A hazards approach to the biometric analysis of infant mortality

Göran Broström[1] Tommy Bengtsson[2]

[1]CEDAR, Umeå University (gb@ehar.se, https://github.com/goranbrostrom)

[2]CED, Lund University (tommy.bengtsson@ekh.lu.se)

Outline

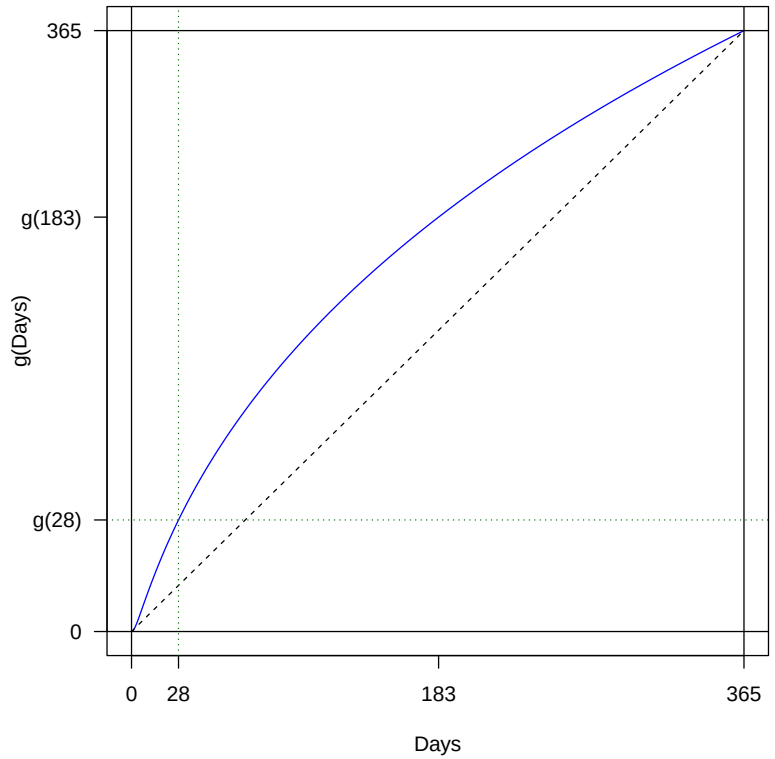
- Bourgeois-Pichat (1951): Biometric analysis of IM (background).
- Hazard-based alternative.
- Theoretical considerations
- Real-world examples.

The log-cube transform

$$g(t) = C \log^3(t+1),\ 0 < t \leq 365.$$

where C is a normalizing constant:

$$C = \frac{365}{\log^3(365+1)}$$

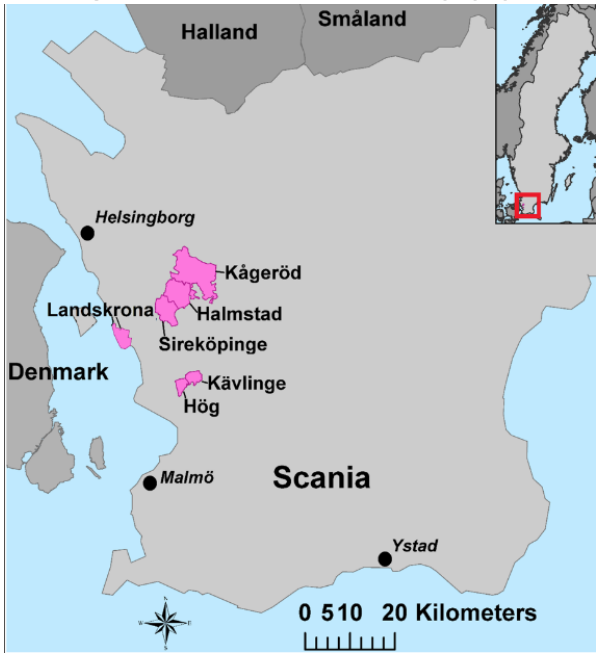


Earlier work

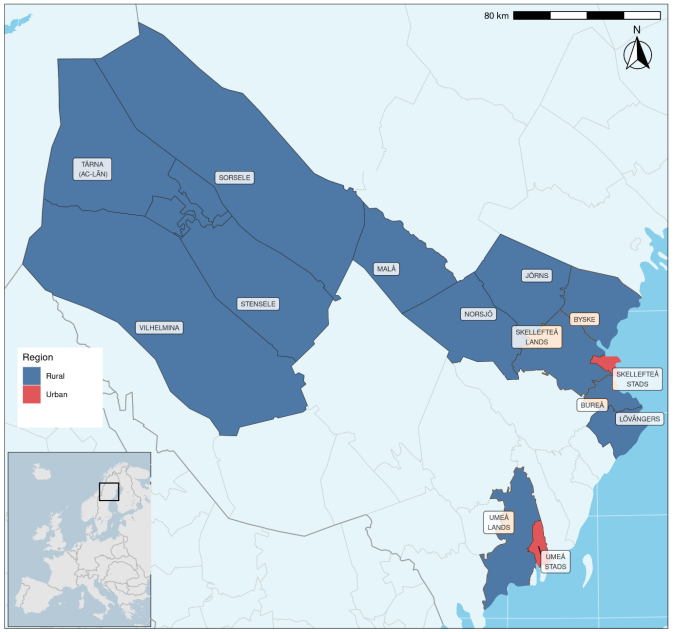
- Knodel & Kintner (1977)
- Wrigley (1977).
- Lynch, Greenhouse & Brändström (1998).
- Bengtsson (1999).
- Manfredini (2004).

