

# PERSUADE OUTPUT

Authors

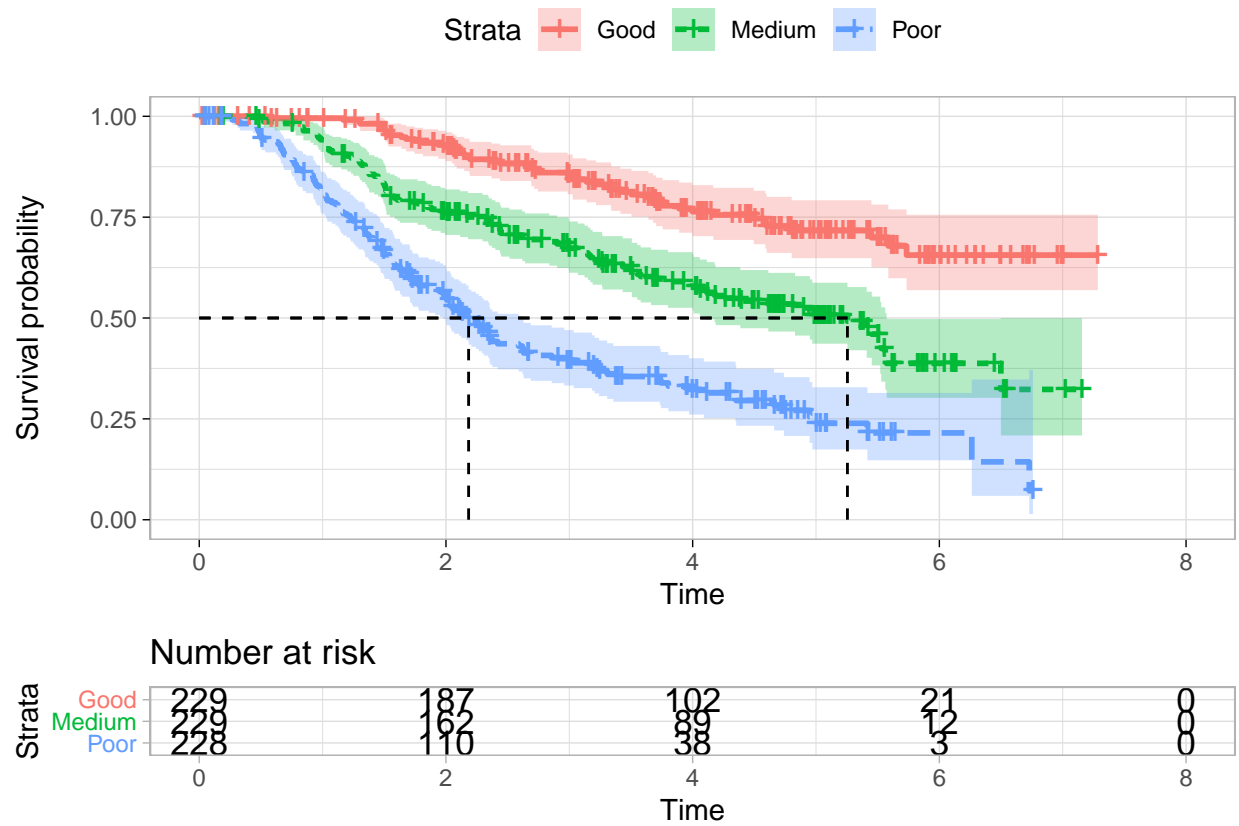
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2020-06-26

## Kaplan Meier

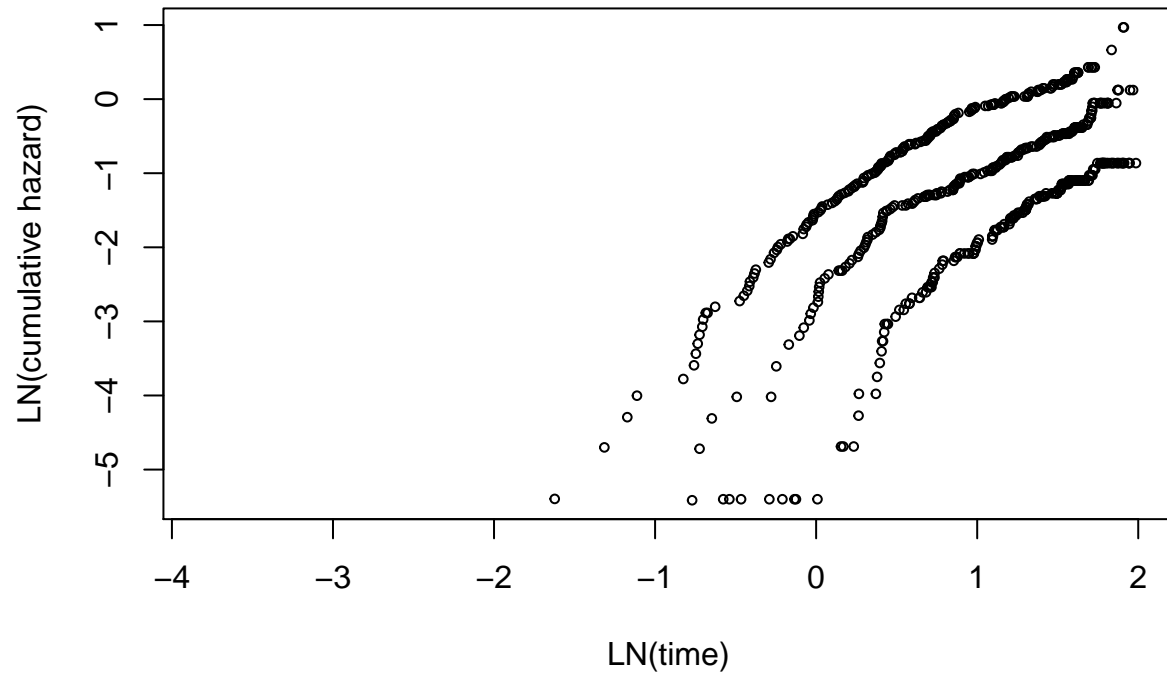
```
## Warning: Vectorized input to `element_text()` is not officially supported.  
## Results may be unexpected or may change in future versions of ggplot2.
```



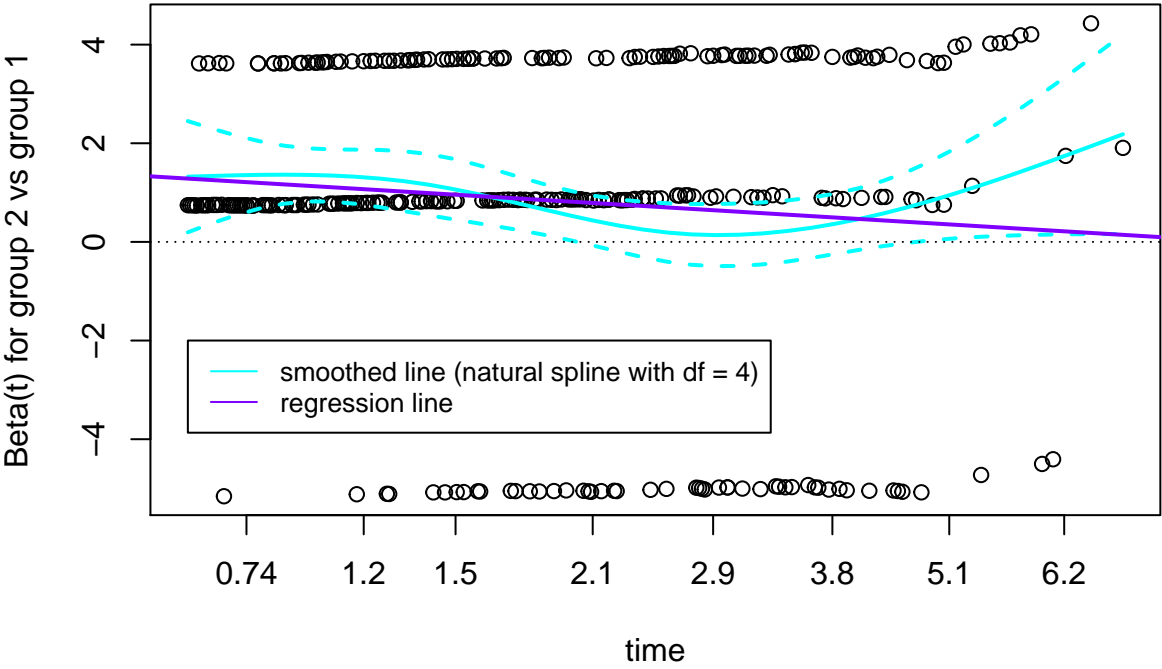
## Stratified models?

Should stratified parametric survival models be used?

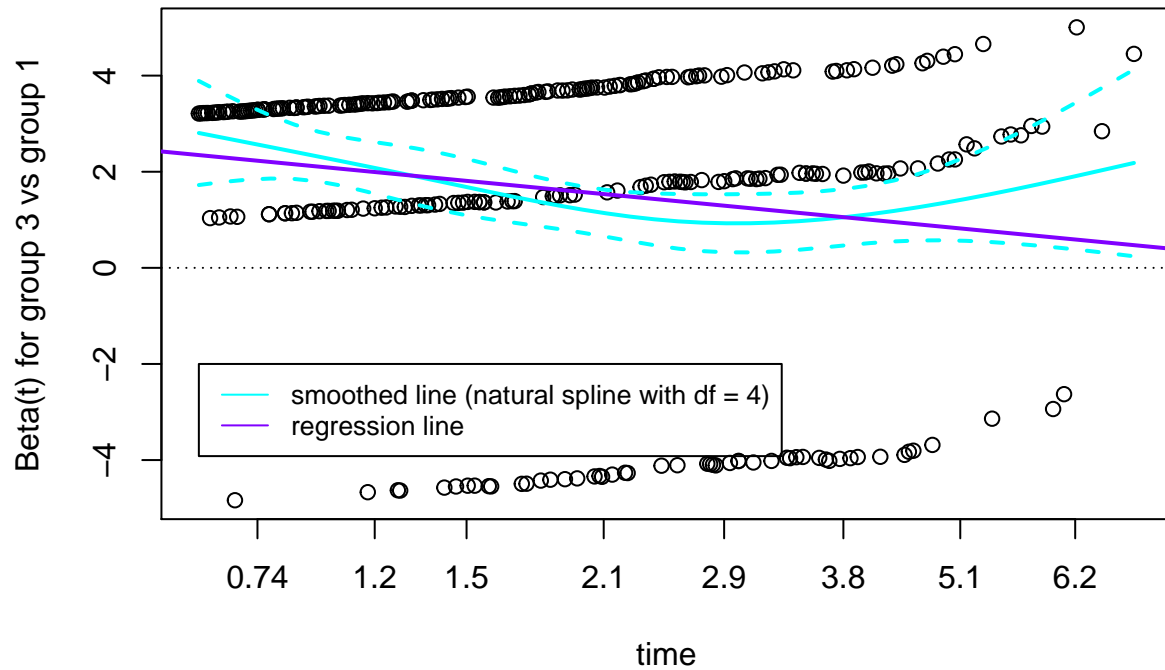
**A: LN(cumulative hazard)**



**B: Scaled Schoenfeld residuals**

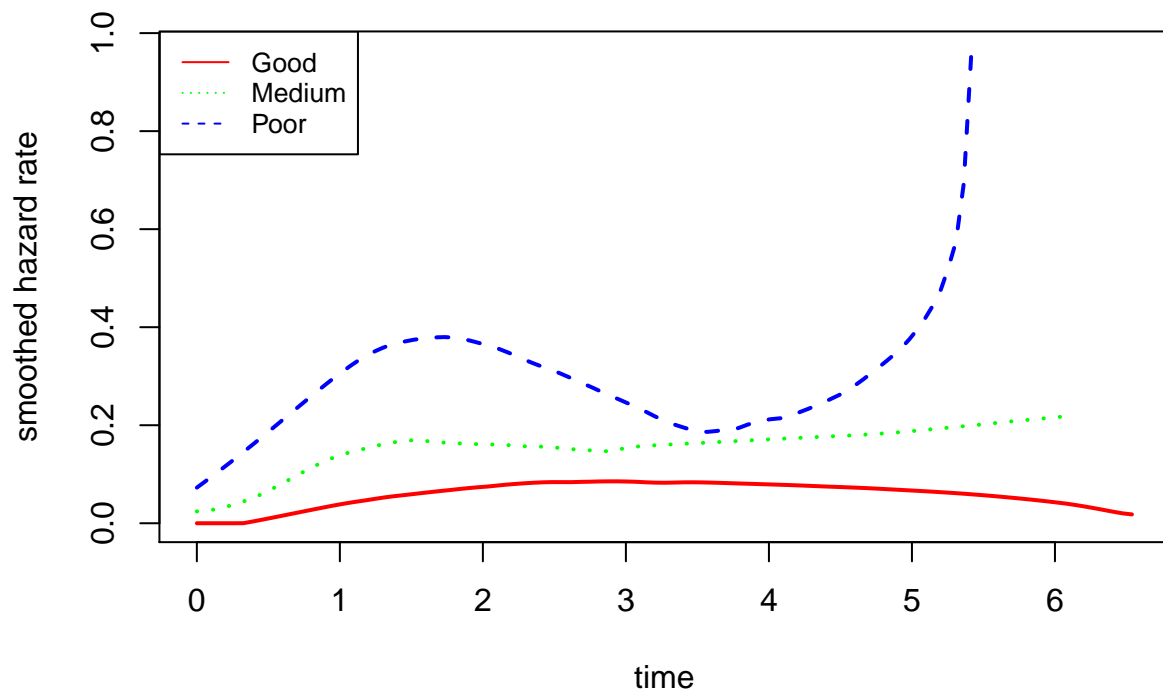


### C: Scaled Schoenfeld residuals



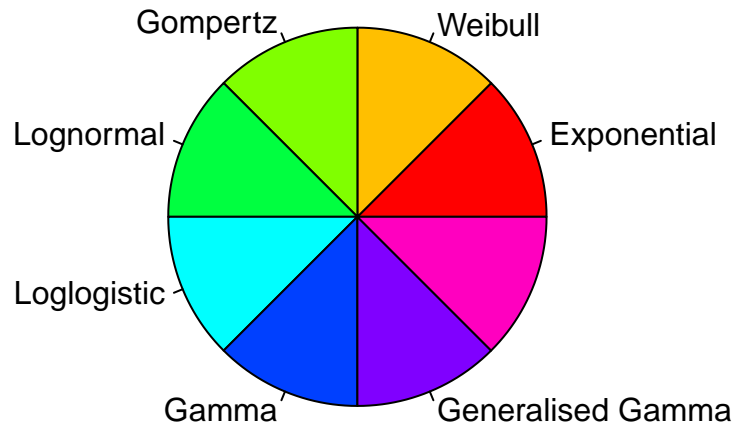
### Monotonic hazard models?

Should parametric survival models assuming a monotonic hazard rate (i.e. exponential, Weibull, Gompertz) be used?



## Standard parametric models?

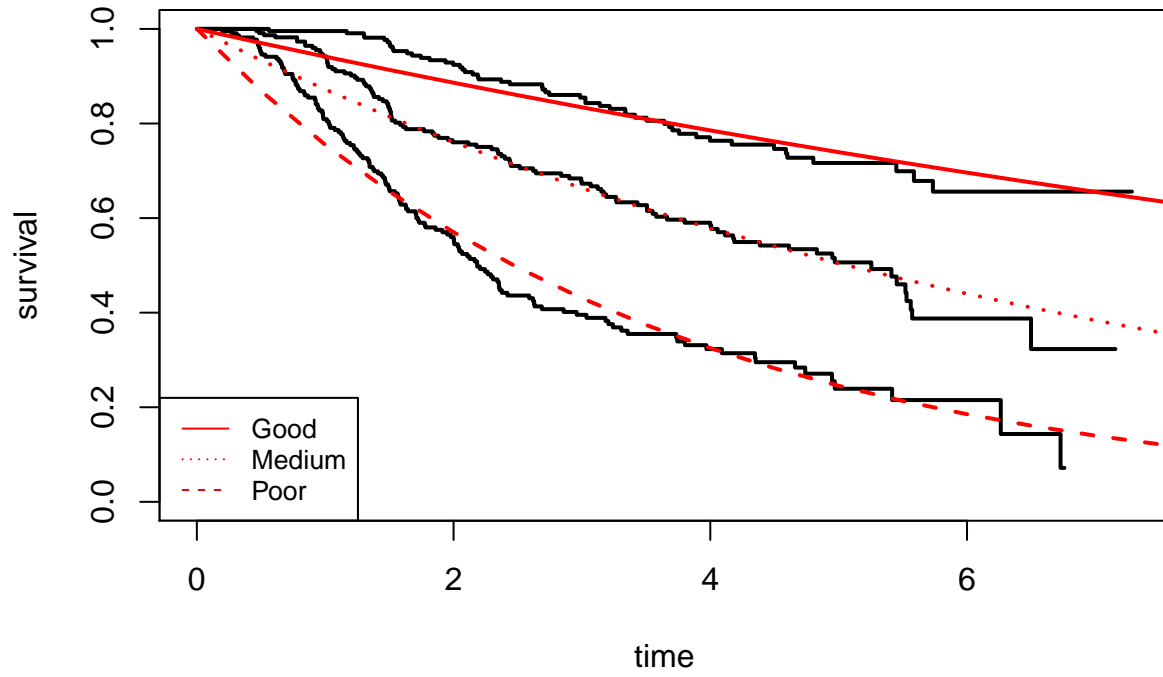
Do standard parametric models provide an appropriate fit to the data?



