Amendments and Errata for Cook and Lawless (2007)

1. Page 5, line 13
   Reference should be to Table D.3.

2. Page 30, Theorem 2.2 of Cook and Lawless (2007) states :

   Theorem 2.2. For an event process with integrable intensity (2.1),

   $$\Pr\{N(s,t)=0|H(s^+)\}=\exp\left\{-\int_s^t \lambda(u|H(u))du\right\}. \tag{2.8}$$

   In the statement of the theorem and the associated proof, we took $H(u)$ in the intensity function on the right hand side of (2.8) to stand for $\{N(s^+), N(s,u)=0\}$. This is implied by the probability being calculated, and was assumed in subsequent uses of this theorem in the book. However, it has been pointed out to us that a reader might not assume this, and that a rigorous proof and statement of the theorem should make this explicit. Consequently, we restate the theorem as follows:

   Theorem 2.2. For an event process with integrable intensity (2.1),

   $$\Pr\{N(s,t)=0|H(s^+)\}=\exp\left\{-\int_s^t \lambda(u|H(u))du\right\}, \tag{2.8}$$

   where in the right hand side of (2.8), $H(u)=\{H(s^+), N(s,u)=0\}$.

   Lines 3 and 4 of the proof can be similarly amended to:

   $$\begin{aligned}\Pr\{N(s,t)=0|H(s^+)\} &= \lim_{R\to\infty}\prod_{r=1}^{R}\Pr\{\Delta N(u_r)=0|H(s^+),N(s^+,u_{r-1})=0\}\\ &= \lim_{R\to\infty}\prod_{r=1}^{R}\{1-\lambda(u_r|H(s^+),N(s^+,u_{r-1})=0)\Delta u_r+o(\Delta u_r)\}.\end{aligned}$$

3. Page 36, Equation (2.29)
   Given only z_i the probability function is then

   $$\begin{aligned}\Pr(N_i(s,t)=n|z_i) &= \int_0^\infty \frac{[u\mu_i(s,t)]^n}{n!}\exp\{-u\mu_i(s,t)\}g(u;\phi)du \qquad (2.29)\\ &= \frac{\Gamma(n+\phi^{-1})}{\Gamma(\phi^{-1})\mathbf{n}!}\ \frac{[\phi\mu_i(s,t)]^n}{[1+\phi\mu_i(s,t)]^{n+\phi^{-1}}} \qquad n=0,1,2,\ldots\end{aligned}$$

   which is of negative binomial form.

4. Page 55, Question 2.6 b)
   and variance $\boldsymbol{\phi}\{1+\phi N(t^-)\}/\{1+\phi\mu(t)\}^2$.

5. Page 192, Table 5.4
   Entries under Model 4 have been updated.

Table 5.4. Modulated Markov models for pulmonary exacerbations.

	Model 1		Model 2		Model 3		Model 4	
	EST.	S.E.	EST.	S.E.	EST.	S.E.	EST.	S.E.
Treatment	-0.29	0.11	-0.31	0.13	–	–	–	–
Treatment ($t \leq 80$)	–	–	–	–	-0.51	0.18	-0.43	0.16
Treatment ($t > 80$)	–	–	–	–	-0.16	0.16	-0.06	0.14
FEV	-0.017	0.002	-0.019	0.003	-0.019	0.003	-0.015	0.002
$I(N(t^-) \geq 1)$	–	–	–	–	–	–	0.73	0.13
Variance (ϕ)	–	–	0.94	48.0†	0.94	48.0†	–	–

6. Page 231, Table 6.3
   The following entry has been updated.

Table 1: Estimates from regression models for infection shunt failures.

	SHUNT 1		SHUNT 2		SHUNT 3	
Covariate	EST.	S.E.	EST.	S.E.	EST.	S.E.
Etiology						
Adsten	**1.27**	0.61	-0.24	0.92	-1.41	1.37

7. Page 235, Table 6.5
The following table has been updated.

Table 6.5. Estimates from semiparametric random effect models with independent gamma frailties, for the bronchitis data.

