Appendix IV Children excluded from school: Sheffield

Table AIV.1 *Numbers of children excluded from school by ward: Sheffield. Ward number, observed number excluded; expected numbers based on average for the city times the number of children in the ward; deprivation index*

Ward no.	Observed number ($O(i)$)	Expected number ($E(i)$)	Deprivation index $X_1(i)$
1	1	5.130	−4.930
2	5	5.410	−0.040
3	13	5.510	1.180
4	0	2.910	−3.180
5	11	5.030	3.900
6	8	4.650	6.060
7	3	6.090	−2.960
8	10	6.070	0.640
9	1	4.880	−4.780
10	0	6.240	−7.990
11	15	5.910	3.490
12	0	4.820	−7.170
13	3	4.500	−0.650
14	3	4.950	−0.280
15	7	4.940	−2.360
16	1	5.120	−0.710
17	5	3.810	6.010
18	2	9.930	−2.500
19	3	3.970	−2.520
20	14	5.020	3.540
21	4	2.550	3.490
22	4	3.900	1.860
23	4	4.600	2.060
24	6	4.490	4.280
25	3	4.140	3.850
26	13	5.300	5.580
27	1	6.560	−4.270
28	2	3.790	−2.790
29	2	3.740	−1.300

Table AIV.2 *WinBUGS code for Poisson log-normal model with a single covariate and spatially structured (v[i]) and spatially unstructured (e[i]) random effects*

```
model
{
        v[1 : N] ~ car.normal(adj[ ], weights[ ], num[ ], prec.v)
        v.mean <-mean(v[ ])
    for (i in 1 : N) {
                O[i] ~ dpois(mu[i])
                log(mu[i]) <-log(E[i]) + beta0 + beta1* x1[i] +v[i]+e[i] #x1:tdi
                e[i] ~ dnorm(0, prec.e)
                R[i] <-exp(beta0+beta1*x1[i]+v[i]+e[i])
                  }
            for (k in 1:sumNumNeigh) {weights[k] <-1 }
            # other priors
                beta0 ~ dflat()
                beta1 ~ dnorm(0.0, 1.0E-5)
                prec.v ~ dgamma (0.5,0.0005)       # prior on spatially structured precision
                v.v<- 1/prec.v                     # spatially structured variance
                sigma.v <-1 / sqrt(prec.v)         # spatially structured standard deviation
                prec.e ~ dgamma(0.5, 0.0005)       # prior on unstructured precision
                v.e <-1/prec.e                     # unstructured variance
                sigma.e <-sqrt(1 / prec.e)         # unstructured standard deviation
                }
```

Table AIV.3 *Sample results from WinBUGS*

A 5000 update burn in followed by a further 5000 updates with two chains gave the parameter estimates

Node statistics

node	**Mean**	**sd**	**MC error**	**2.5%**	**median**	**97.5%**	**start**	**sample**
beta0	−0.2509	0.1213	0.003788	−0.5103	−0.243	−0.03141	5001	10000
beta1	0.1997	0.03112	8.243E-4	0.1434	0.198	0.267	5001	10000
prec.e	622.1	1159.0	61.68	3.522	135.7	4027.0	5001	10000
prec.v	1422.0	1811.0	102.2	2.105	765.3	6424.0	5001	10000

Summary statistics

node	**mean**	**sd**	**sample**
R[1]	0.289	0.089	10000
R[2]	0.795	0.186	10000
.			
R[29]	0.625	0.153	10000
v[1]	−0.041	0.142	10000
v[2]	−0.023	0.135	10000
.			
v[29]	0.020	0.108	10000
e[1]	−0.017	0.201	10000
e[2]	0.025	0.176	10000
.			
e[29]	−0.010	0.192	10000

Table AIV.4 *Area by area decomposition of the posterior mean of the relative risk of children excluded from school in Sheffield: Poisson log normal convolution prior*

Ward No.	R_i^{+} from WINBUGS	exp(beta1* $X_1(i)$)$^{+}$	exp($v(i)$)$^{+}$	exp($e(i)$)$^{+}$
1	0.289	0.374	0.960	0.983
2	0.795	0.992	0.977	1.025
3	1.352	1.266	1.105	1.195
4	0.394	0.530	0.957	0.951
5	1.879	2.179	1.043	1.044
6	2.366	3.354	0.971	0.910
7	0.471	0.554	1.034	1.016
8	1.052	1.136	1.033	1.124
9	0.299	0.385	0.961	0.985
10	0.157	0.203	0.955	0.960
11	1.926	2.008	1.084	1.111
12	0.189	0.239	0.980	0.964
13	0.686	0.878	0.978	0.996
14	0.715	0.946	0.962	0.981
15	0.644	0.624	1.087	1.164
16	0.620	0.868	0.961	0.920
17	2.257	3.321	0.951	0.889
18	0.430	0.607	0.937	0.926
19	0.494	0.605	0.969	1.043
20	2.002	2.028	1.096	1.126
21	1.588	2.008	0.995	0.999
22	1.105	1.450	0.966	0.988
23	1.183	1.509	1.028	0.958
24	1.694	2.351	0.955	0.946
25	1.484	2.157	0.949	0.901
26	2.505	3.048	1.044	0.995
27	0.346	0.426	1.039	0.958
28	0.489	0.573	1.035	1.010
29	0.625	0.771	1.020	0.990

$^{+}$ Calculation uses the posterior mean