Distr	ibution	AIC	BIC
7	ggam	1589.049	1629.826
4	lnorm	1592.880	1620.066
5	llog	1609.294	1636.479
6	gam	1621.982	1649.167
2	weib	1632.618	1659.803
3	gom	1660.954	1688.140
1	exp	1668.212	1681.805

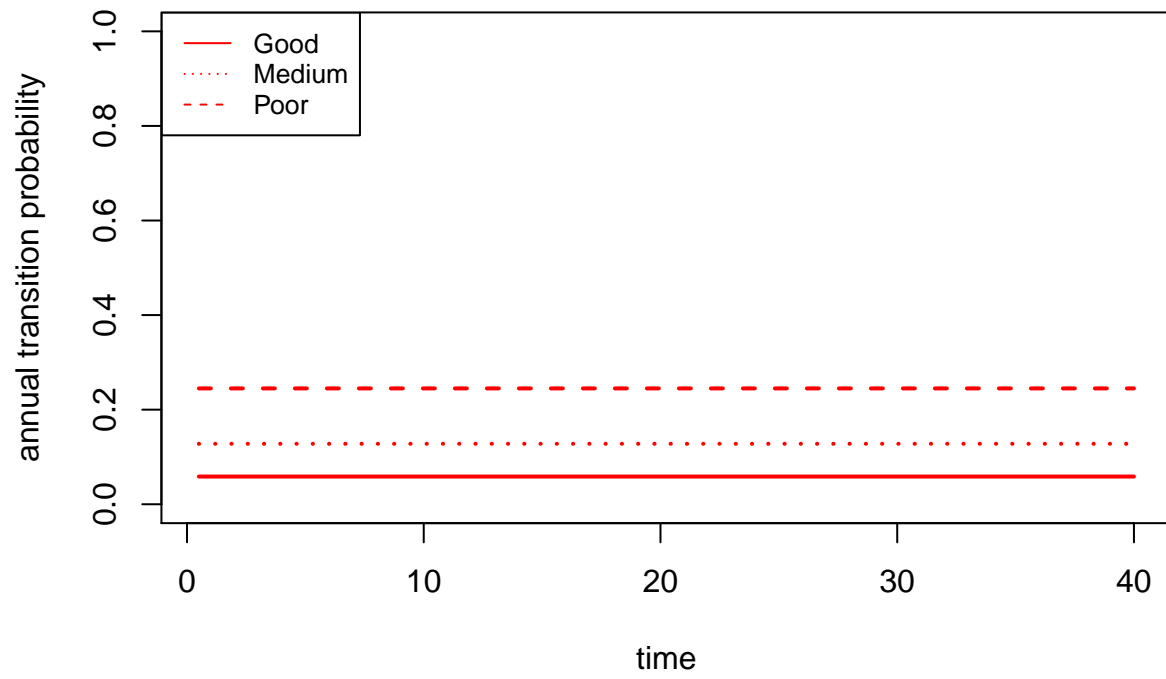
## Exponential

**A: Kaplan–Meier (Exponential)**

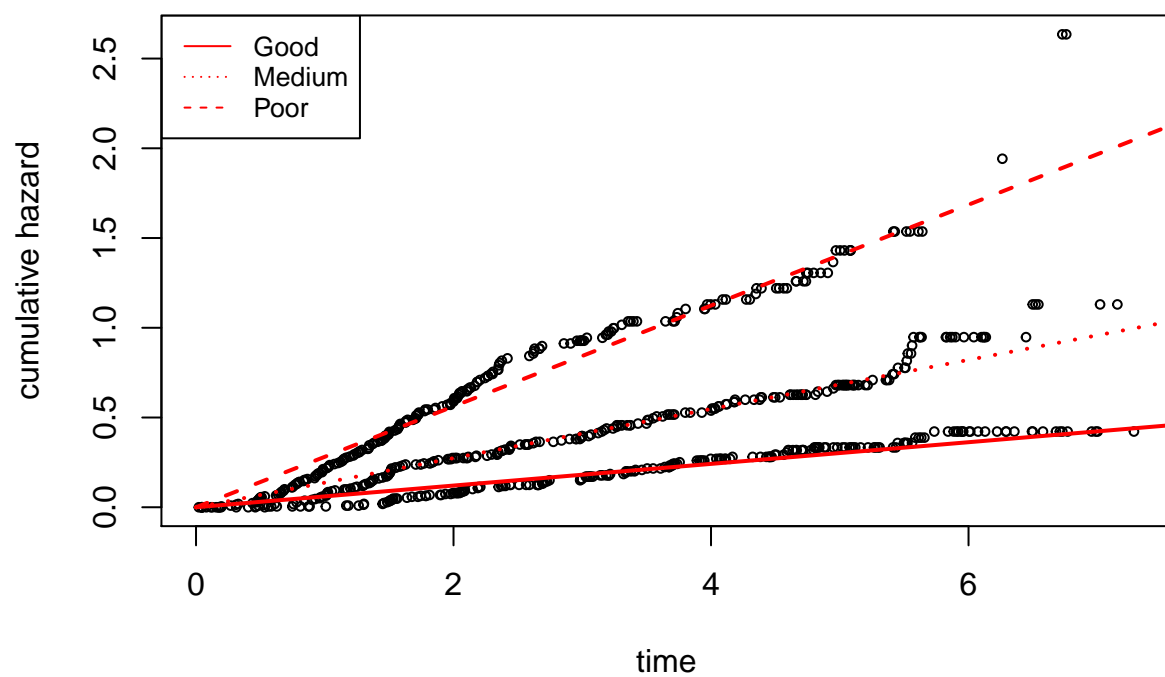




### B: Annual transition probability (Exponential)

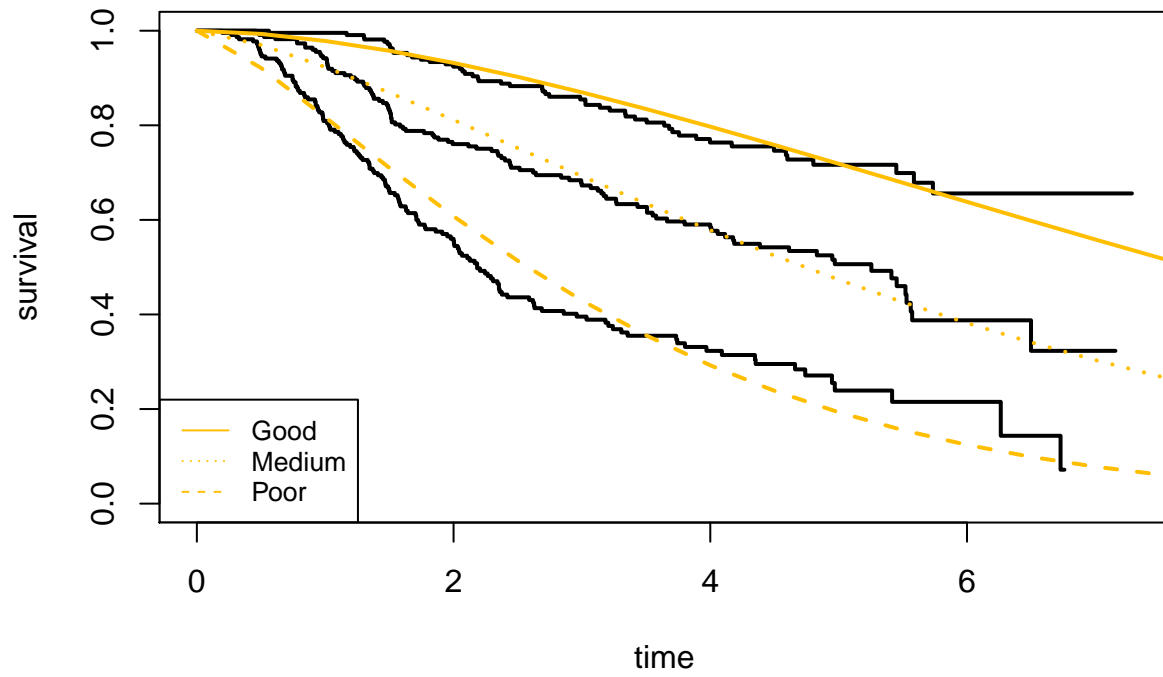


### C: Diagnostic plot (Exponential)

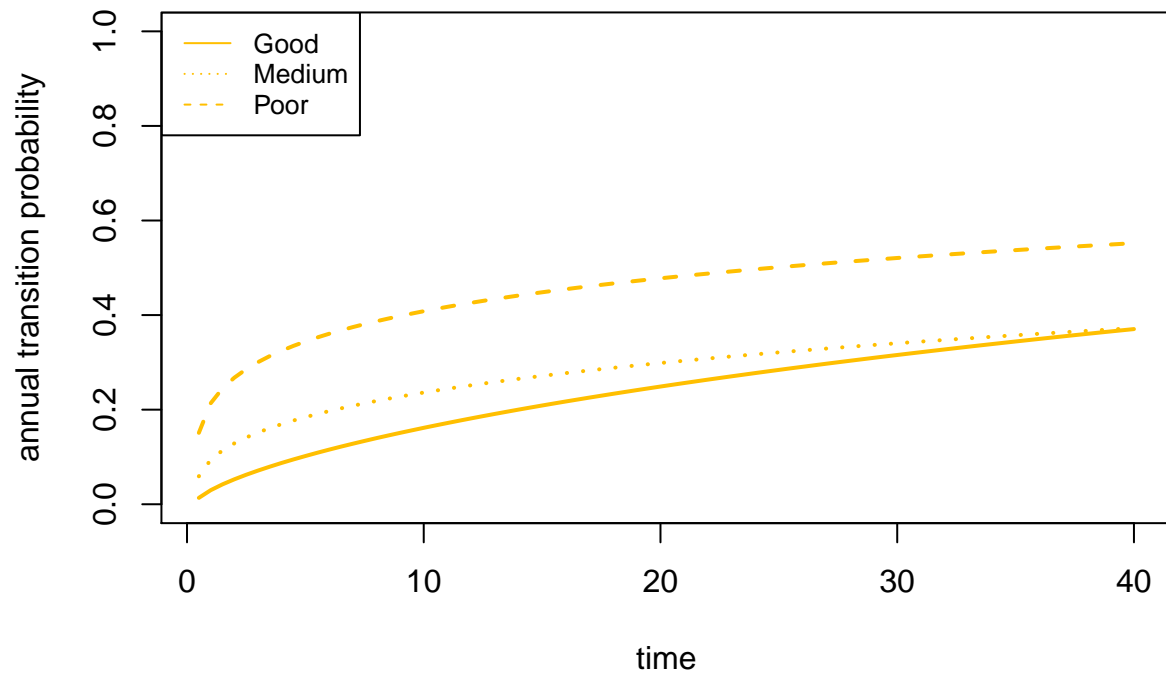


Weibull

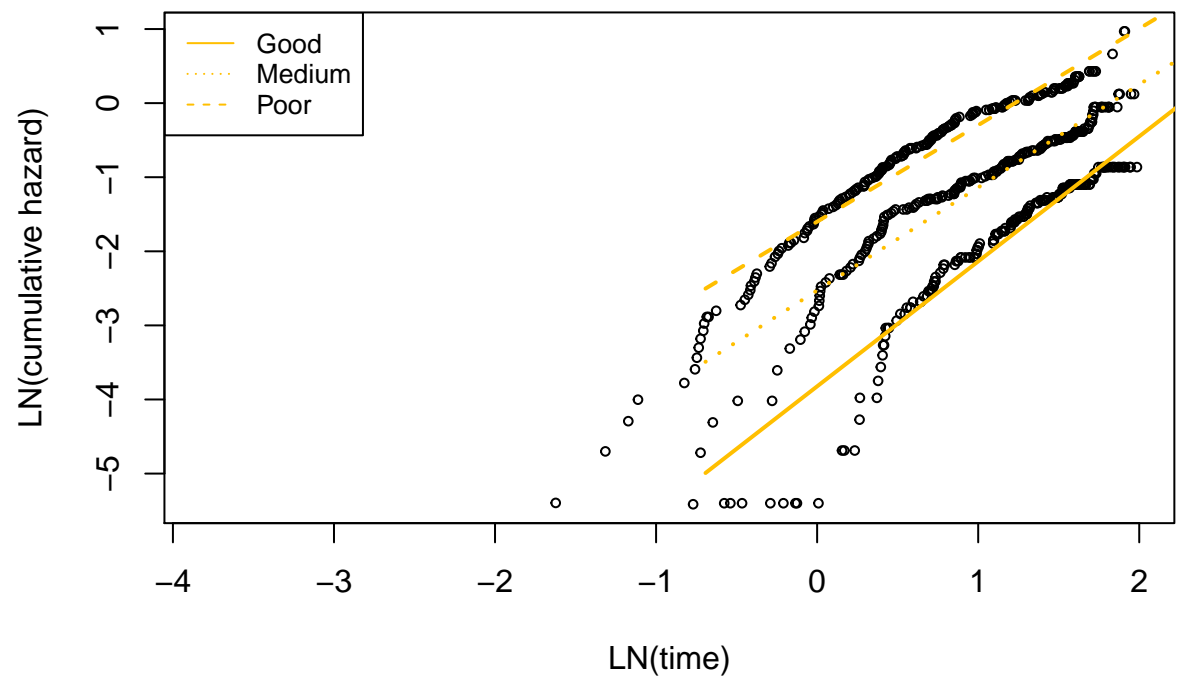
**A: Kaplan–Meier (Weibull)**



### B: Annual transition probability (Weibull)

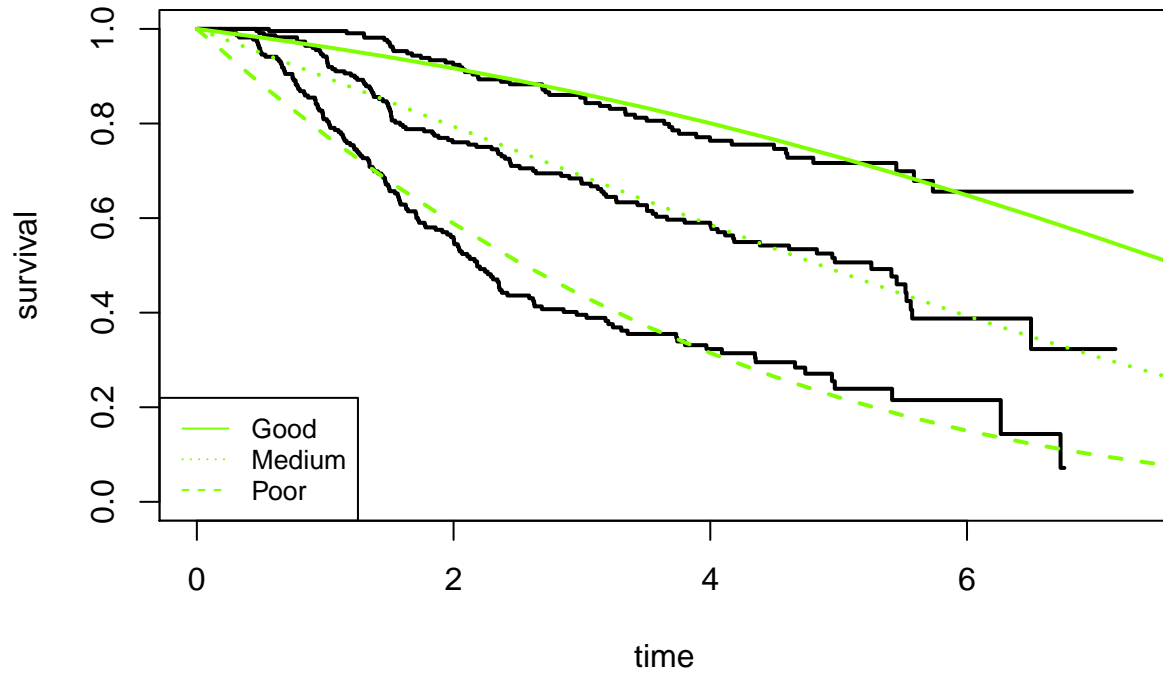


C: Diagnostic plot (Weibull)