Study areas

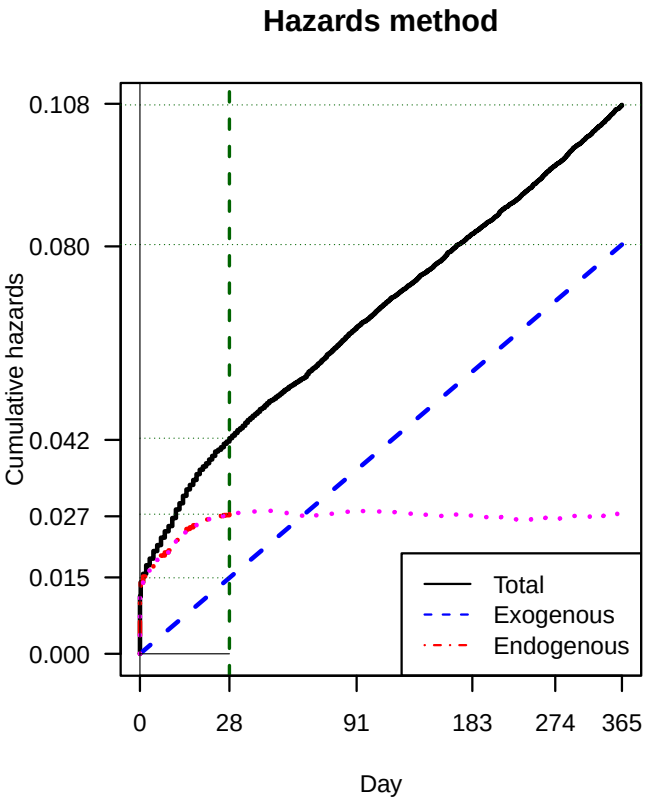
Skåne 1711–1800

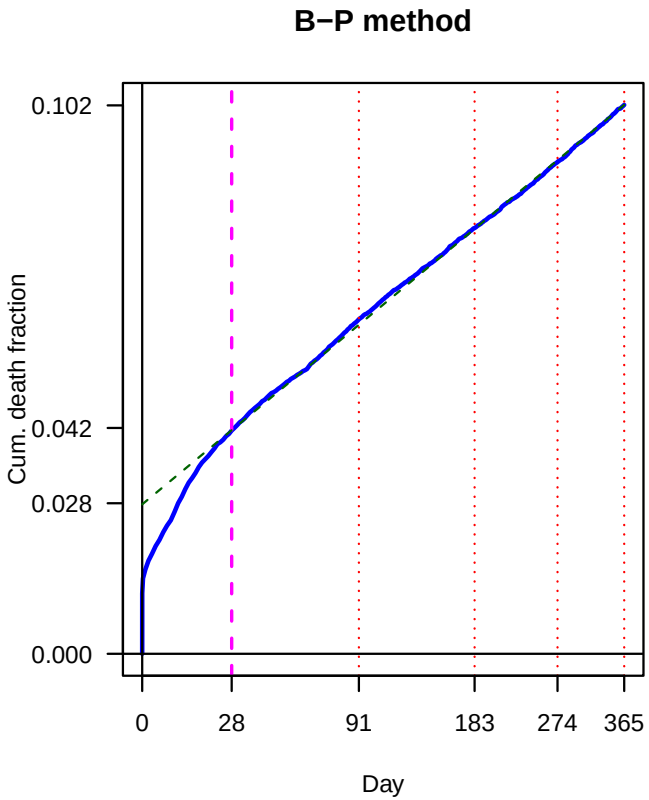


Västerbotten 1801–1950