	AECB to AECB-Free			AECB-Free to AECB		
Covariate	EST.	S.E.	$p-$value	EST.	S.E.	$p-$value
	First Observed Duration					
Treatment	0.527	0.159	0.001	–	–	–
Sex	-0.201	0.160	0.210	–	–	–
Severity	-0.268	0.249	0.282	–	–	–
Symptoms	-0.111	0.016	< 0.001	–	–	–
	Second and Subsequent Durations					
Treatment	0.058	0.132	0.658	-0.036	0.130	0.779
Sex	-0.070	0.135	0.608	0.250	0.133	0.061
Severity	0.015	0.181	0.932	0.619	0.182	0.001
Symptoms	-0.012	0.010	0.226	–	–	–
Season						
Jan–March	–	–	–	–	–	–
April–Jun	0.358	0.118	0.002	-0.502	0.151	0.001
July–Sept	0.117	0.147	0.425	-0.307	0.144	0.033
Oct–Dec	0.269	0.122	0.028	-0.182	0.141	0.196
Disease duration	–	–	0.159	–	–	0.034
Variance (ϕ_j)	$\widehat{\phi}_1 = 0.1723$			$\widehat{\phi}_2 = 0.2767$		
Log-likelihood	-2843.178			-2151.203		

8. Page 235, line -3
$RR = 1.69$, $p = 0.001$.

9. Page 236, line 24-26
There is evidence that exacerbations occur more frequently in the summer months than the winter months ($p = 0.033$), and the disease duration also appears to be a significant factor ($p = 0.008$);

10. Page 358-359
The dataframe is

```
  id enum etype estart estop gstart gstop estatus xmark
1101    0     1      0     4      0     4       0     3
1101    0     1      4    36      4    36       1     3
1101    1     2     36    87      0    51       0     3
1101    1     2     87    97     51    61       1     3
1101    2     1     97   137      0    40       1     3
1101    3     2    137   178      0    41       0     3
1101    3     2    178   270     41   133       0     3
1101    3     2    270   362    133   225       0     3
```

```
1101    3     2    362   369    225   232        0      3
1202    0     1      0     1      0     1        0      5
1202    0     1      1     7      1     7        0      5
1202    0     1      7    16      7    16        1      5

 xseason trt symptoms symptomsc gender severity
       1   0        4 -1.824324      0        0
       1   1        4 -1.824324      0        0
       1   1        4 -1.824324      0        0
       2   1        4 -1.824324      0        0
       2   1        4 -1.824324      0        0
       2   1        4 -1.824324      0        0
       3   1        4 -1.824324      0        0
       4   1        4 -1.824324      0        0
       1   1        4 -1.824324      0        0
       1   0        1 -4.824324      1        0
       1   0        1 -4.824324      1        0
       2   0        1 -4.824324      1        0
```

11. Page 359, lines -13 and -12
    The phrase "`trt.dt` *(*$1 =$ *Ciprofloxacin received and in the first exacerbation,* $0 =$ *standard care)*" has been deleted.