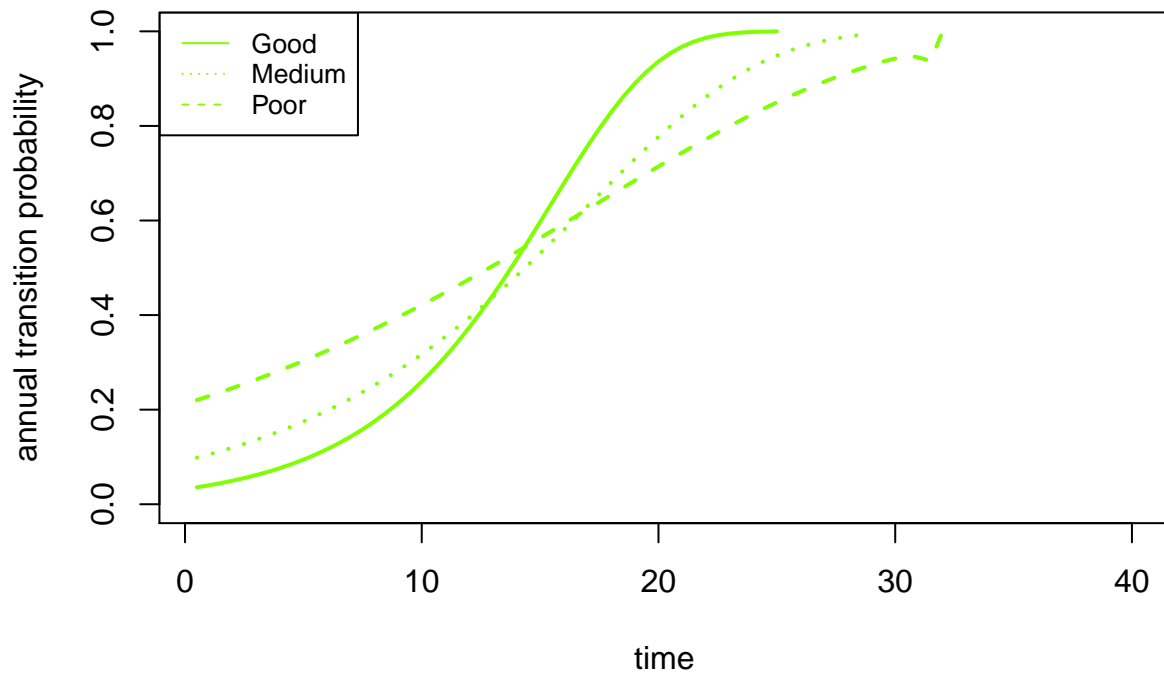


## Gompertz

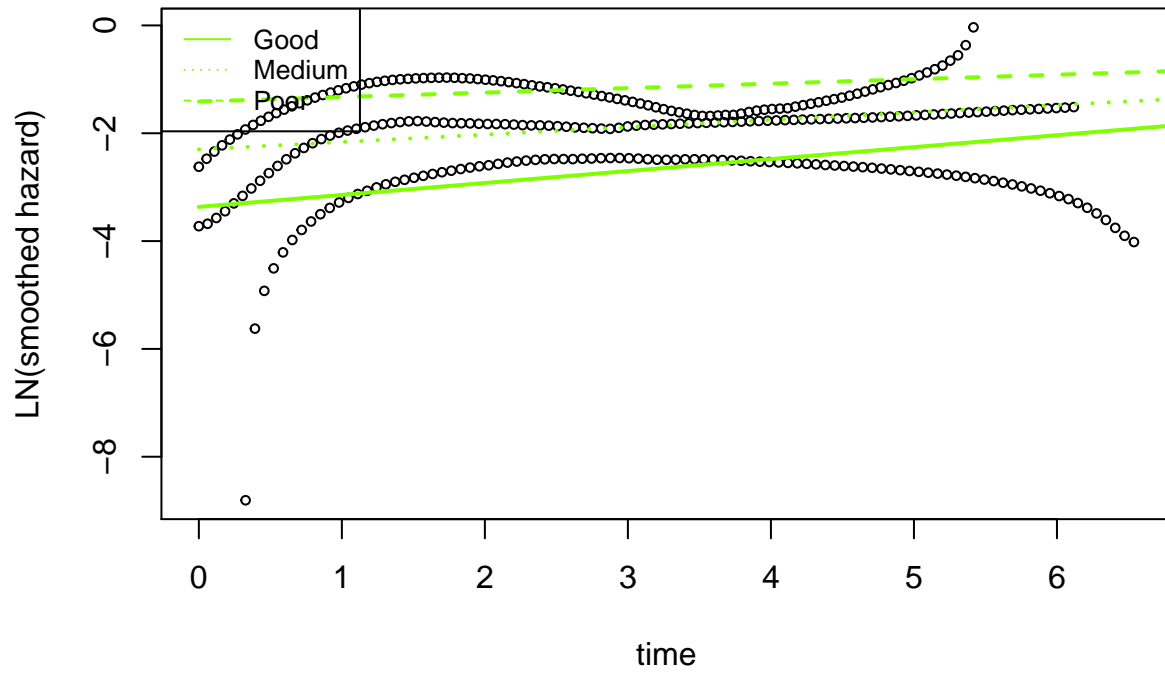
**A: Kaplan–Meier (Gompertz)**



### B: Annual transition probability (Gompertz)



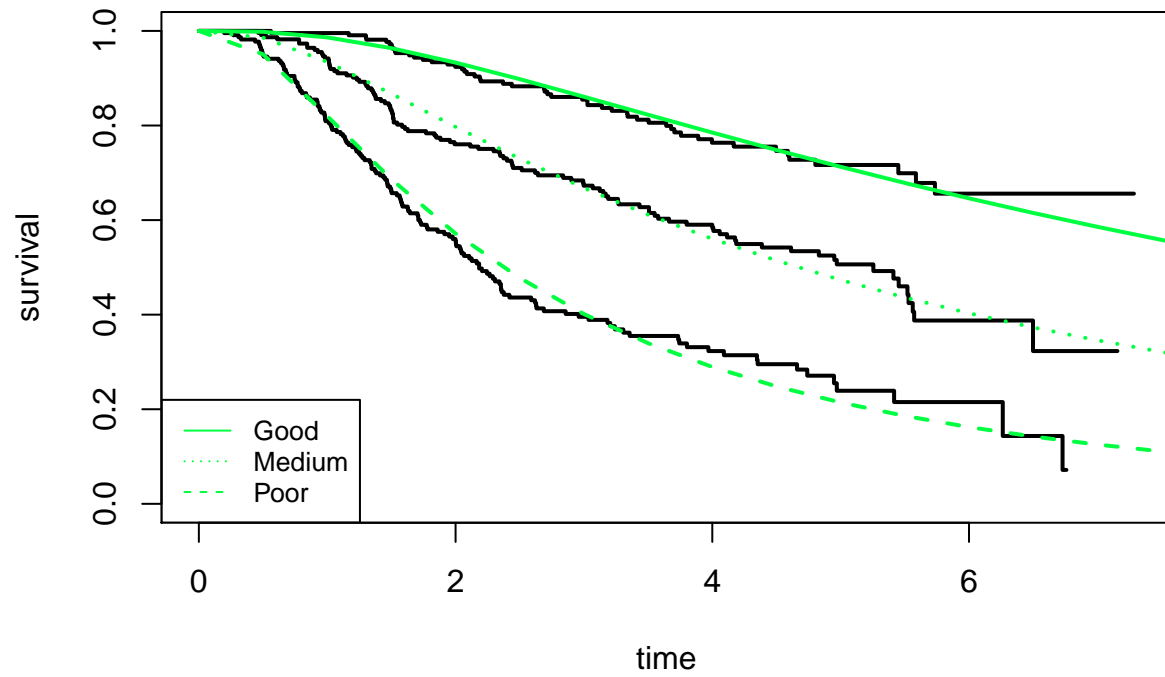
### C: Diagnostic plot (Gompertz)