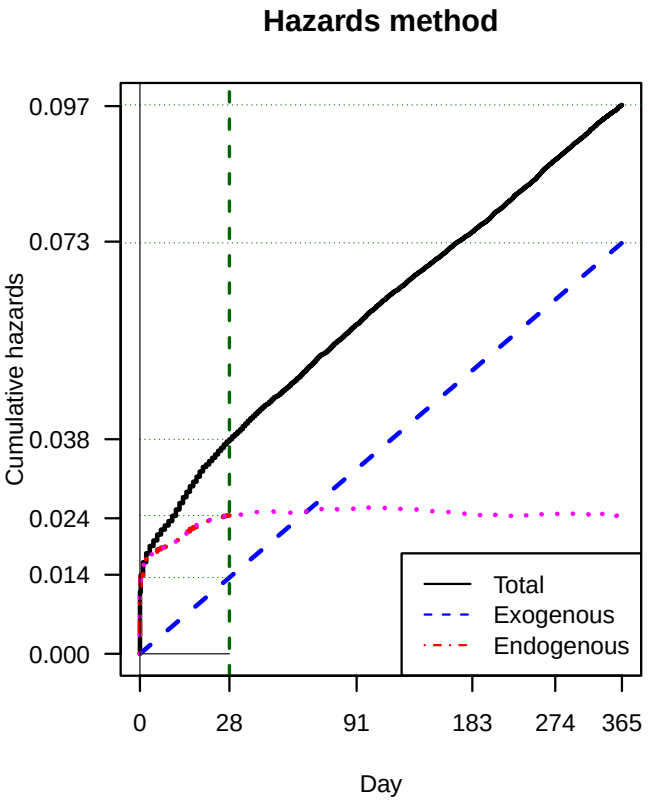


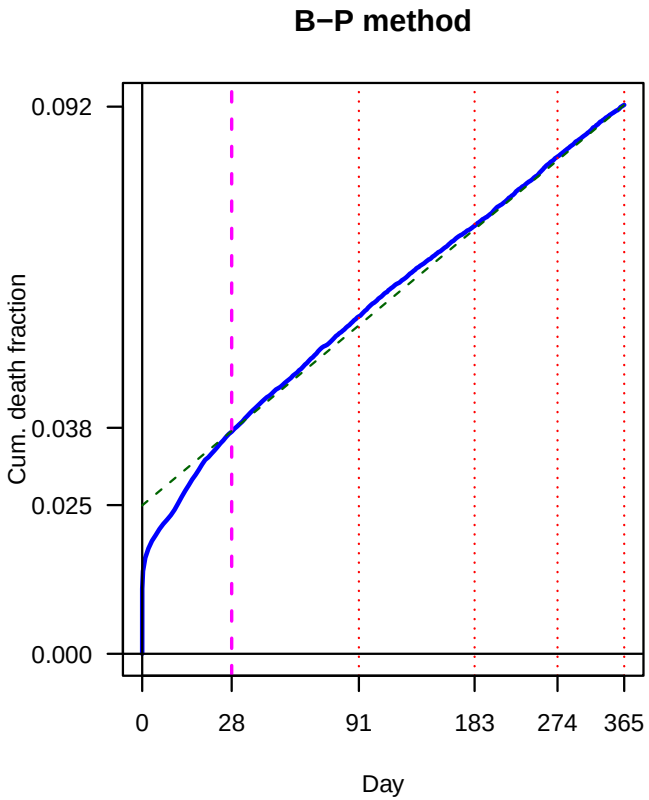
Väterbotten 1861-1890



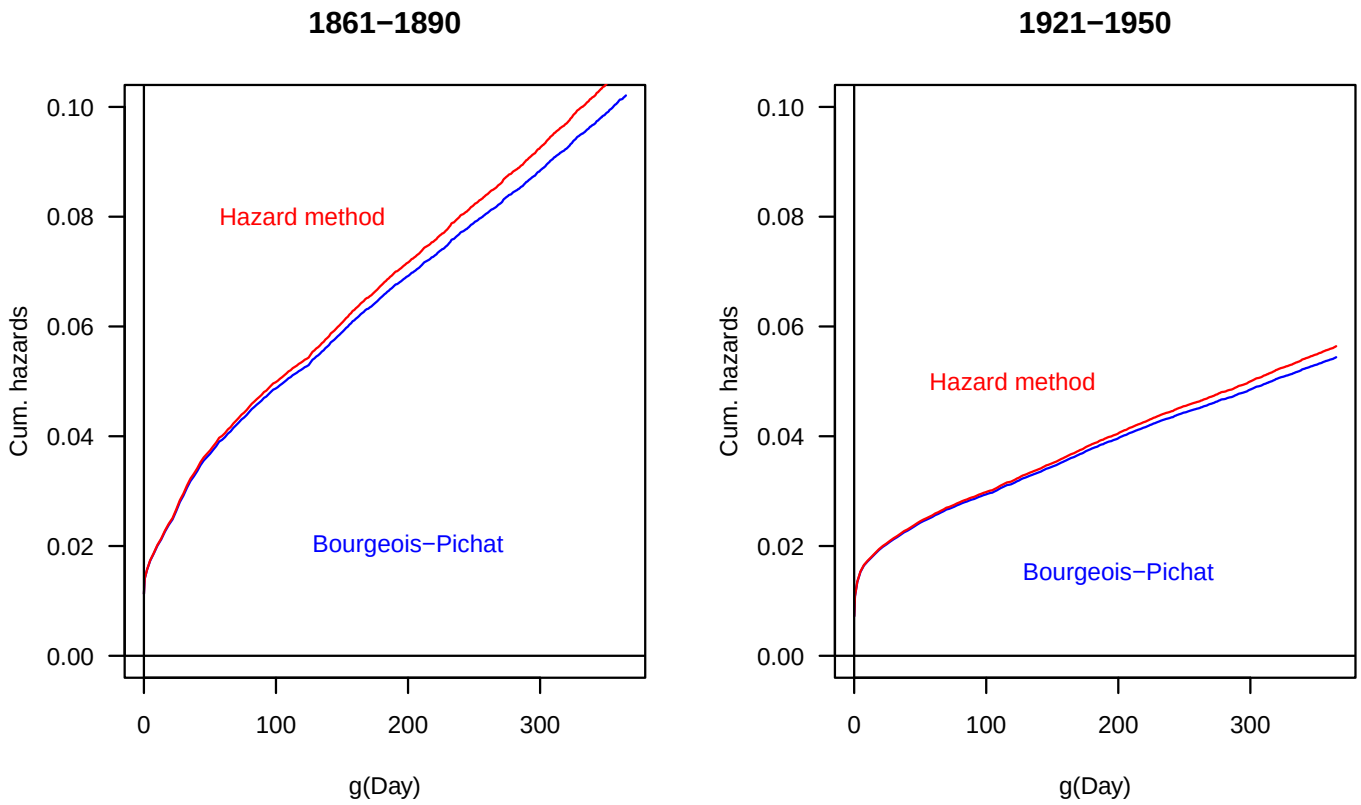


Västerbotten 1921–1950