12. Page 359-361
    The output given on page 359-360 has been changed to the following:

```
> coxph(Surv(gstart,gstop,estatus) ~
           (trt+gender+severity+symptomsc)*strata(Ienum.gt.0) +
            factor(xmark)+factor(xseason)+
            strata(Ienum.gt.0)+frailty(id,distribution="gamma"),
            data=chest, subset=(etype == 1), method="breslow",
            control=coxph.control(eps=1e-06, iter.max=100))

 n= 910
                                 coef se(coef)    se2  Chisq DF       p
                          trt  0.5271 0.1592   0.1440  10.97  1 9.3e-04
                       gender -0.2011 0.1604   0.1442   1.57  1 2.1e-01
                     severity -0.2680 0.2489   0.2239   1.16  1 2.8e-01
                    symptomsc -0.1109 0.0160   0.0150  47.81  1 4.7e-12
             factor(xmark)2 -0.1567 0.1664   0.1345   0.89  1 3.5e-01
             factor(xmark)3 -0.2827 0.1663   0.1311   2.89  1 8.9e-02
             factor(xmark)4 -0.4674 0.2011   0.1580   5.40  1 2.0e-02
             factor(xmark)5 -0.4102 0.2258   0.1833   3.30  1 6.9e-02
             factor(xmark)6 -0.2761 0.2760   0.2165   1.00  1 3.2e-01
             factor(xmark)7  0.2857 0.3391   0.2673   0.71  1 4.0e-01
             factor(xmark)8 -0.7039 0.4226   0.3471   2.78  1 9.6e-02
             factor(xmark)9 -0.4828 0.3052   0.2308   2.50  1 1.1e-01
          factor(xseason)2  0.3584 0.1185   0.1130   9.16  1 2.5e-03
          factor(xseason)3  0.1169 0.1466   0.1408   0.64  1 4.3e-01
          factor(xseason)4  0.2687 0.1223   0.1174   4.83  1 2.8e-02
 frailty(id, distribution                            104.17 60 3.5e-04
    trt:strata(Ienum.gt.0) -0.4688 0.1884   0.1797   6.19  1 1.3e-02
```

```
 gender:strata(Ienum.gt.0)  0.1316 0.1906   0.1814   0.48  1 4.9e-01
 severity:strata(Ienum.gt.  0.2835 0.2743   0.2632   1.07  1 3.0e-01
 symptomsc:strata(Ienum.gt  0.0987 0.0178   0.0172  30.67  1 3.1e-08

 Iterations: 8 outer, 36 Newton-Raphson
    Variance of random effect= 0.17   I-likelihood = -2843.2
 Degrees of freedom for terms= 0.8 0.8 0.8 0.9 5.0 2.7 60.0 0.9
                               0.9 0.9 0.9
 Rsquare= 0.26 (max possible= 0.998)
 Likelihood ratio test= 274 on 74.73 df, p=0
```

The output given on the bottom of 360 and top of 361 has been updated to the following:

```
> coxph(Surv(gstart,gstop,estatus) ~
            trt + gender + severity + factor(xmark) +
            factor(xseason) + frailty(id, distribution="gamma"),
            data=chest, subset=(etype == 2), method="breslow",
            control=coxph.control(eps=1e-06, iter.max=100))

 n= 1377
                              coef se(coef)   se2  Chisq DF       p
                       trt -0.0364 0.130    0.105   0.08  1 0.78000
                    gender  0.2496 0.133    0.109   3.51  1 0.06100
                  severity  0.6185 0.182    0.140  11.59  1 0.00066
             factor(xmark)2  0.0436 0.196    0.166   0.05  1 0.82000
             factor(xmark)3  0.4947 0.193    0.159   6.60  1 0.01000
             factor(xmark)4  0.5436 0.234    0.189   5.38  1 0.02000
             factor(xmark)5  0.0196 0.271    0.226   0.01  1 0.94000
             factor(xmark)6  0.4357 0.310    0.251   1.97  1 0.16000
             factor(xmark)7  0.7433 0.397    0.308   3.50  1 0.06100
             factor(xmark)8  0.4471 0.531    0.428   0.71  1 0.40000
             factor(xmark)9  0.6922 0.343    0.265   4.08  1 0.04300
          factor(xseason)2 -0.5024 0.151    0.150  11.07  1 0.00088
          factor(xseason)3 -0.3068 0.144    0.143   4.54  1 0.03300
          factor(xseason)4 -0.1824 0.141    0.141   1.67  1 0.20000
  frailty(id, distribution                        101.03 66 0.00360

  Iterations: 7 outer, 24 Newton-Raphson
     Variance of random effect= 0.276   I-likelihood = -2151.2
  Degrees of freedom for terms= 0.7 0.7 0.6 5.1 3.0 66.0
  Rsquare= 0.143 (max possible= 0.958)
  Likelihood ratio test= 212 on 76.01 df, p=9.44e-15
```