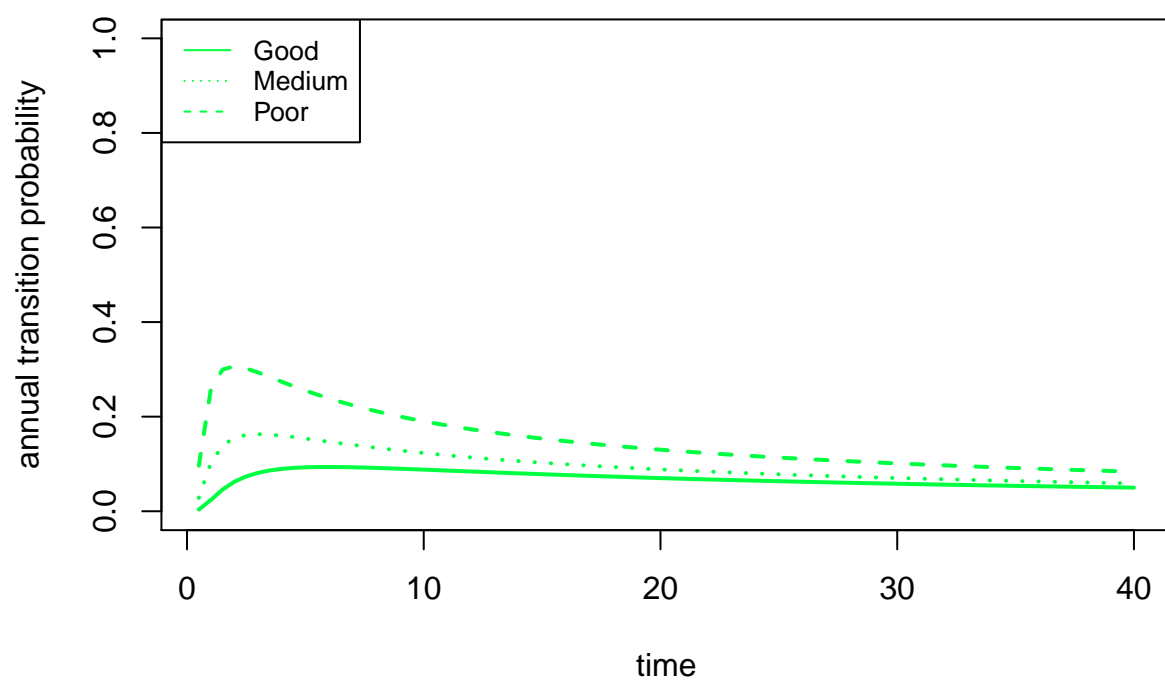


Lognormal

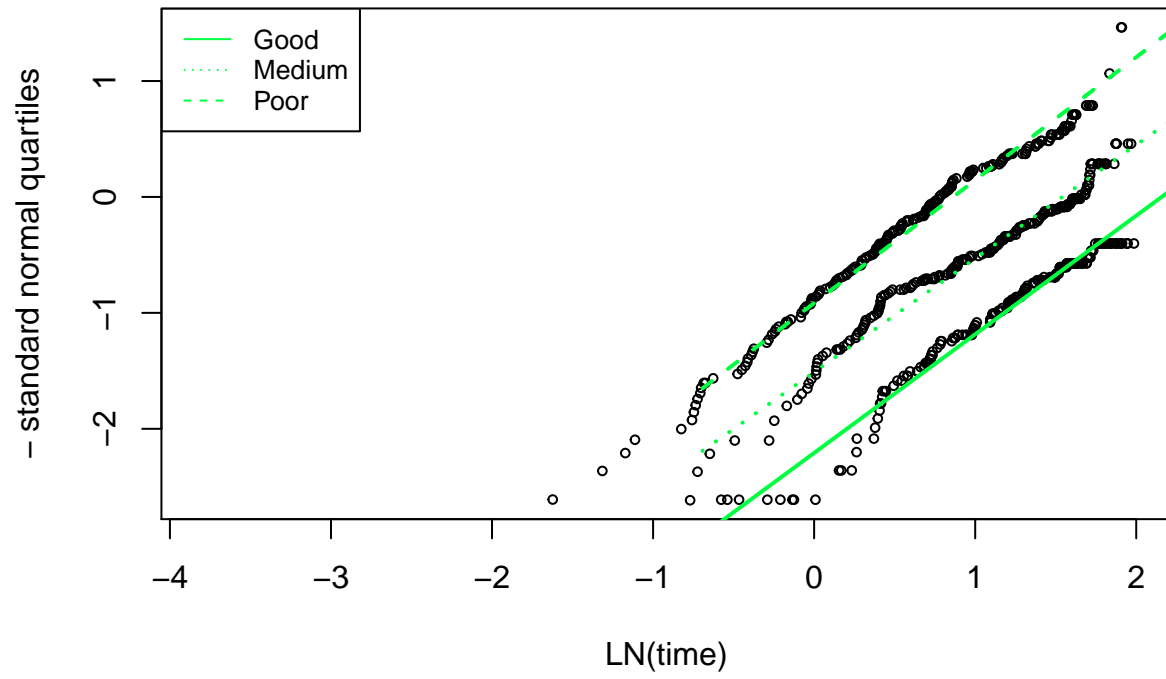
**A: Kaplan–Meier (Log-normal)**



### B: Annual transition probability (Log-normal)

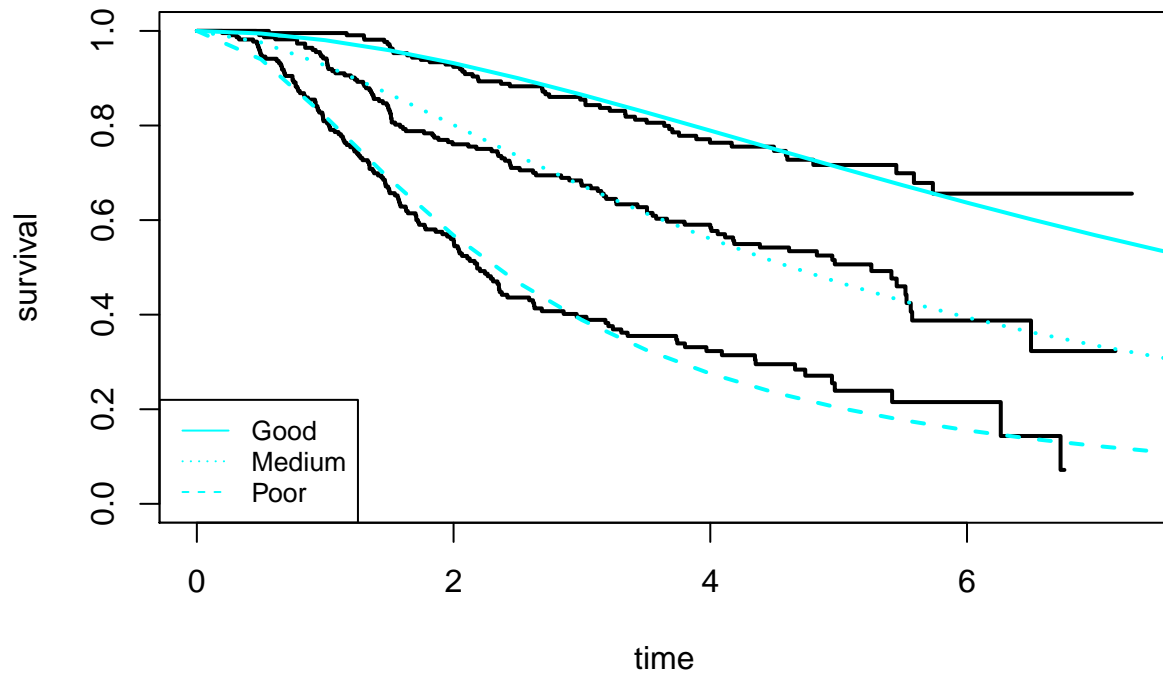


### C: Diagnostic plot (Log-normal)

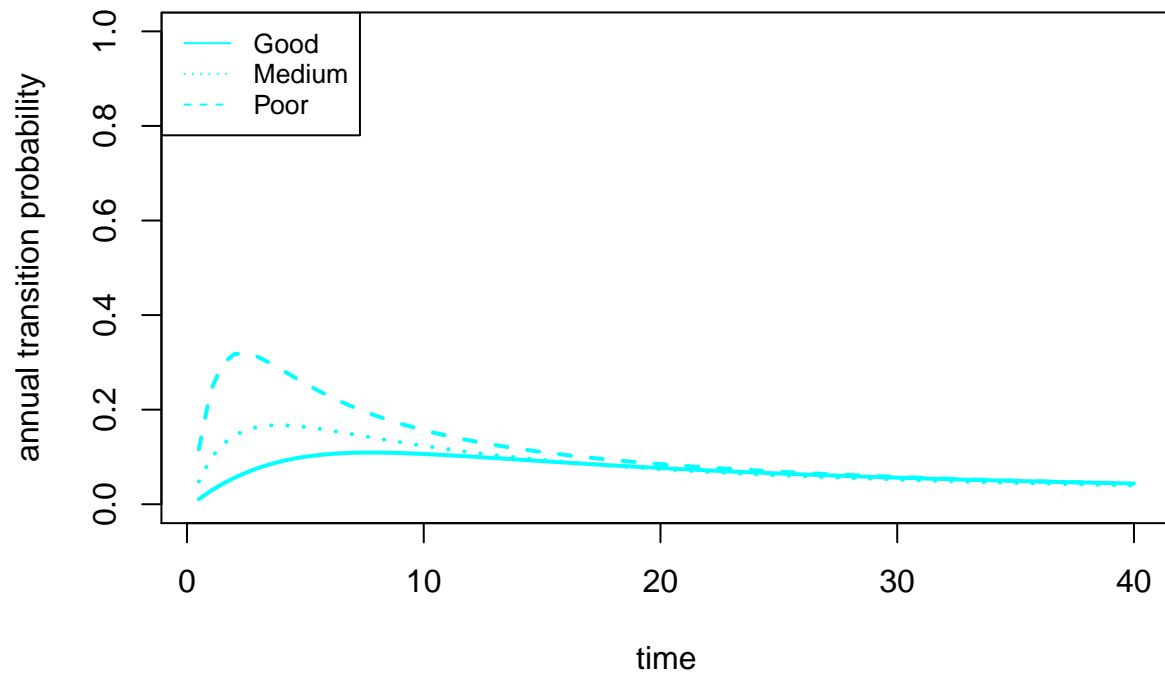


Loglogistic

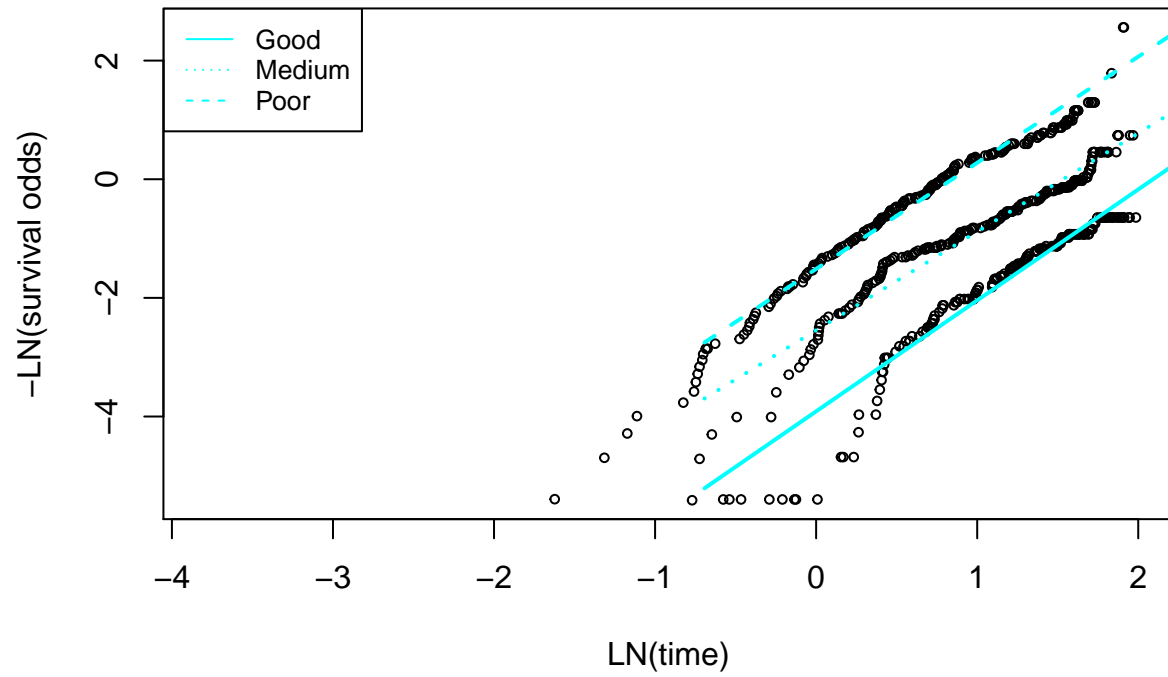
**A: Kaplan–Meier (Log–logistic)**



### B: Annual transition probability (Log-logistic)

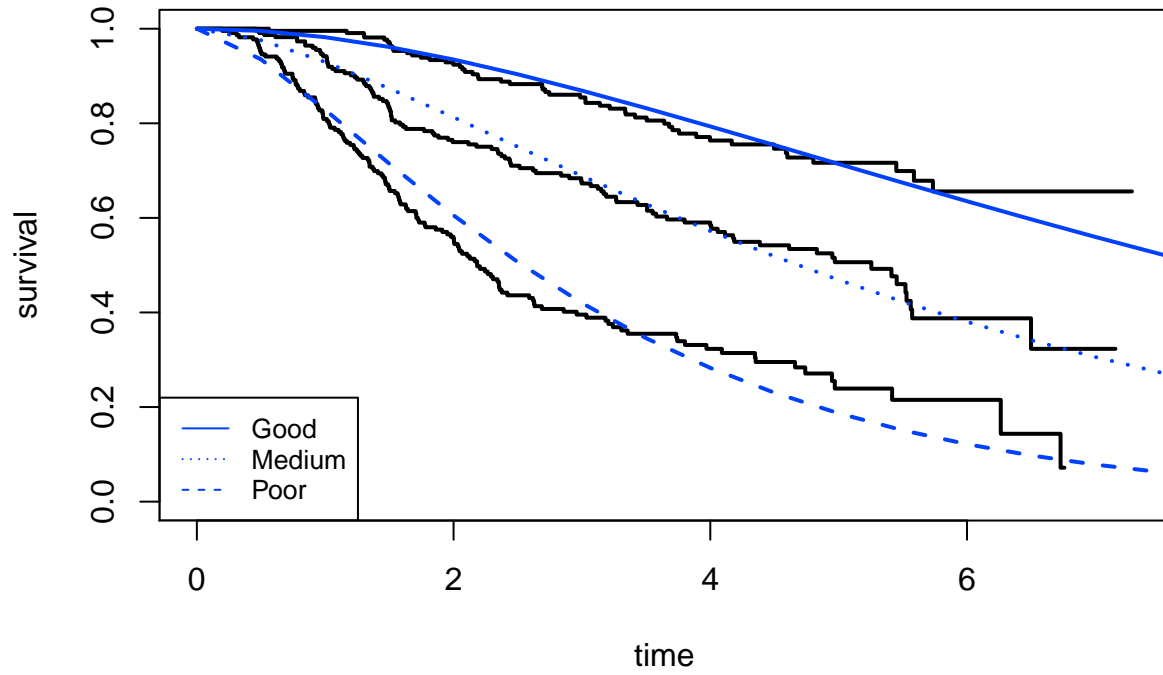


### C: Diagnostic plot (Log-logistic)

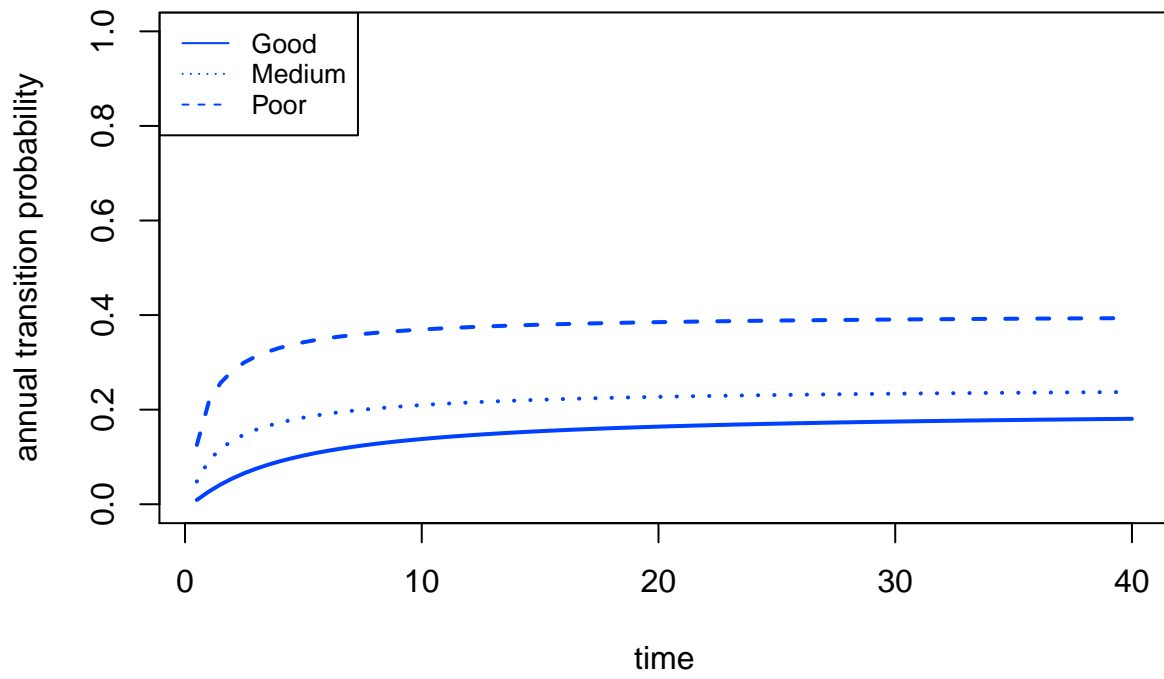


Gamma

**A: Kaplan–Meier (Gamma)**

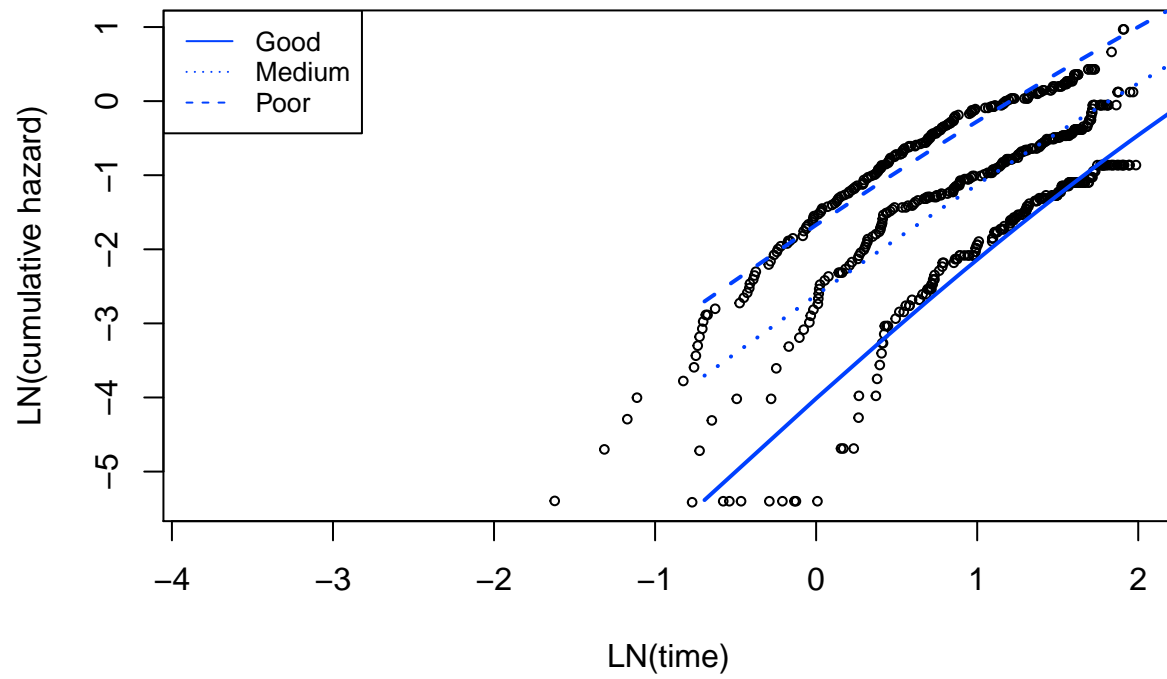


### B: Annual transition probability (Gamma)



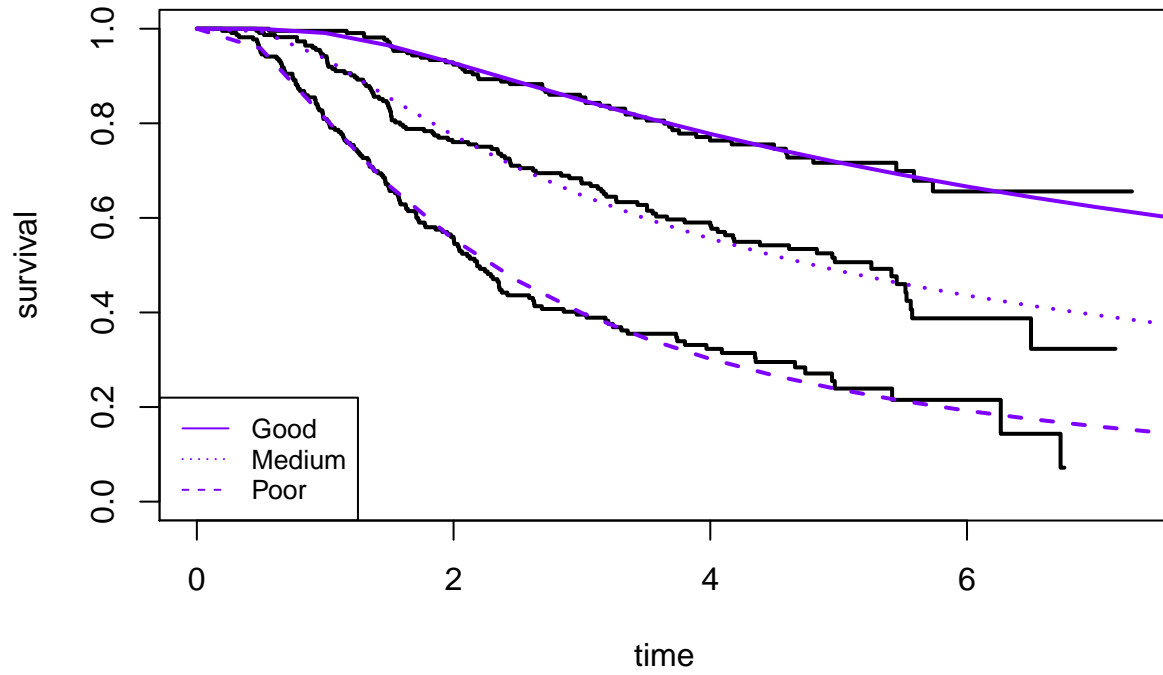


### C: Diagnostic plot (Gamma)

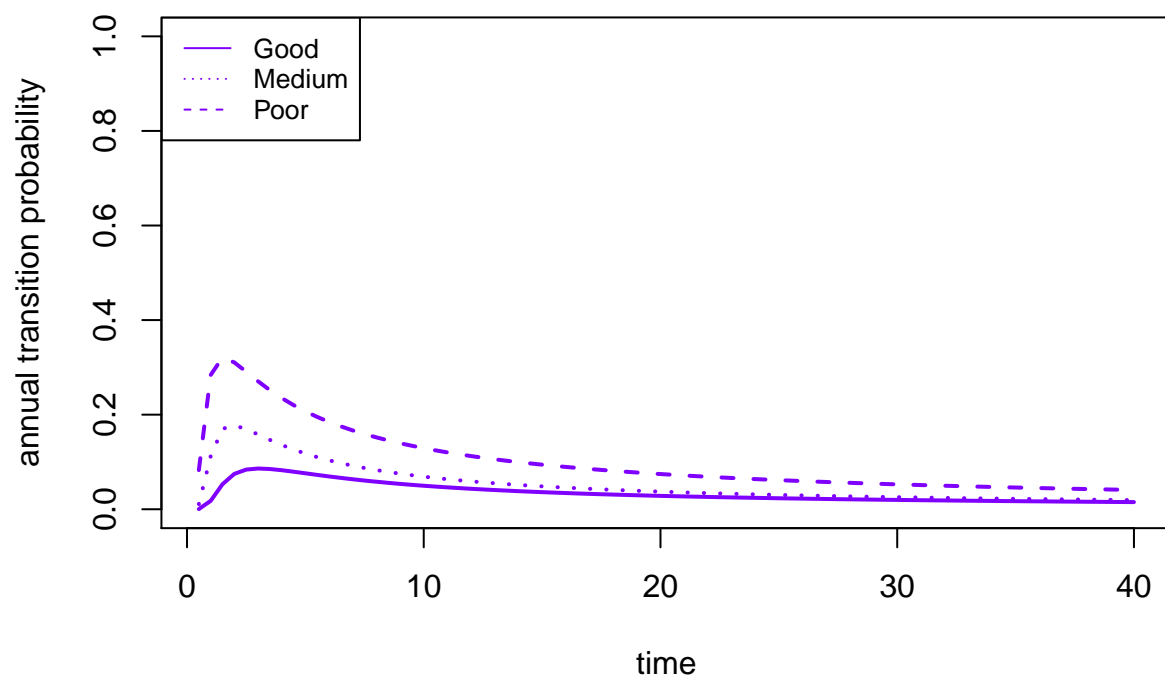


## Generalised Gamma

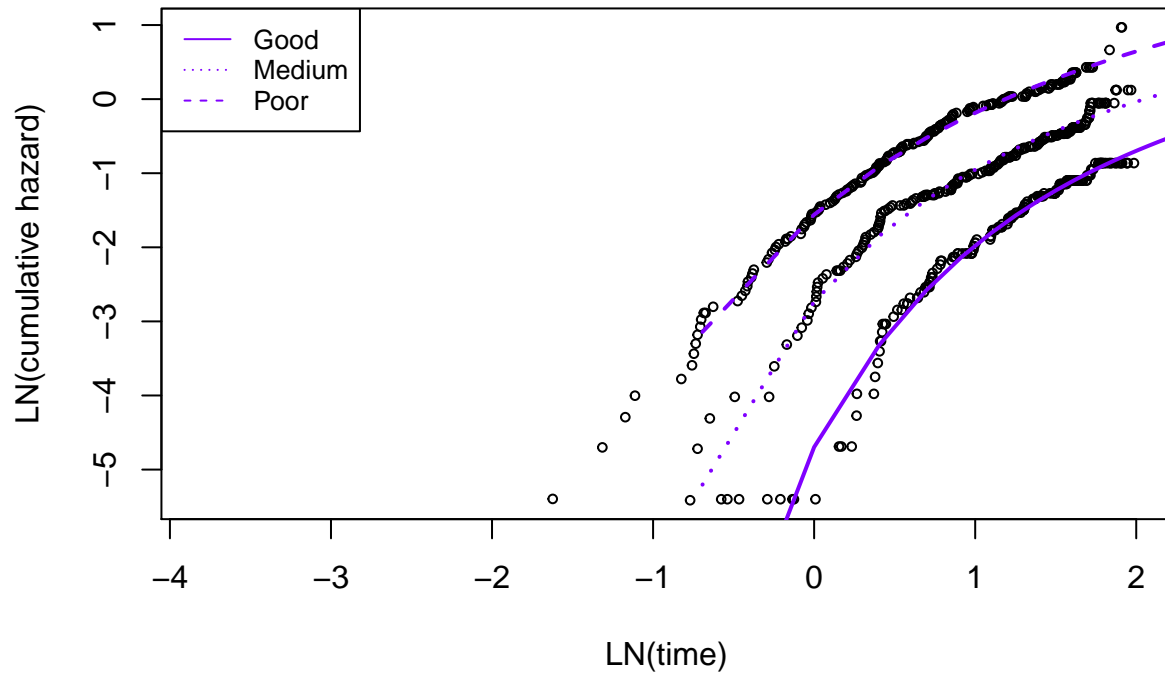
**A: Kaplan–Meier (Generalised gamma)**



## B: Annual transition probability (Generalised gamma)

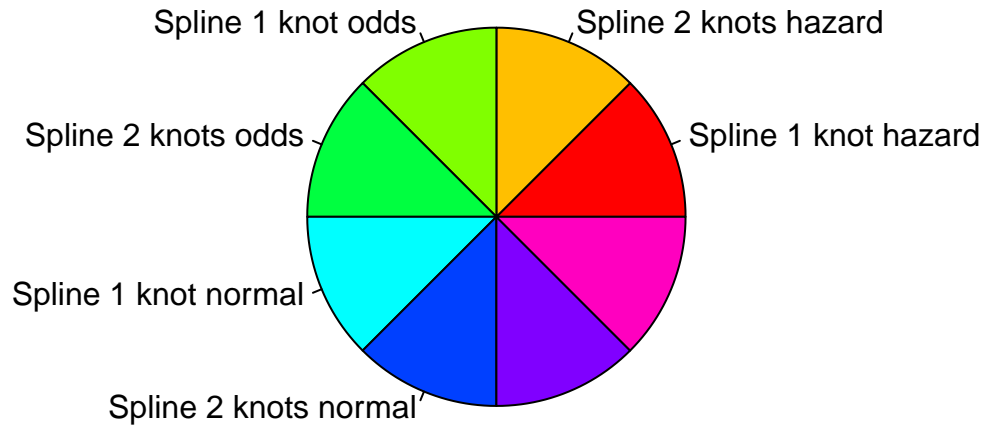


### C: Diagnostic plot (Generalised gamma)



### Parametric spline models?

If standard parametric models are not appropriate, are spline models a more appropriate fit to the data?