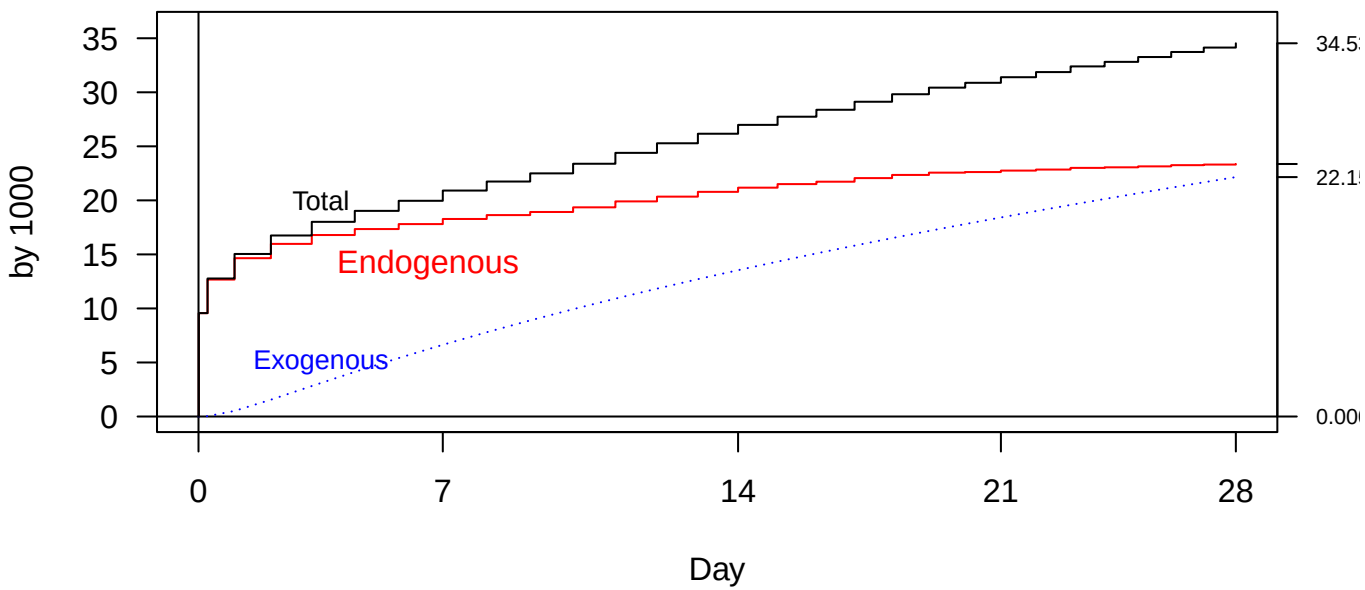




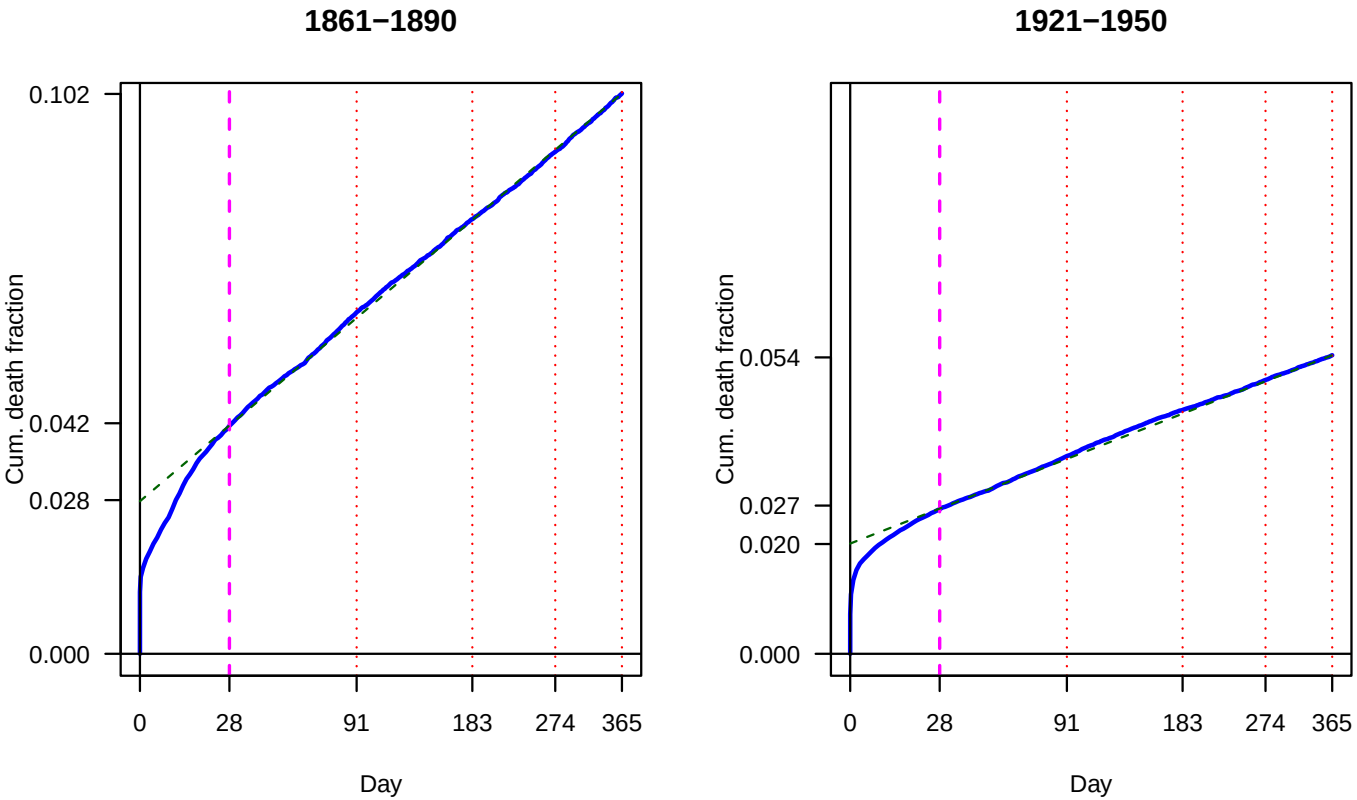
Comparison


1861−1890
1921−1950
Cum. hazards
0.10
0.08
0.06
0.04
0.02
0.00
