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:

   \[
   \Pr\{N(s, t) = 0|H(s^+)\} = \lim_{R \to \infty} \prod_{r=1}^R \Pr\{\Delta N(u_r) = 0|H(s^+, N(s^+, u_{r-1}) = 0)\Delta u_r + o(\Delta u_r)\}.
   \]

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

   \[
   \Pr(N_i(s, t) = n|z_i) = \int_0^\infty \frac{[u \mu_i(s, t)]^n}{n!} \exp\{-u \mu_i(s, t)\} g(u; \phi) du \tag{2.29}
   \]

   \[
   = \frac{\Gamma(n + \phi^{-1})}{\Gamma(\phi^{-1})n!} \frac{[\phi \mu_i(s, t)]^n}{[1 + \phi \mu_i(s, t)]^{n + \phi^{-1}}} \quad n = 0, 1, 2, \ldots
   \]

   which is of negative binomial form.

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

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

**Table 5.4.** Modulated Markov models for pulmonary exacerbations.
6. Page 231, Table 6.3
   The following entry has been updated.

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

<table>
<thead>
<tr>
<th>Etiology</th>
<th>SHUNT 1</th>
<th>SHUNT 2</th>
<th>SHUNT 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adsten</td>
<td>1.27</td>
<td>-0.24</td>
<td>-1.41</td>
</tr>
<tr>
<td></td>
<td>0.61</td>
<td>0.92</td>
<td>1.37</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>-0.29</td>
<td>-0.31</td>
<td>-0.51</td>
<td>-0.43</td>
</tr>
<tr>
<td></td>
<td>0.11</td>
<td>0.13</td>
<td>0.18</td>
<td>0.16</td>
</tr>
<tr>
<td>Treatment ($t \leq 80$)</td>
<td>-</td>
<td>-</td>
<td>-0.16</td>
<td>-0.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.16</td>
<td>0.14</td>
</tr>
<tr>
<td>Treatment ($t &gt; 80$)</td>
<td>-</td>
<td>-</td>
<td>-0.19</td>
<td>-0.015</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.003</td>
<td>0.002</td>
</tr>
<tr>
<td>FEV</td>
<td>-0.017</td>
<td>-0.019</td>
<td>-0.019</td>
<td>-0.015</td>
</tr>
<tr>
<td></td>
<td>0.002</td>
<td>0.003</td>
<td>0.003</td>
<td>0.002</td>
</tr>
<tr>
<td>$I(N(t^-) \geq 1)$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.13</td>
</tr>
<tr>
<td>Variance ($\phi$)</td>
<td>-</td>
<td>-</td>
<td>0.94</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>48.0†</td>
<td>48.0†</td>
</tr>
</tbody>
</table>

† Significant at the 0.05 level.
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.

<table>
<thead>
<tr>
<th>Covariate</th>
<th>AECB to AECB-Free</th>
<th>AECB-Free to AECB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EST.</td>
<td>S.E.</td>
</tr>
<tr>
<td><strong>First Observed Duration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>0.527</td>
<td>0.159</td>
</tr>
<tr>
<td>Sex</td>
<td>-0.201</td>
<td>0.160</td>
</tr>
<tr>
<td>Severity</td>
<td>-0.268</td>
<td>0.249</td>
</tr>
<tr>
<td>Symptoms</td>
<td>-0.111</td>
<td>0.016</td>
</tr>
<tr>
<td><strong>Second and Subsequent Durations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>0.058</td>
<td>0.132</td>
</tr>
<tr>
<td>Sex</td>
<td>-0.070</td>
<td>0.135</td>
</tr>
<tr>
<td>Severity</td>
<td>0.015</td>
<td>0.181</td>
</tr>
<tr>
<td>Symptoms</td>
<td>-0.012</td>
<td>0.010</td>
</tr>
<tr>
<td>Season</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan–March</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>April–Jun</td>
<td>0.358</td>
<td>0.118</td>
</tr>
<tr>
<td>July–Sept</td>
<td>0.117</td>
<td>0.147</td>
</tr>
<tr>
<td>Oct–Dec</td>
<td>0.269</td>
<td>0.122</td>
</tr>
<tr>
<td>Disease duration</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Variance ($\phi_j$)</td>
<td>$\hat{\phi}_1 = 0.1723$</td>
<td>$\hat{\phi}_2 = 0.2767$</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-2843.178</td>
<td>-2151.203</td>
</tr>
</tbody>
</table>

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
```
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:

```r
> 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 0.1408   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 0.2761 0.2165   1.00 1 3.2e-01
  factor(xmark)6 -0.2761 0.2760 0.2165   1.00 1 3.2e-01
  factor(xmark)7  0.2857 0.3391 0.2673   2.78 1 9.6e-02
  factor(xmark)8 -0.7039 0.4226 0.3471   2.90 1 9.6e-02
  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) 0.2835 0.2743 0.2632 1.07 1 3.0e-01
symptomsc: strata(Ienum.gt.0) 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
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:

```r
> 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 4.94 1 0.03300
factor(xseason)4 -0.1824 0.141 0.141 1.67 1 0.20000

frailty(id, distribution = 0.10103 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