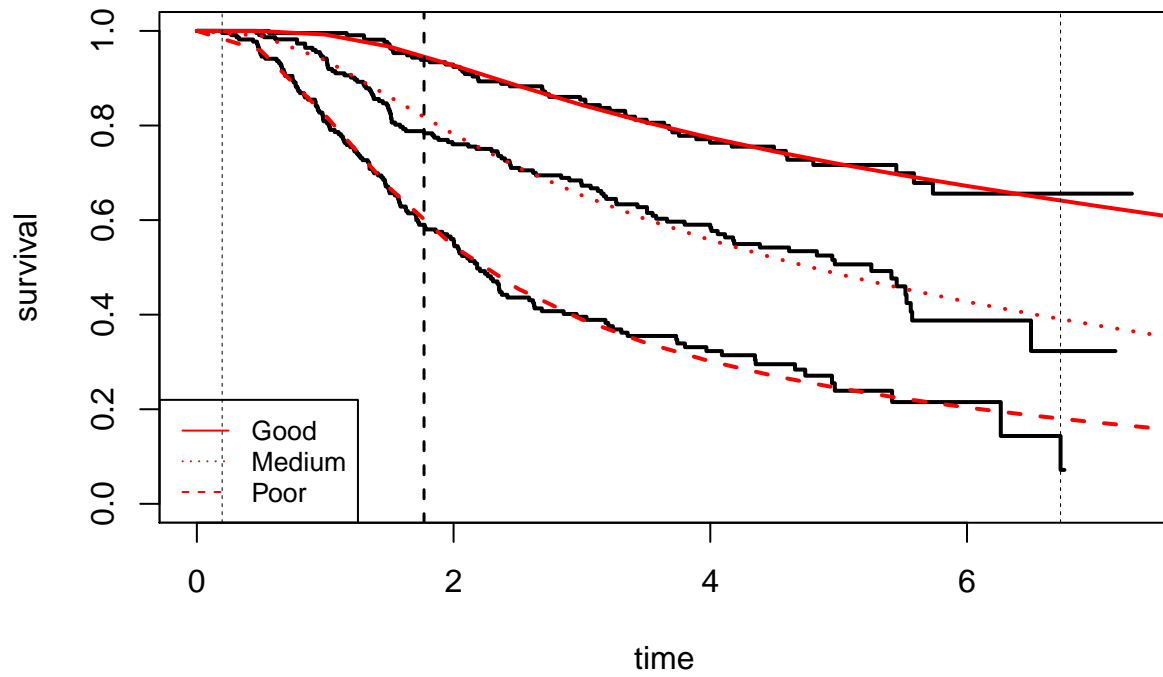


Distr	ibution	AIC	BIC
7	ggam	1589.049	1629.826
4	lnorm	1592.880	1620.066
5	llog	1609.294	1636.479
6	gam	1621.982	1649.167
2	weib	1632.618	1659.803
3	gom	1660.954	1688.140
1	exp	1668.212	1681.805

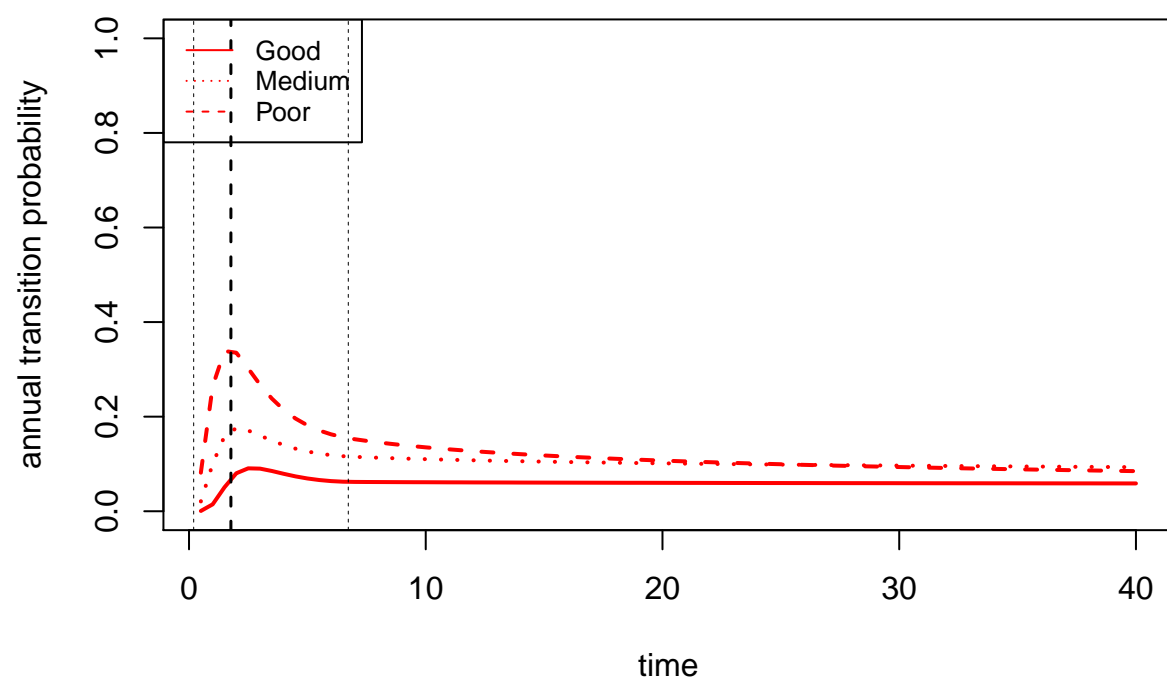
	Scale	knots	AIC	BIC
4	hazard	2	1585.894	1640.264
5	odds	2	1587.289	1641.659
3	normal	1	1587.682	1628.460
6	normal	2	1588.343	1642.714
1	hazard	1	1589.327	1630.105
2	odds	1	1590.221	1630.999

Spline hazard 1 knot

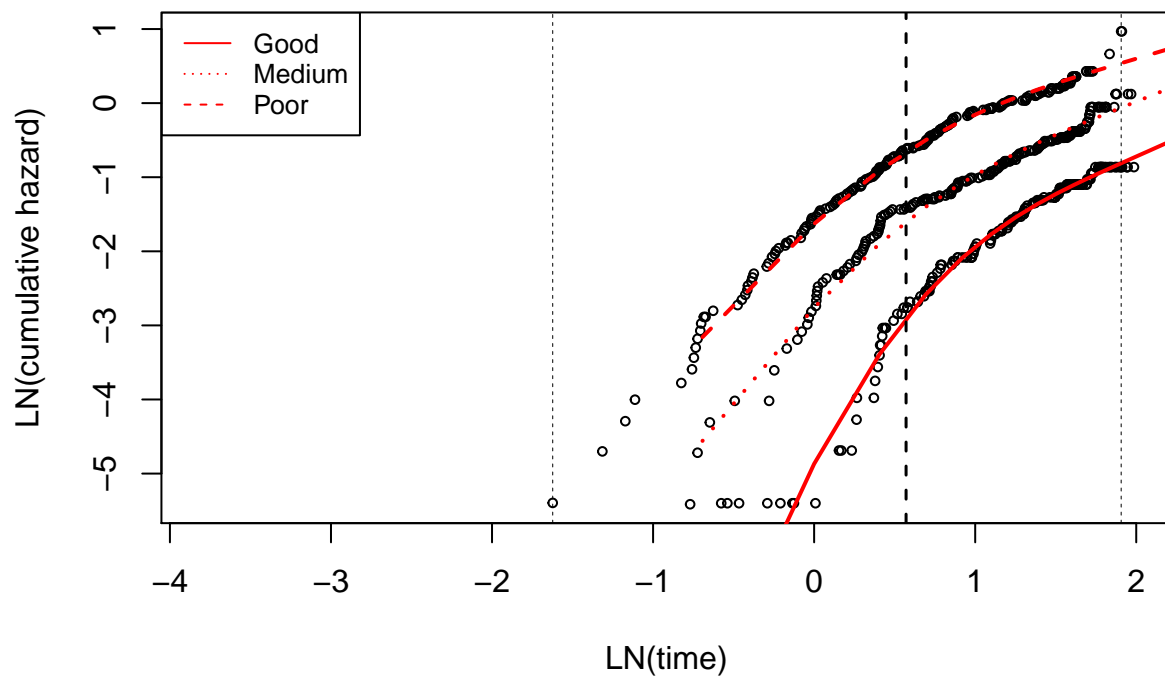
**A: Kaplan–Meier (Spline, 1 knot, hazard scale)**



### B: Annual transition probability (Spline, 1 knot, hazard scale)



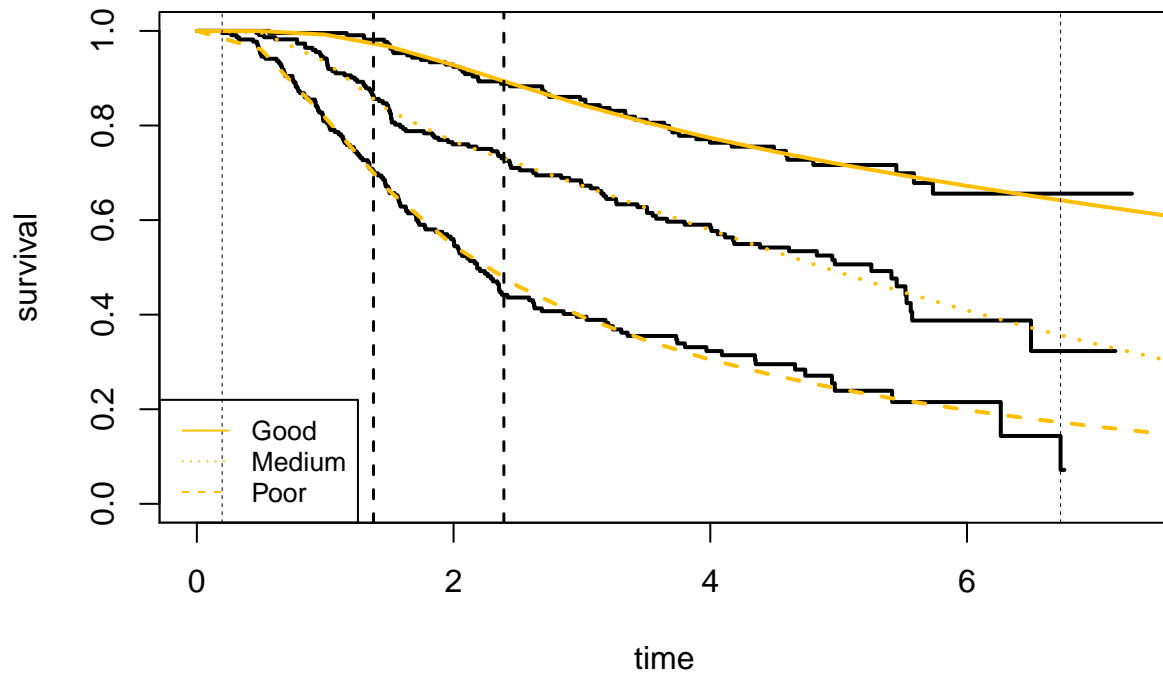
**C: Diagnostic plot (Spline, 1 knot, hazard scale)**



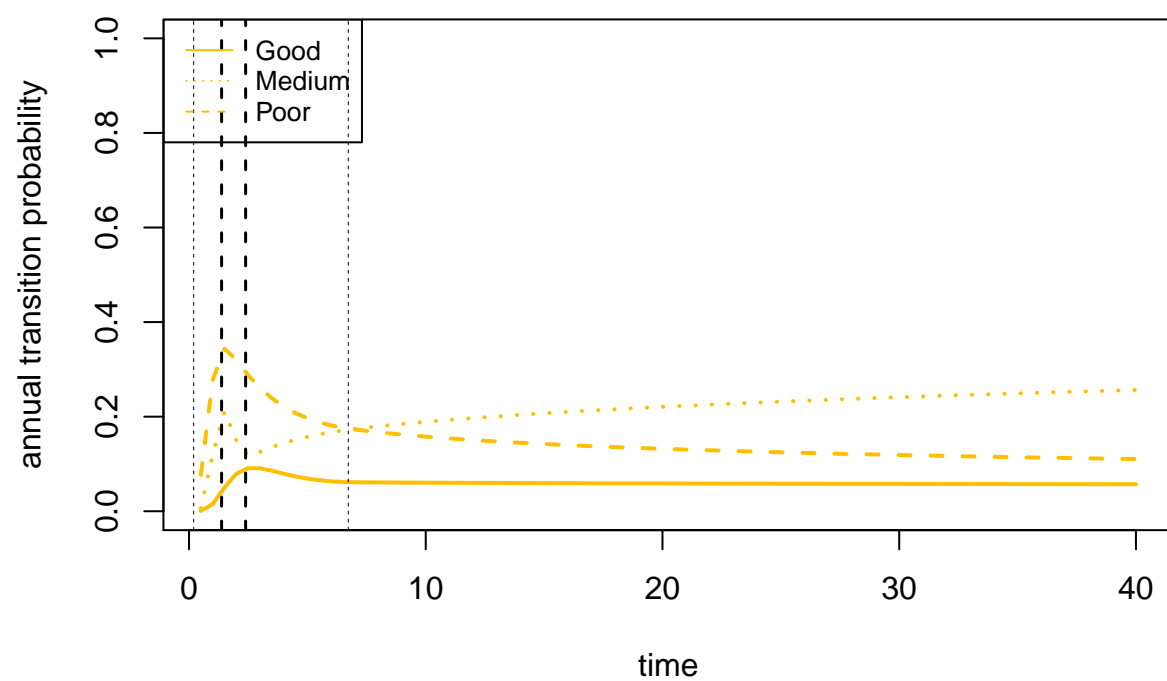


## Spline hazard 2 knots

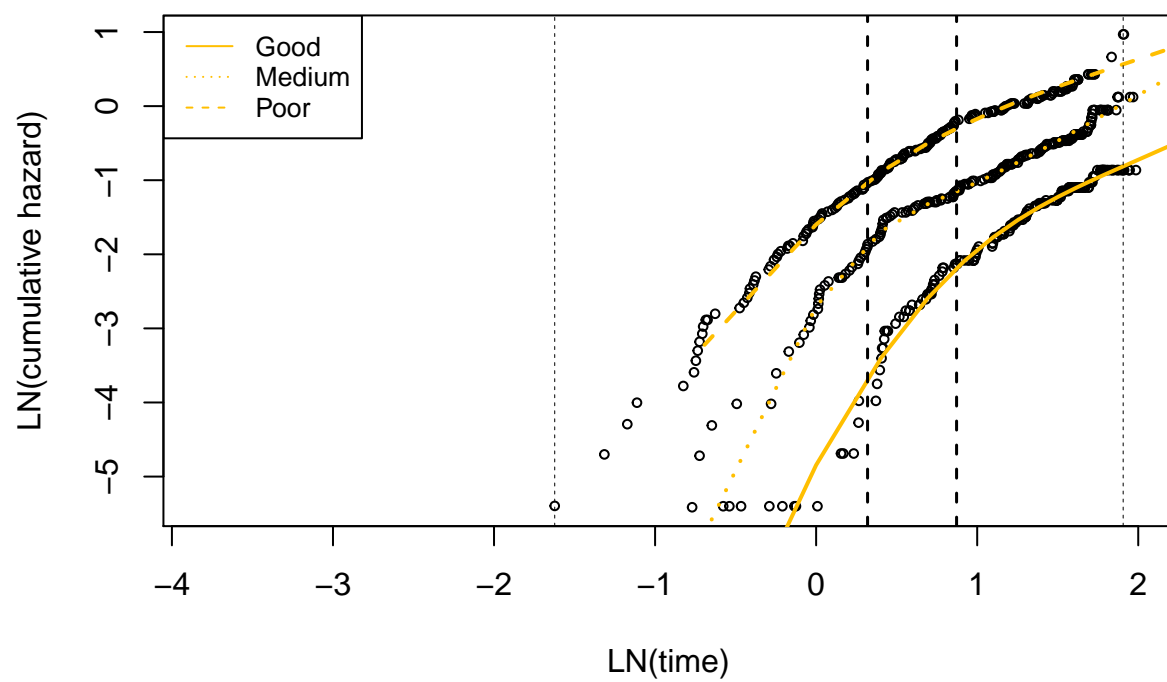
**A: Kaplan–Meier (Spline, 2 knots, hazard scale)**