Hazard method
Bourgeois−Pichat
0
100
200
300
g(Day)

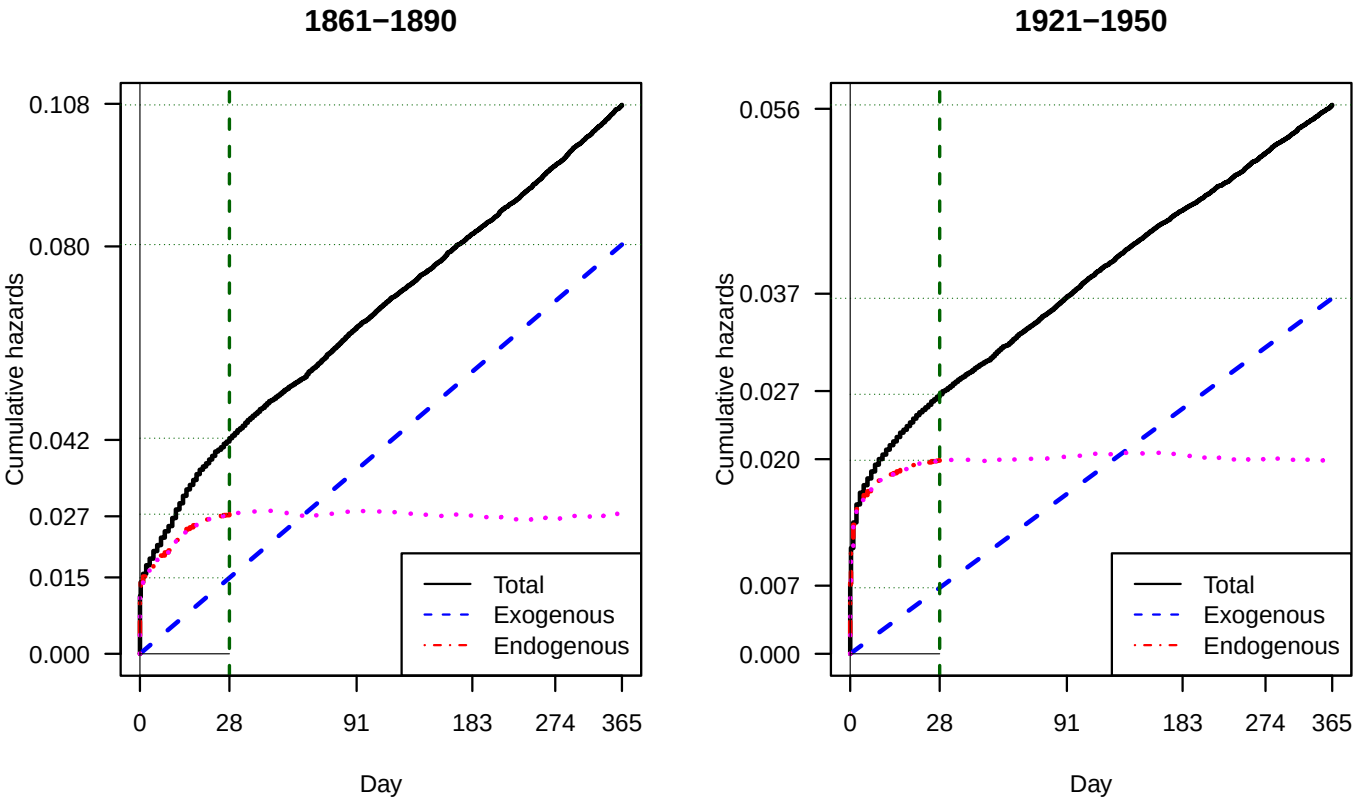
Cumulative hazards, neonatal mortality, Västerbotten 1861-1950



