

Example: Electrical wiring and childhood cancer.

Ebi et al [17] conducted an analysis of exposure to electrical wiring and childhood cancer. The data were originally collected by Savitz et al. from 1976 to 1983 in the Denver, CO metropolitan area, and included 356 diagnosed cancers in children aged 0-14 years [18]. Ebi et al. conducted analyses of case-specular pairs, where controls were matched children in houses that were a “reflection” of the case house, or located across the street [19]. The exposure of interest for one analysis was backyard power lines, defined by three levels: three phase lines, secondary lines, or no line. Greenland et al. reanalyzed these data using conditional maximum likelihood methods of 259 matched pairs [20]; this secondary analysis is the subject of our example here. The model of interest is for the odds of childhood leukemia at exposures to three phase (β_1) and secondary lines (β_2) compared to the referent no lines. The distribution of cases and controls is provided in Table 2 of Greenland et al.’s work [20].

Results

Table e1 summarizes the results of analyses using no prior information and WIPs. The maximum likelihood ORs assessing childhood cancer associated with exposure to three-phase and secondary line compared to no line are 32.0 (95% CI: 4.0, 253) and 14 (1.8, 107), respectively. When we apply a WIP, the ORs of childhood cancer for three-phase and secondary line exposure are 8.11 (95% HPD: 2.90, 22.04) and 3.73 (95% HPD, 1.40, 9.74), representing a 137% and 132% change in the effect estimates, respectively. While the lower bounds of the confidence interval are largely unchanged, the upper bound for both estimates exhibits significant shrinkage towards the values specified by the prior. The results of this analysis may be recreated with the SAS code provided.

Table e1. Odds of childhood cancer comparing exposure to three-phase and secondary lines to no exposure.

	Three-phase		Secondary	
	OR	95% CL*	OR	95% CL*
CML	32	4.0, 253	14	1.8, 107
WIP	8.11	2.90, 22.04	3.73	1.40, 9.75

% change from CML 137% 132%

*For CML (conditional maximum likelihood) results, the CL represents a 'confidence interval.' When implemented with a WIP, the CL represents the 'posterior interval.'

SAS code for recreating the example in Table e1.

```
*create dataset;
data a;
    input cx1 cx2 dx1 dx2 f;
    cards;
0 1 0 1 15
1 0 1 0 107
0 0 0 0 81
0 1 1 0 24
0 1 0 0 11
1 0 0 1 11
1 0 0 0 9
0 0 1 0 1
;
data a;
    set a;
    retain s 0;
    do i=1 to f; s=s+1; x1=cx1; x2=cx2; y=1; yc=1-y; output; x1=dx1; x2=dx2; y=0; yc=1-y; output; end;
    keep s x1 x2 y yc; run;
```

*Specify WIP for x1 and x2;

```
data prior;
    input _type_ $ _name_ :$6. x1 x2;
    cards;
Mean . 0 0
Cov x1 1.3806 0
Cov x2 0 1.3806;
run;
```

*Run analysis with WIP;

```
proc phreg data=a;
    strata s;
    model yc=x1 x2/ties=discrete;
    bayes seed=1 nbi=1000 thin=2 nmc=10000 coeffprior=normal(input=prior) diag=autocorr
diag=gelman(nchain=3);
    title "Results: MLE and Bayesian WIP";
    ods exclude censoredsummary nobis initialvalues autocorr geweke ess;
    ods output posteriorsample=post;

run;
quit;
run;
```