**B: Annual transition probability (Spline, 2 knots, hazard scale)**

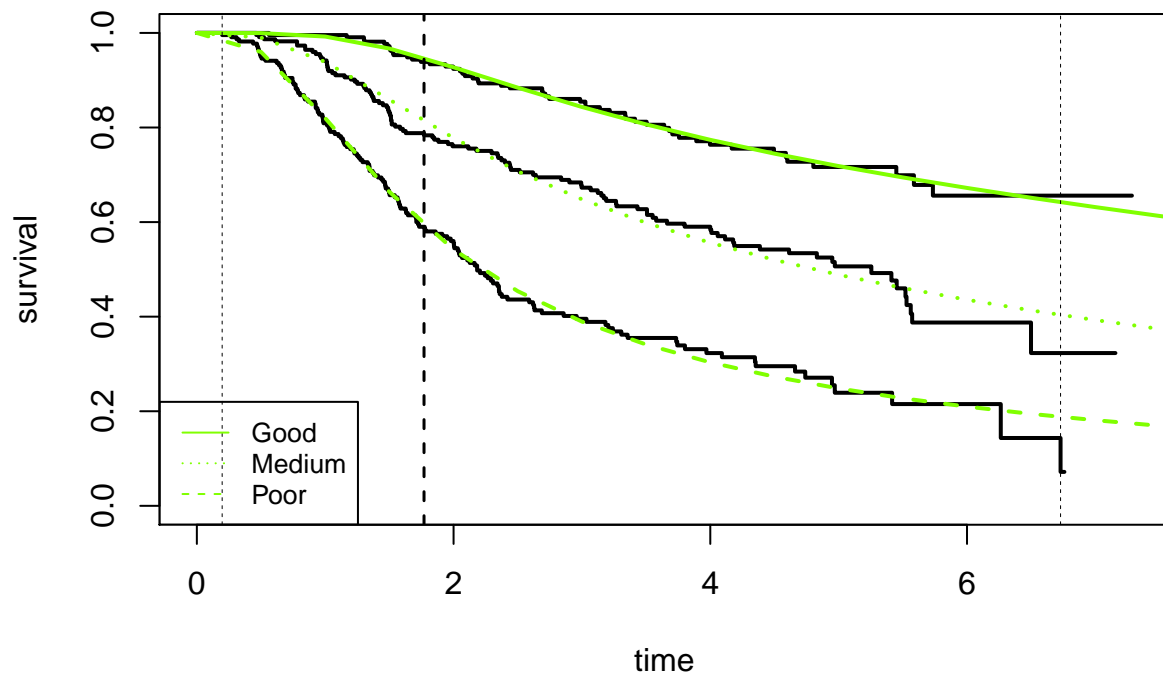


**C: Diagnostic plot (Spline, 2 knots, hazard scale)**

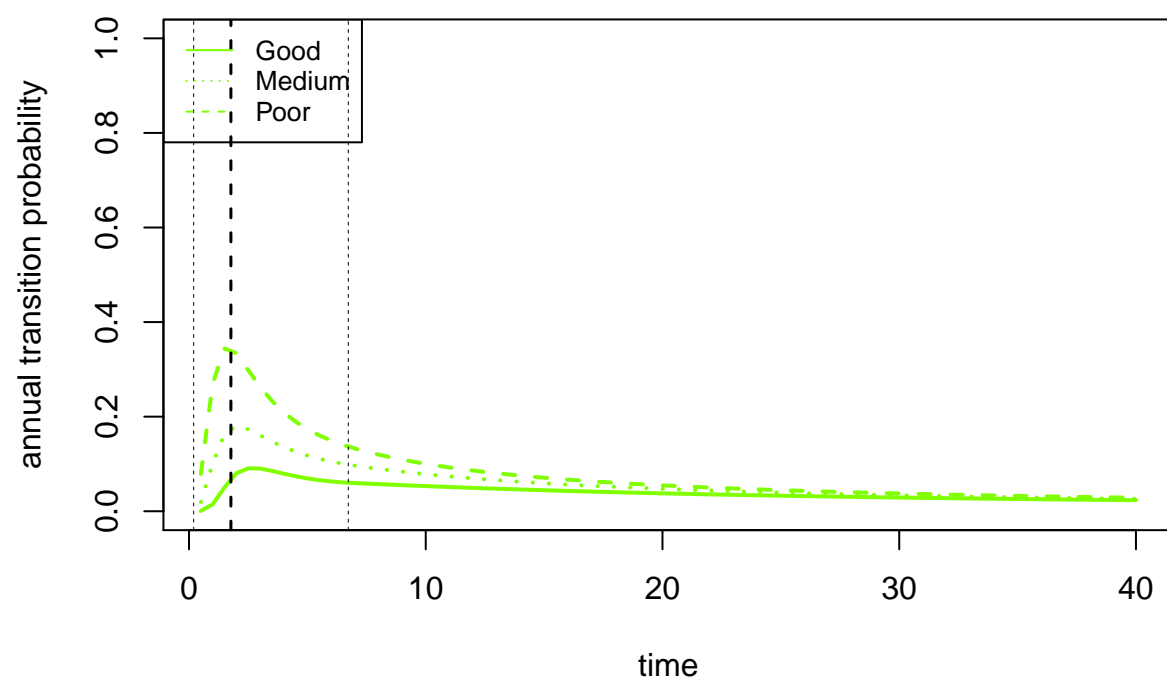


Spline odds 1 knot

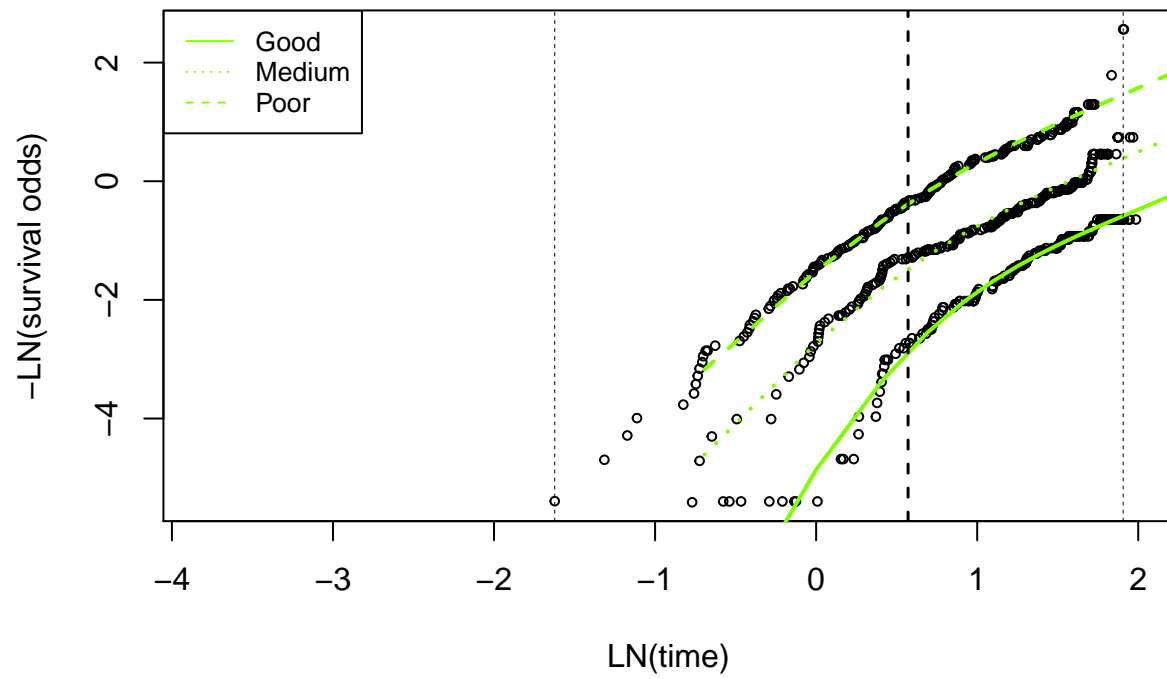
**A: Kaplan–Meier (Spline, 1 knot, odds scale)**