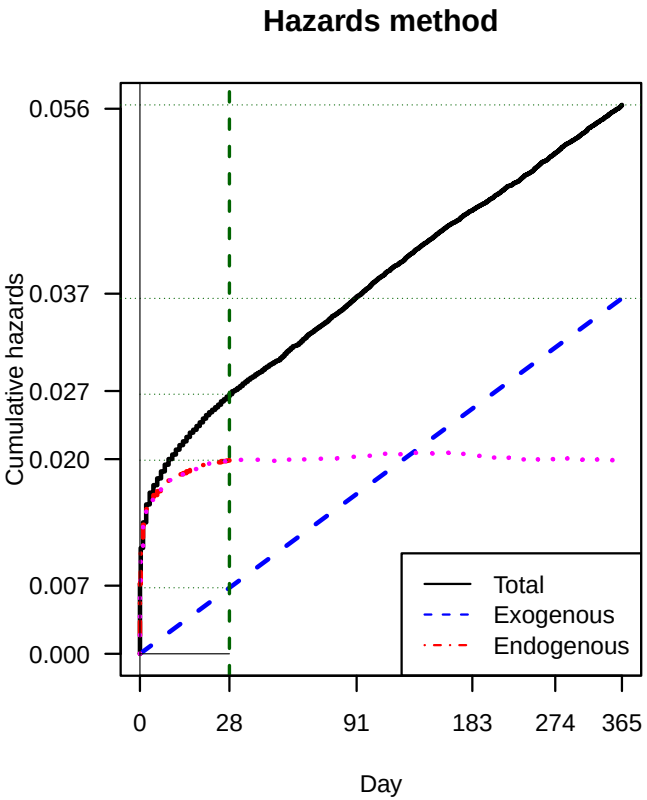
Västerbotten, Bourgeois-Pichat's method

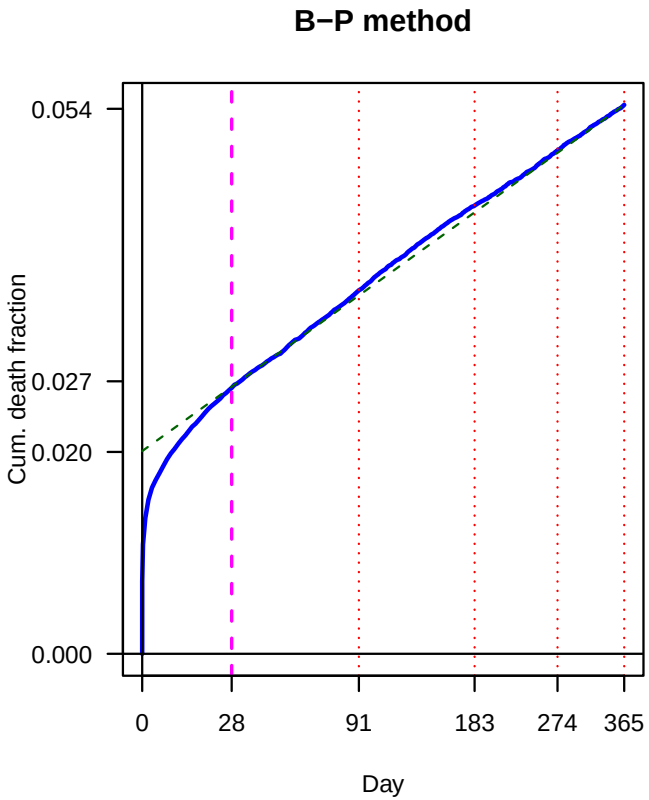


Västerbotten, hazards method

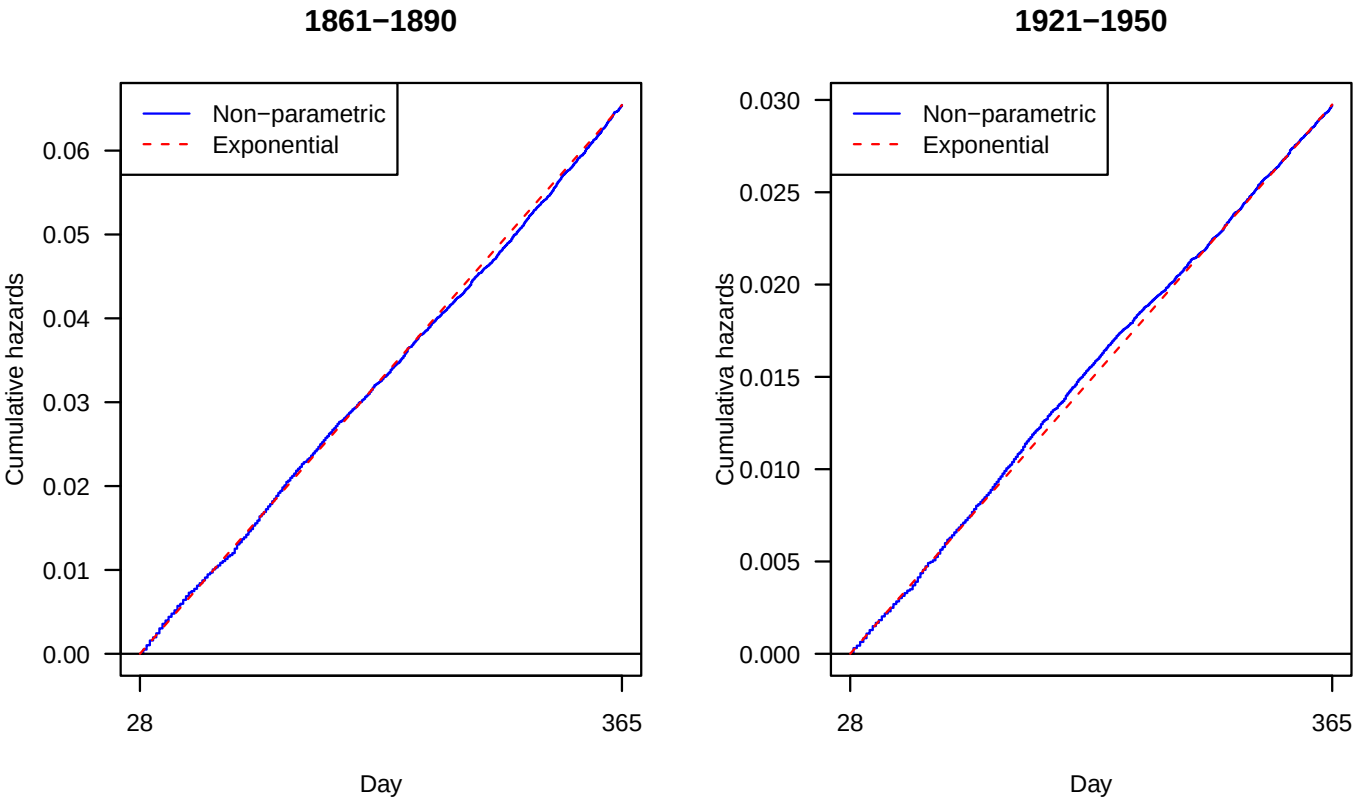


Västerbotten 1921–1950

