tables
       1. Mutual independent model (*X*, *Y*, *Z*):
          1. Variables are unrelated.
       2. (*XY*, *Z*), (*XZ*, *Y*), (*X*, *YZ*) model:
          1. (*XY*, *Z*): *X* and *Y* are dependent given *Z*.
       3. (*XY*, *XZ*), (*XY*, *YZ*), (*XZ*, *YZ*) model:
          1. (*XY*, *XZ*): *X* and *Y* are dependent given *Z*; *X* and *Z* are dependent given *Y*.
       4. Pairwise dependent model (*XY*, *XZ*, *YZ*) model:
          1. Homogenous association: relationship between *Y* and *Z* does not depend on *X*

, same for *j* (*Y*) and *k* (*Z*).

Conditional independence:

Test by with Residual Deviance.

Lowest value of *G*2 is a better fit.

Reduced model is better 🡪 conditional independence.

Conditional Odds Ratio:

Interp

“There is a strong (weak) positive association between [*X*] and [*Y*], given a level of [*Z*].”

“[*X*] and [*Y*] are conditionally independent given [*Z*].”

* + - 1. Saturated model (*XYZ*):
  1. Logit model from (*XY*, *YZ*, *XZ*):
     1. Conditional odds ratios: ;
        1. Interp of : “The odds of [*Y* = 1] when [*X* = 1] are [] the odds of [*Y* = 1] when [*X* = 2].”
     2. Response variable:

1. Model with ordinal associations
   1. Models
      1. Independent model: where all
      2. Saturated model:
      3. Uniform association model:
   2. Odds ratios
      1. If and or intervals between weights are equal
         * 1. All local OR will be the same since depends on neither *i* nor *j*.
           2. A 1-unit increase in level is the same at each level.
      2. If intervals between weights are unequal: *i* = {*a*, *c*} and *j* = {*b*, *d*}.
         1. Akin to having *a* = *i*, *c* = *i* + 1, *b* = *j*, and *d* = *j* + 1.
      3. CI:
      4. Interp
         1. “According to the estimate, the association is (positive/negative), implying that subjects in [category on one variable] also tend to [category on other variable].”
         2. “The association is (weak/strong). However, with distance, the odds ratios are (larger/smaller). For example, the odds of responding [extreme on one variable] over [other extreme on the same variable] are [] times higher if the subject responded [extreme on other variable] versus [other extreme on other variable].
         3. “The odds of responding in the adjacent category on [one variable] are [] more likely if subject responded in [higher category of the other variable] as opposed to [lower category of other variable].”
   3. Tests of independence
      1. Hypotheses
         1. *H0*:
         2. *Ha*:
      2. Test Statistics
         1. Test:
         2. Conditional Test (LRT): , where is Residual Deviance.
         3. Wald Test:
      3. Concl: There is evidence of an association between *X* and *Y*.
2. Chapter 8: Models for Matched Pairs
   1. Matched pairs
   2. McNemar’s Test (*Large sample*: *n*\* > 10): Test for marginal homogeneity
      1. *H0*: ; marginal homogeneity.
      2. *Ha*: ; marginal heterogeneity.
      3. TS: or
      4. Concl: “At the [] level, there is (in)sufficient evidence to indicate that [cases from Observation 1] are more likely than [cases from Observation 2] to…”
      5. CI
         1. Interp
            1. “We are []% confident that the difference in proportions between [Observation 1] and [Observation 2] is between…”
            2. “There is (in)sufficient evidence to indicate that the proportion of [*n*] changed significantly from [Observation 1] to [Observation 2].”
   3. Exact Test (*Small sample*: *n*\* ≤ 10): Test for marginal homogeneity for binary matched pairs
      1. *H0*:
      2. *Ha*:
      3. *p*-value: Assuming …
         1. *p = p*( + *p*(
            1. *p* = 2*p*(
            2. *p* = 2*p*(
   4. Symmetry and quasi-symmetry models: special cases of the saturated model with symmetric association
      1. Marginal homogeneity: () 🡨[All cases | Only when *I* = 2]🡪 Symmetry ()
      2. Symmetric association: ; present in symmetric and quasi-symmetric models
      3. Symmetry model (special case of saturated model): , where and
         1. Conditions and
         2. ML Fit and Expected Frequency:
         3. Perfect diagonal:
         4. Residual *df* for :
         5. Adjusted residuals:
      4. Quasi-symmetry model: , where and
         1. Odds ratio
            1. Interp: “The odds of [level of X] as opposed to [adjacent level of X] in [Observation 1] are higher by a factor of [OR] for those in [Observation 2] in [level of Y] compared to those in [other level of Y].”

Look at table carefully for interpretation.

* + - 1. Goodness-of-fit test: , where is Residual Deviance and *df* is Residual Degrees of Freedom.
         1. Interp [*H*0(*Ha*)]: “The model is (not) an appropriate fit for the data set.”