**B: Annual transition probability (Spline, 1 knot, odds scale)**

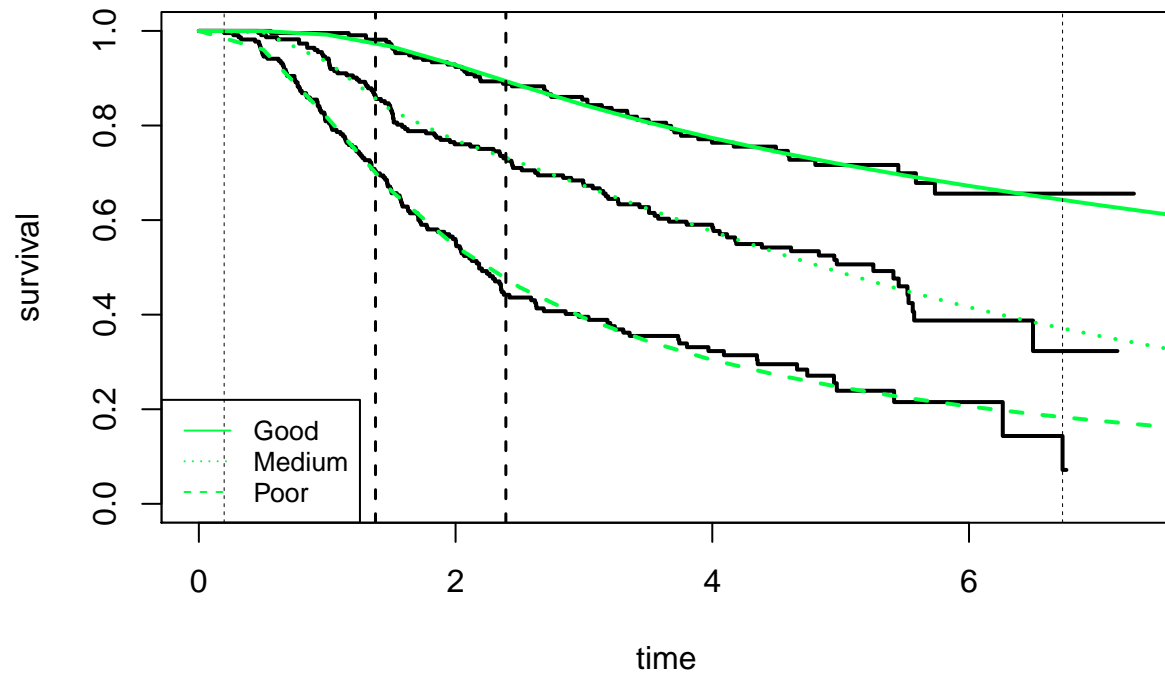


**C: Diagnostic plot (Spline, 1 knot, odds scale)**

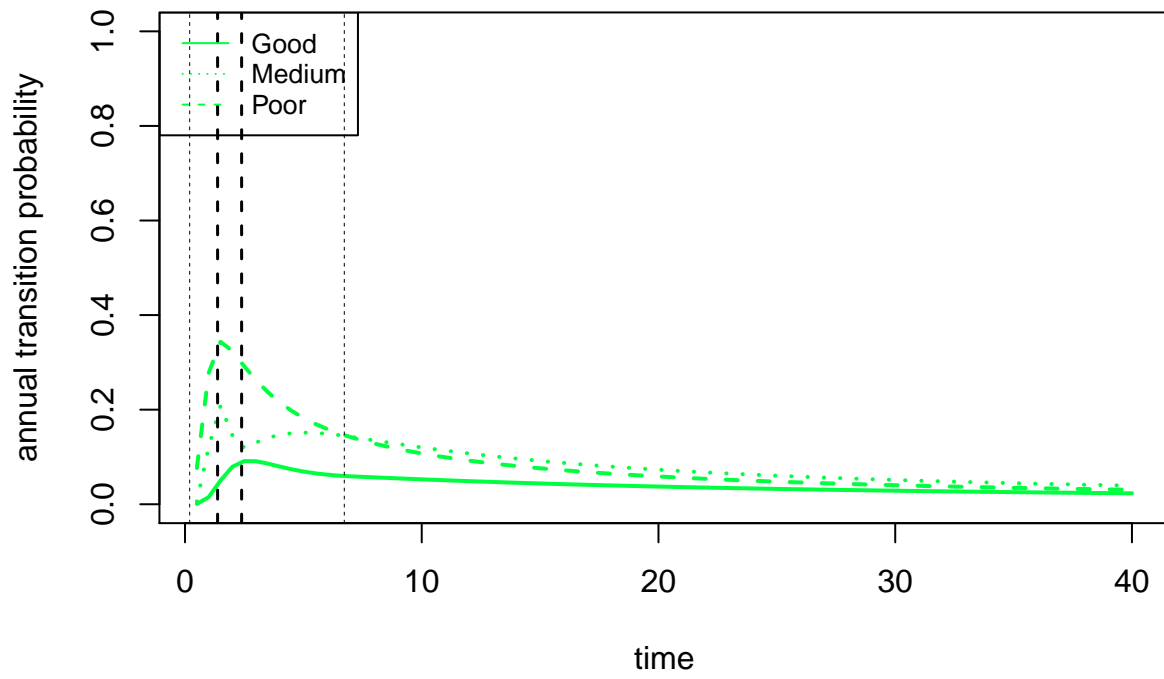


Spline odds 2 knots

**A: Kaplan–Meier (Spline, 2 knots, odds scale)**

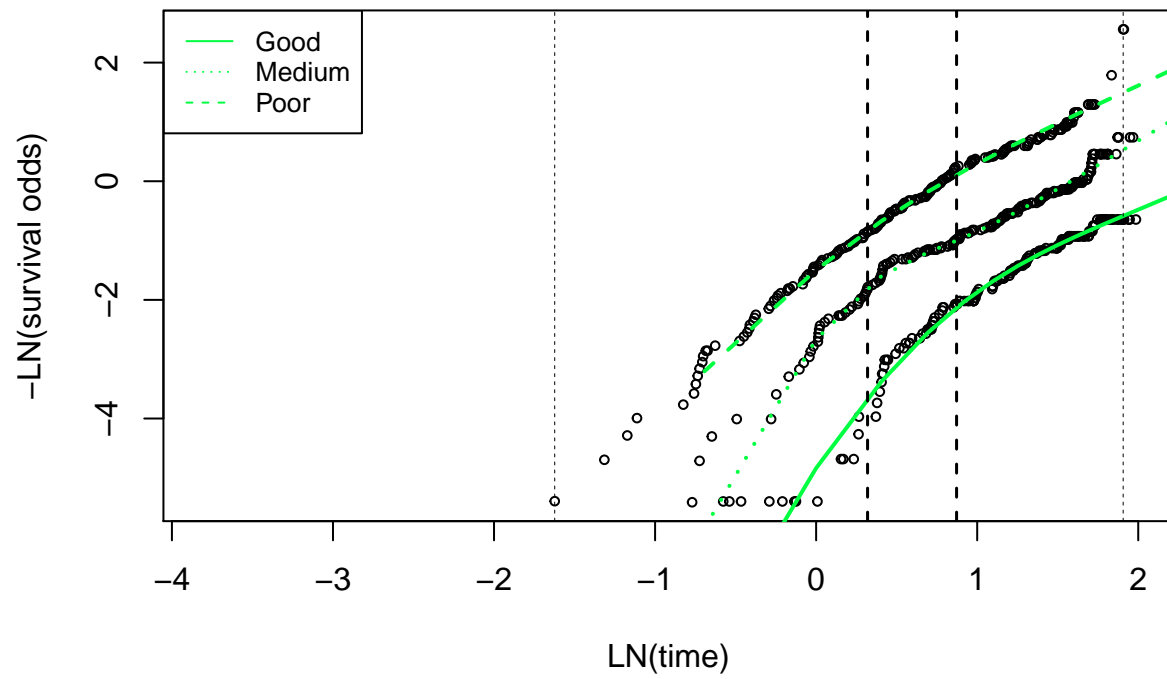


**B: Annual transition probability (Spline, 2 knots, odds scale)**



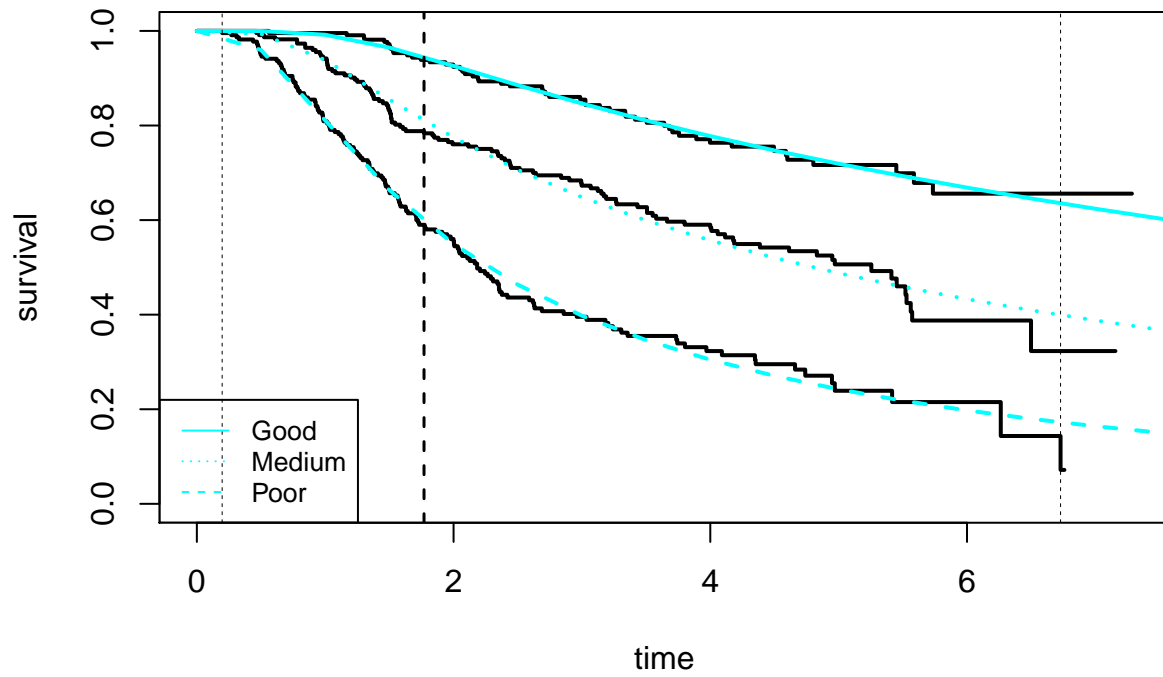


**C: Diagnostic plot (Spline, 2 knots, odds scale)**

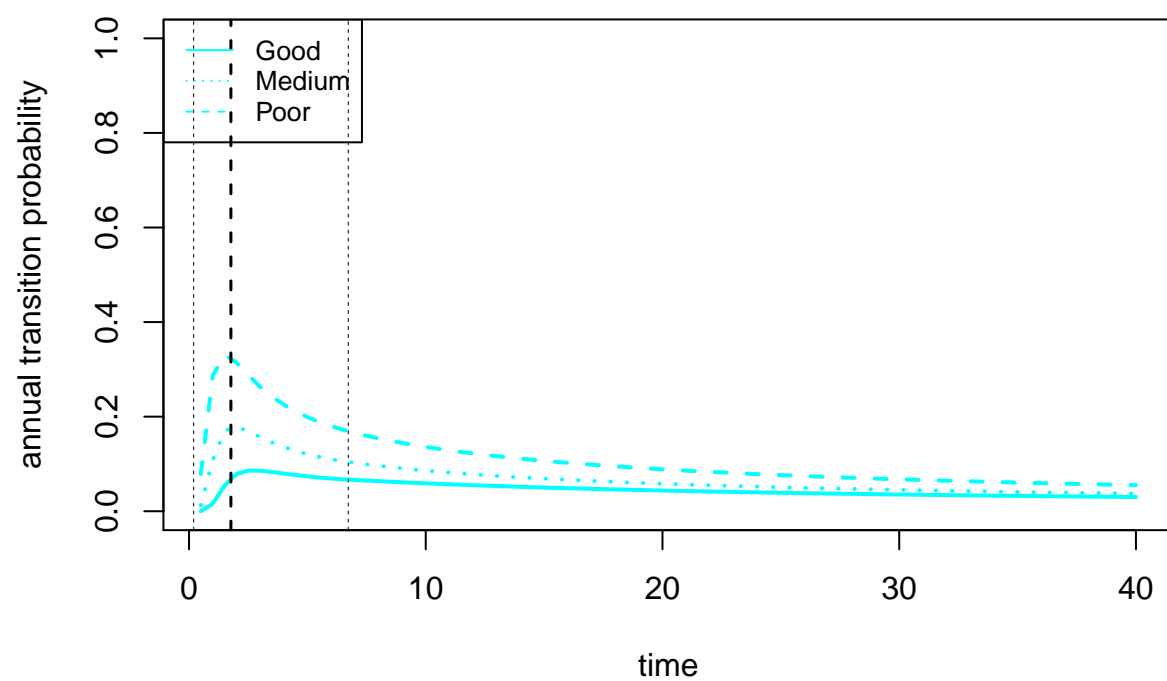


Spline normal 1 knot

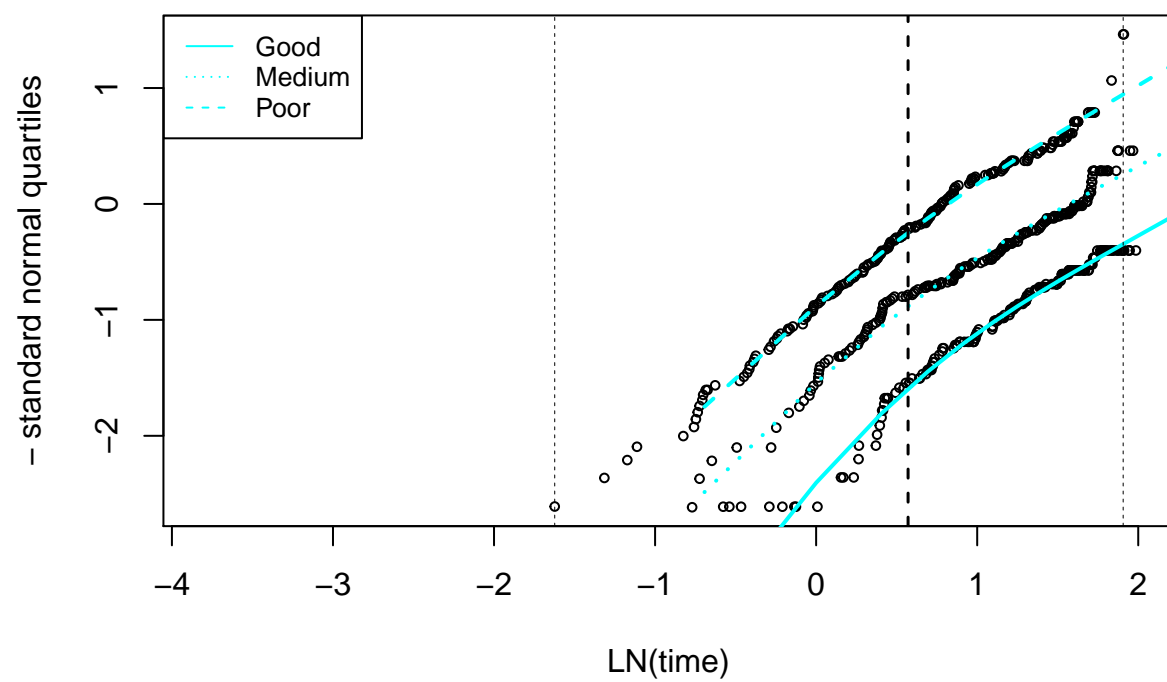
**A: Kaplan–Meier (Spline, 1 knot, normal scale)**



### B: Annual transition probability (Spline, 1 knot, normal scale)

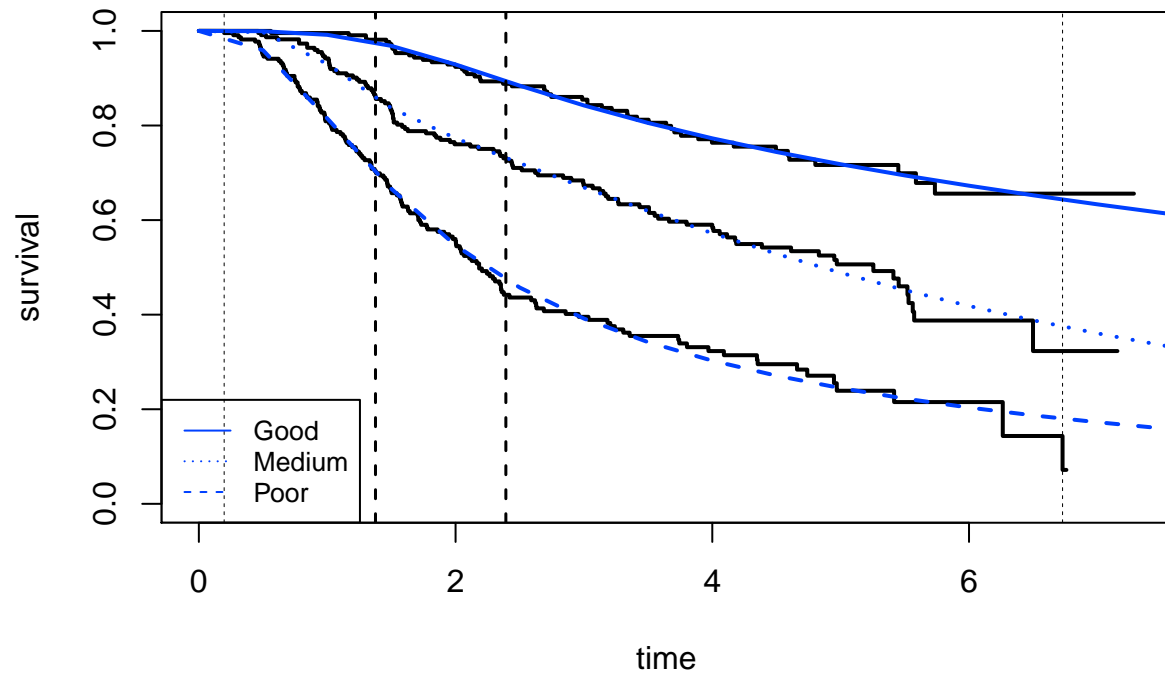


**C: Diagnostic plot (Spline, 1 knot, normal scale)**

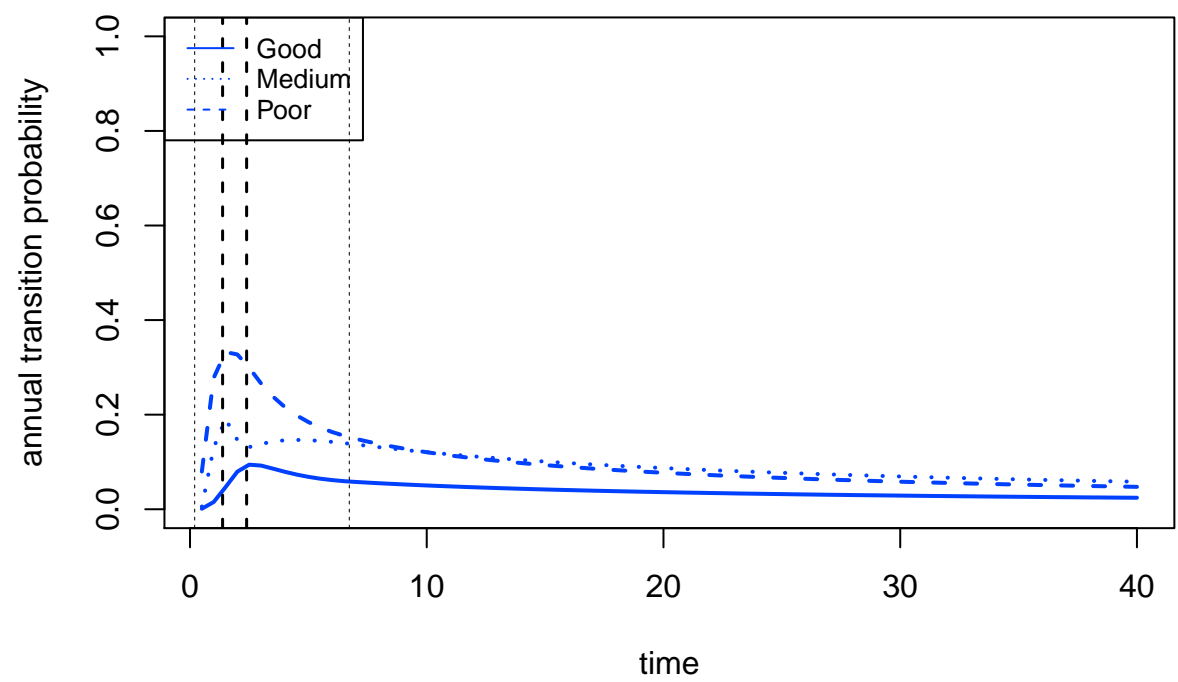


Spline normal 2 knots

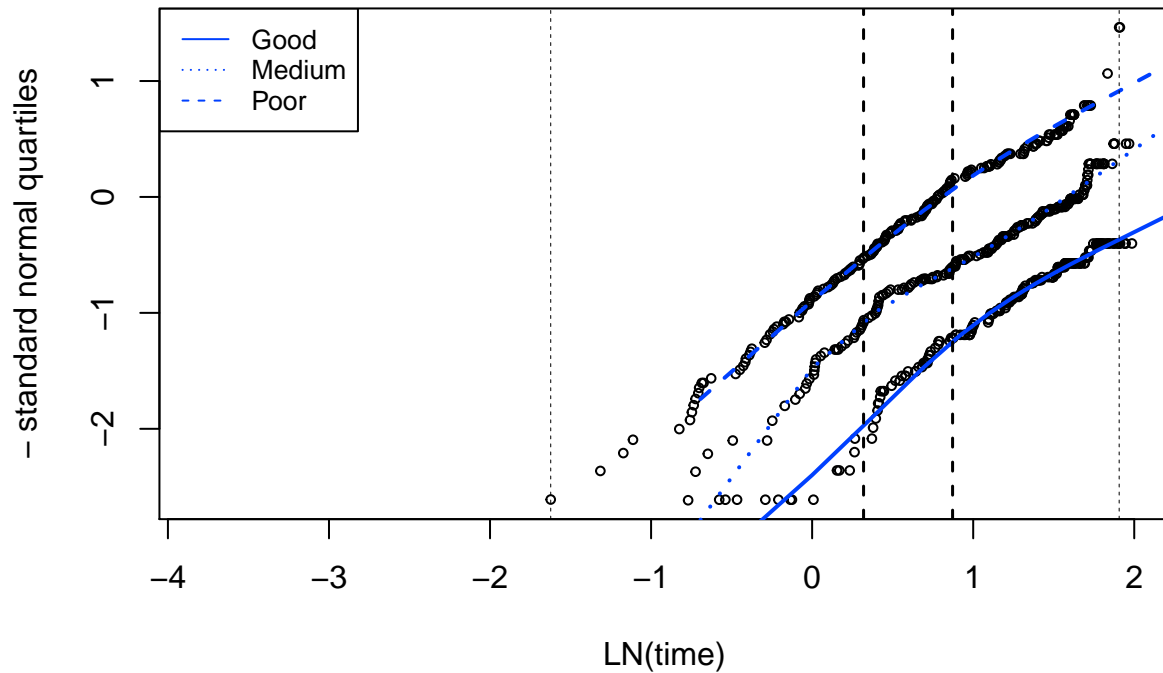
**A: Kaplan–Meier (Spline, 2 knots, normal scale)**



**B: Annual transition probability (Spline, 2 knots, normal scale)**



### C: Diagnostic plot (Spline, 2 knots, normal scale)



### Validity of long-term extrapolation?

What model(s) is/are more appropriate for long-term extrapolation? Are/is the selected model(s) plausible in comparison with general population mortality?

#### Group Good

Time	Exponential	Weibull	Gompertz	Lognormal	Loglogistic	Gamma	Generalised Gamma
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	0.941	0.978	0.962	0.986	0.980	0.982	0.991
2	0.886	0.932	0.917	0.933	0.932	0.935	0.928
3	0.834	0.870	0.863	0.861	0.865	0.869	0.849
4	0.785	0.797	0.801	0.785	0.789	0.793	0.778
5	0.739	0.719	0.729	0.713	0.712	0.714	0.717
10	0.547	0.345	0.280	0.441	0.403	0.367	0.526
15	0.404	0.122	0.015	0.287	0.240	0.165	0.425
20	0.299	0.033	0.000	0.196	0.156	0.069	0.362
25	0.221	0.007	0.000	0.139	0.108	0.027	0.319
30	0.163	0.001	0.000	0.102	0.080	0.011	0.286
35	0.121	0.000	0.000	0.076	0.061	0.004	0.261

Time	Spline 1 knot normal	Spline 2 knots normal
0	1.000	1.000
1	0.992	0.992
2	0.926	0.929
3	0.847	0.842
4	0.778	0.773
5	0.719	0.718
10	0.515	0.538
15	0.391	0.426
20	0.308	0.350
25	0.250	0.295
30	0.207	0.253
35	0.174	0.220

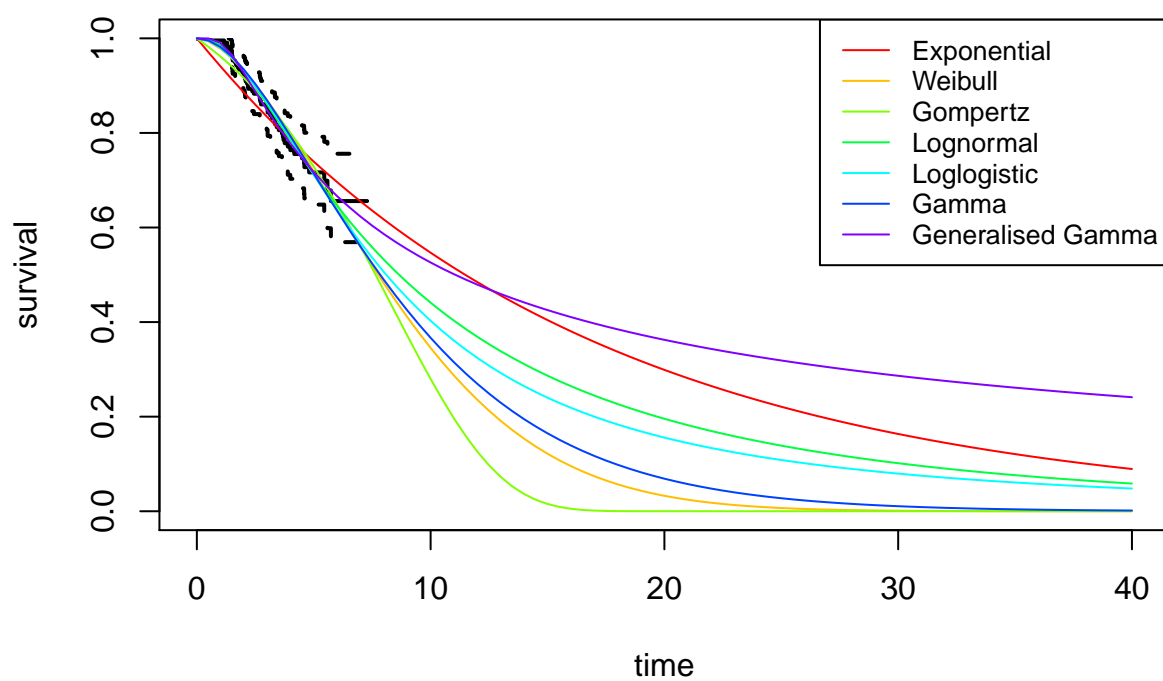
Exponential	Weibull	Gompertz	Lognormal	Loglogistic
Min. :0.0586	Min. :0.0135	Min. :0.0359	Min. :0.00350	Min. :0.01080
1st Qu.:0.0586	1st Qu.:0.1654	1st Qu.:0.1325	1st Qu.:0.05658	1st Qu.:0.05373
Median :0.0586	Median :0.2507	Median :0.4243	Median :0.06695	Median :0.06985
Mean :0.0586	Mean :0.2350	Mean :0.4907	Mean :0.06835	Mean :0.07280
3rd Qu.:0.0586	3rd Qu.:0.3164	3rd Qu.:0.8826	3rd Qu.:0.08142	3rd Qu.:0.09320
Max. :0.0586	Max. :0.3704	Max. :1.0000	Max. :0.09360	Max. :0.10920
		NA's :30		

Gamma	Generalised Gamma	Spline 1 knot hazard	Spline 2 knots hazard
Min. :0.0091	Min. :0.00040	Min. :0.00060	Min. :0.00060
1st Qu.:0.1396	1st Qu.:0.01903	1st Qu.:0.05920	1st Qu.:0.05767
Median :0.1645	Median :0.02685	Median :0.05990	Median :0.05850
Mean :0.1493	Mean :0.03472	Mean :0.06053	Mean :0.05938
3rd Qu.:0.1749	3rd Qu.:0.04510	3rd Qu.:0.06100	3rd Qu.:0.05992
Max. :0.1807	Max. :0.08610	Max. :0.09070	Max. :0.09120

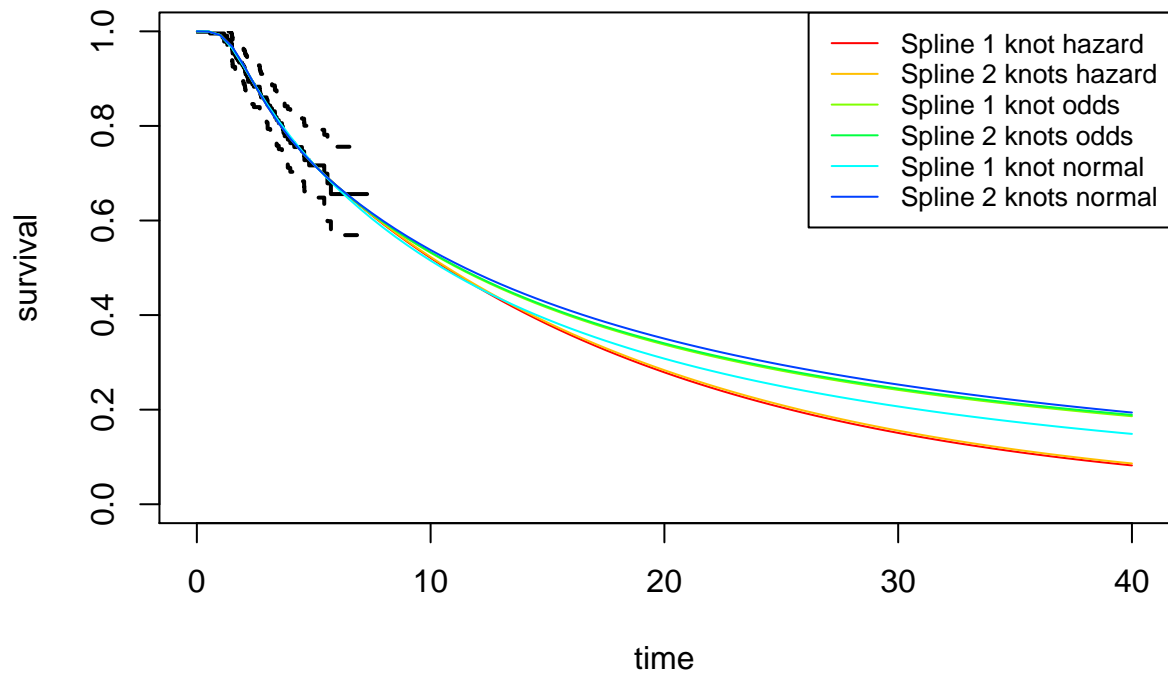
Spline 1 knot odds	Spline 2 knots odds	Spline 1 knot normal	Spline 2 knots normal
Min. :0.00060	Min. :0.00070	Min. :0.00030	Min. :0.00110
1st Qu.:0.02823	1st Qu.:0.02790	1st Qu.:0.03470	1st Qu.:0.02823
Median :0.03645	Median :0.03605	Median :0.04245	Median :0.03500
Mean :0.04100	Mean :0.04065	Mean :0.04639	Mean :0.04002
3rd Qu.:0.05035	3rd Qu.:0.04980	3rd Qu.:0.05532	3rd Qu.:0.04677
Max. :0.09070	Max. :0.09120	Max. :0.08590	Max. :0.09420