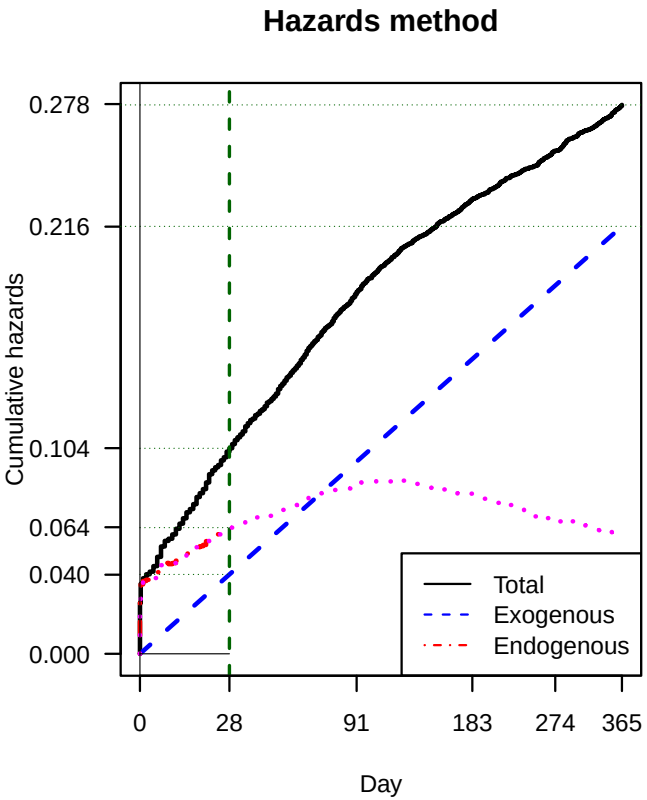


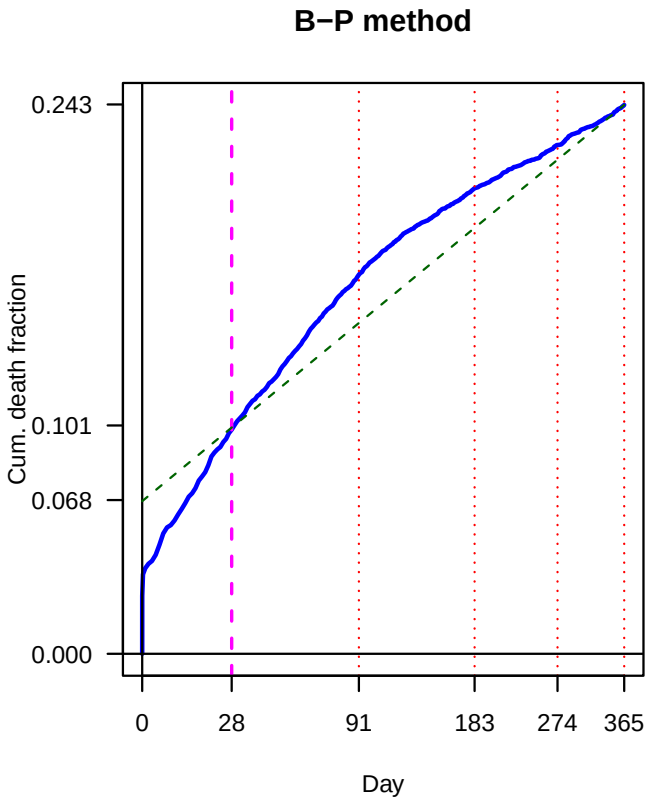


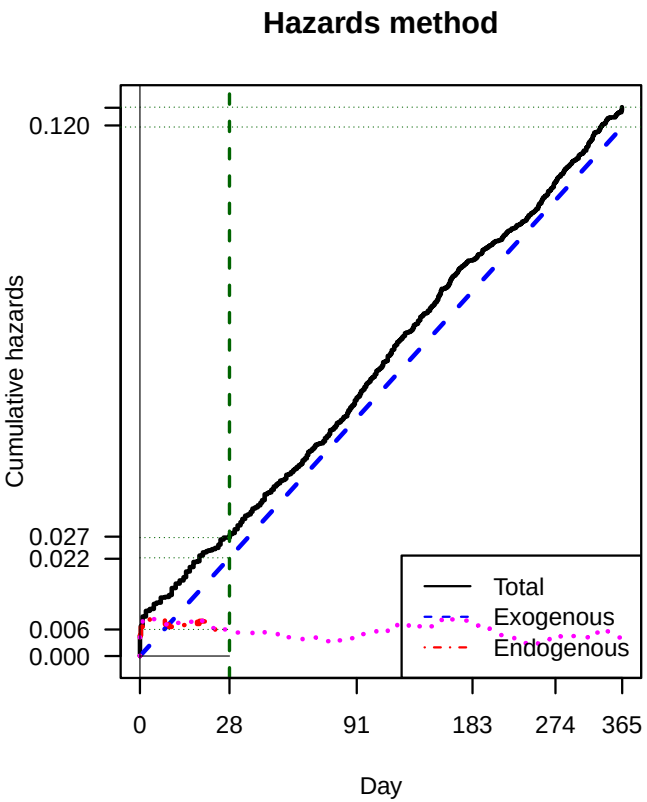
Exponential fits to post-neonatal data, Västerbotten

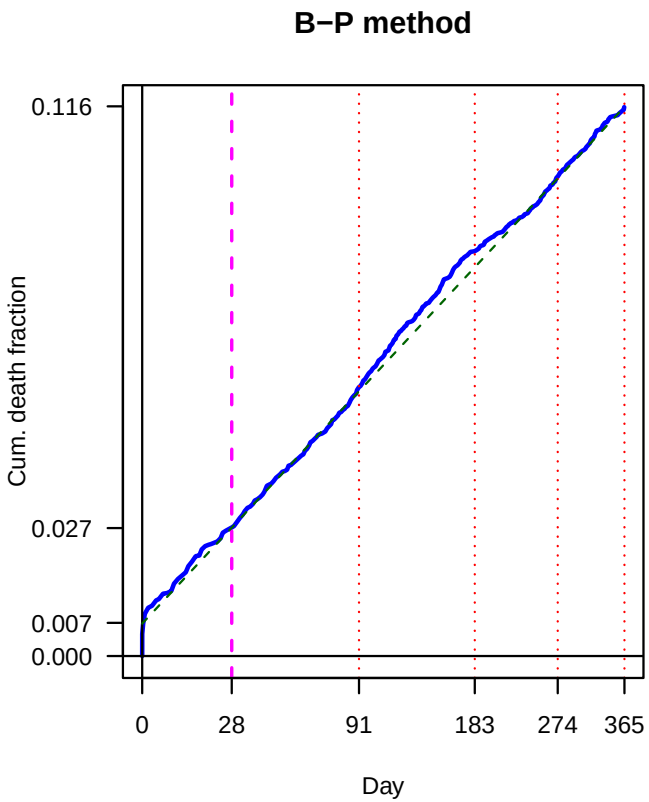


Scania 1711–1800






Hazards method
Cumulative hazards
0.120
0.027
0.022
0.006
0.000
0
28
91
183
274
365
Day
Total
Exogenous
Endogenous


B−P method
Cum. death fraction
0.116
0.027
0.007
0.000
0
28
91
183
274
365
Day

Conclusions

- Good