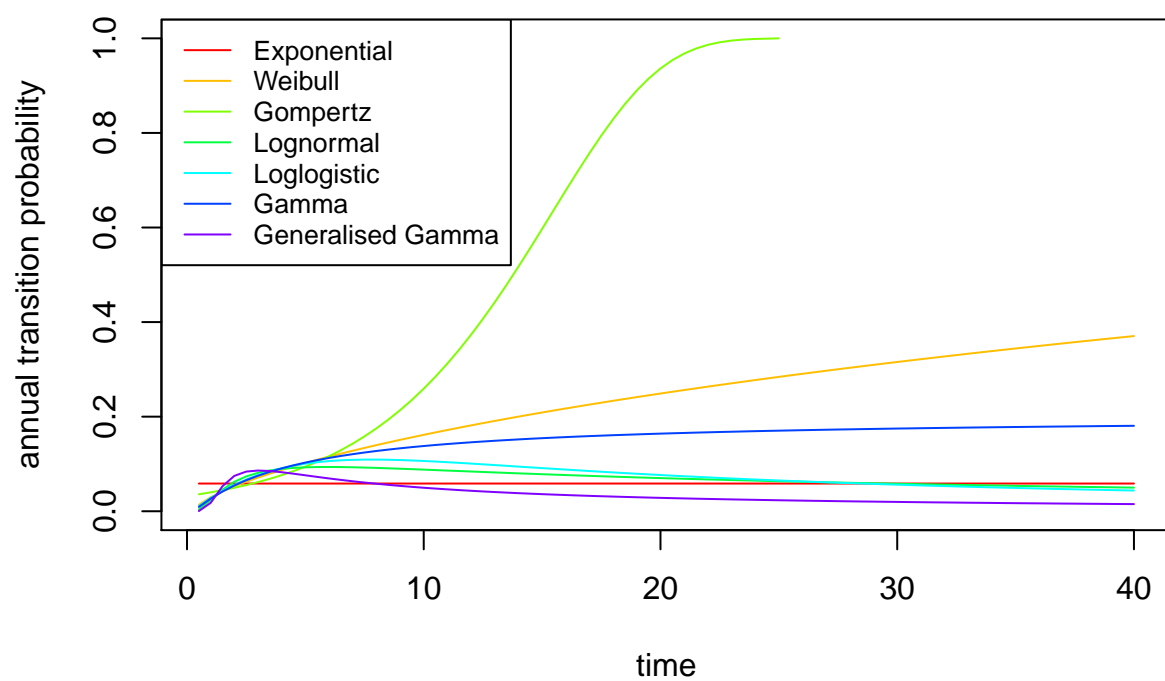
### A: Kaplan–Meier (parametric curves)



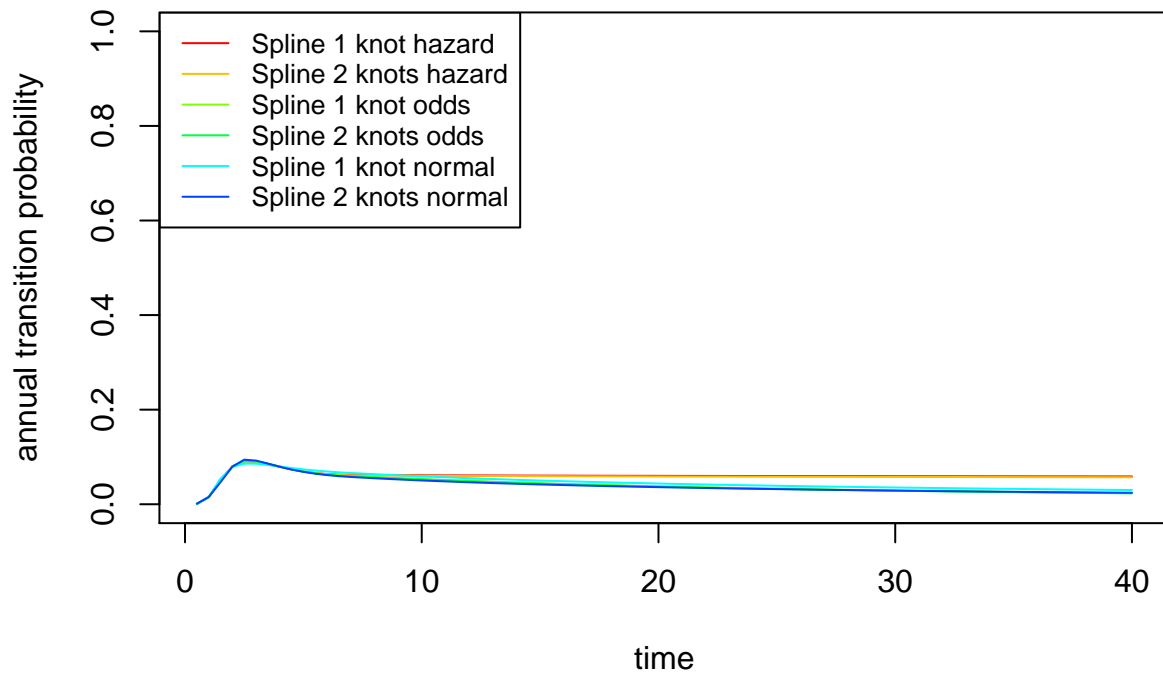
## B: Kaplan–Meier (spline curves)



### C: Annual transition probability (parametric curves)



## D: Annual transition probability (spline curves)



### Group Medium

Time	Exponential	Weibull	Gompertz	Lognormal	Loglogistic	Gamma	Generalised Gamma
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	0.872	0.923	0.898	0.935	0.927	0.930	0.937
2	0.761	0.811	0.794	0.797	0.801	0.813	0.774
3	0.663	0.693	0.689	0.668	0.673	0.689	0.648
4	0.578	0.578	0.586	0.560	0.561	0.572	0.556
5	0.505	0.474	0.486	0.473	0.468	0.469	0.488
10	0.255	0.141	0.117	0.228	0.218	0.154	0.310
15	0.128	0.032	0.007	0.126	0.124	0.045	0.232
20	0.065	0.006	0.000	0.077	0.081	0.013	0.187
25	0.033	0.001	0.000	0.050	0.057	0.003	0.158
30	0.016	0.000	0.000	0.034	0.043	0.001	0.138
35	0.008	0.000	0.000	0.024	0.034	0.000	0.122

Time	Spline 1 knot normal	Spline 2 knots normal
0	1.000	1.000
1	0.938	0.930
2	0.775	0.773
3	0.648	0.669
4	0.557	0.572
5	0.488	0.489

Time	Spline 1 knot normal	Spline 2 knots normal
10	0.290	0.240
15	0.195	0.135
20	0.141	0.083
25	0.107	0.054
30	0.084	0.037
35	0.067	0.026

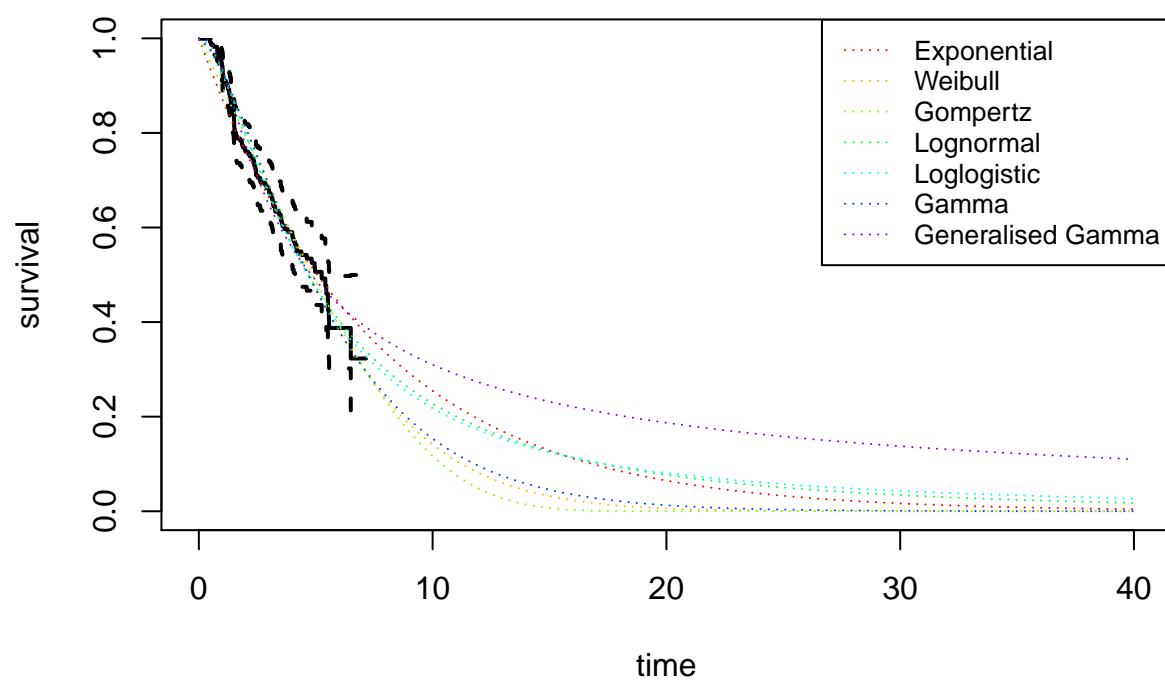
Exponential	Weibull	Gompertz	Lognormal	Loglogistic
Min. :0.1279	Min. :0.0591	Min. :0.0987	Min. :0.02830	Min. :0.03980
1st Qu.:0.1279	1st Qu.:0.2392	1st Qu.:0.2409	1st Qu.:0.06943	1st Qu.:0.05103
Median :0.1279	Median :0.2999	Median :0.5187	Median :0.08670	Median :0.07195
Mean :0.1279	Mean :0.2819	Mean :0.5422	Mean :0.09545	Mean :0.08535
3rd Qu.:0.1279	3rd Qu.:0.3408	3rd Qu.:0.8561	3rd Qu.:0.11657	3rd Qu.:0.11403
Max. :0.1279	Max. :0.3724	Max. :1.0000	Max. :0.16300	Max. :0.16720

NA's :22

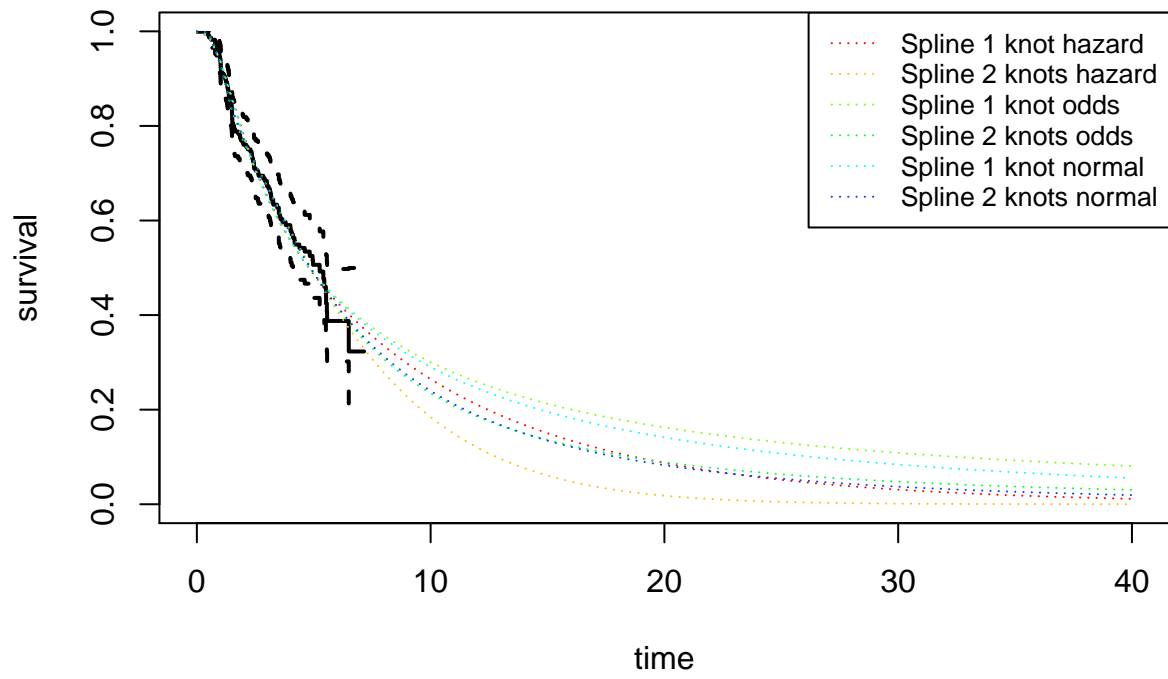
Gamma	Generalised Gamma	Spline 1 knot hazard	Spline 2 knots hazard
Min. :0.0480	Min. :0.01090	Min. :0.02070	Min. :0.0062
1st Qu.:0.2109	1st Qu.:0.02500	1st Qu.:0.09625	1st Qu.:0.1927
Median :0.2273	Median :0.03600	Median :0.10055	Median :0.2213
Mean :0.2143	Mean :0.05278	Mean :0.10554	Mean :0.2108
3rd Qu.:0.2339	3rd Qu.:0.06415	3rd Qu.:0.10845	3rd Qu.:0.2414
Max. :0.2373	Max. :0.17720	Max. :0.17590	Max. :0.2565

Spline 1 knot odds	Spline 2 knots odds	Spline 1 knot normal	Spline 2 knots normal
Min. :0.01960	Min. :0.00580	Min. :0.01290	Min. :0.00530
1st Qu.:0.03318	1st Qu.:0.05040	1st Qu.:0.04460	1st Qu.:0.06853
Median :0.04595	Median :0.07085	Median :0.05700	Median :0.08545
Mean :0.06026	Mean :0.08286	Mean :0.06914	Mean :0.09341
3rd Qu.:0.07418	3rd Qu.:0.11432	3rd Qu.:0.08230	3rd Qu.:0.11657
Max. :0.18000	Max. :0.20830	Max. :0.17890	Max. :0.19080

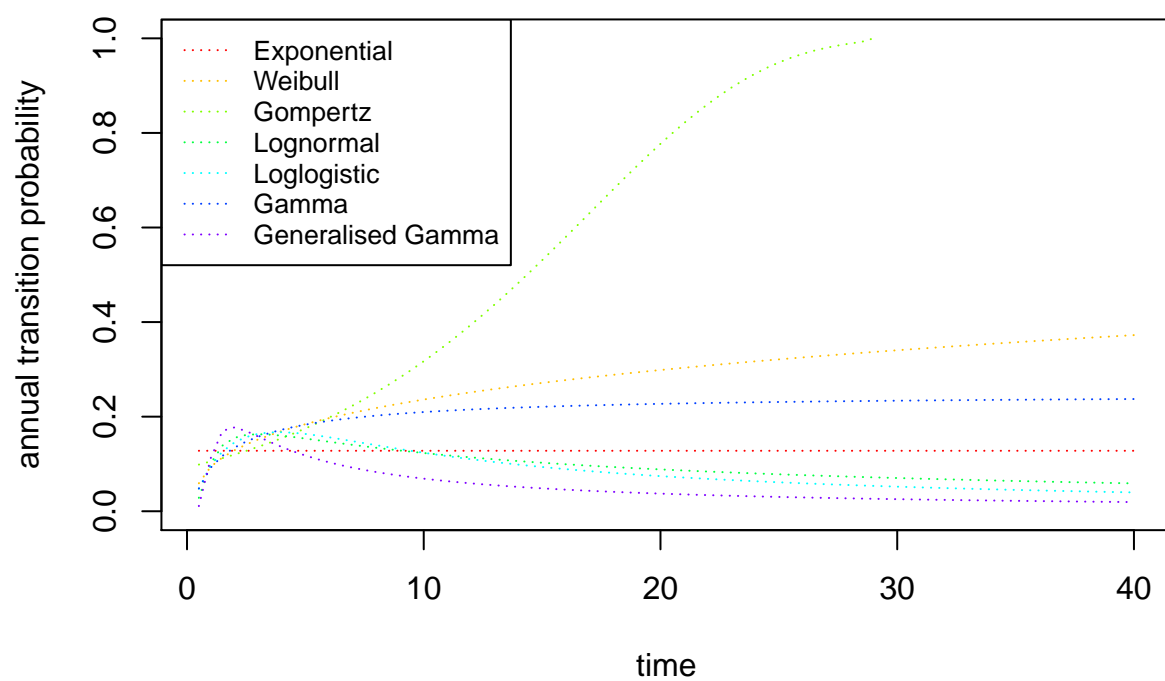
### A: Kaplan–Meier (parametric curves)



## B: Kaplan–Meier (spline curves)

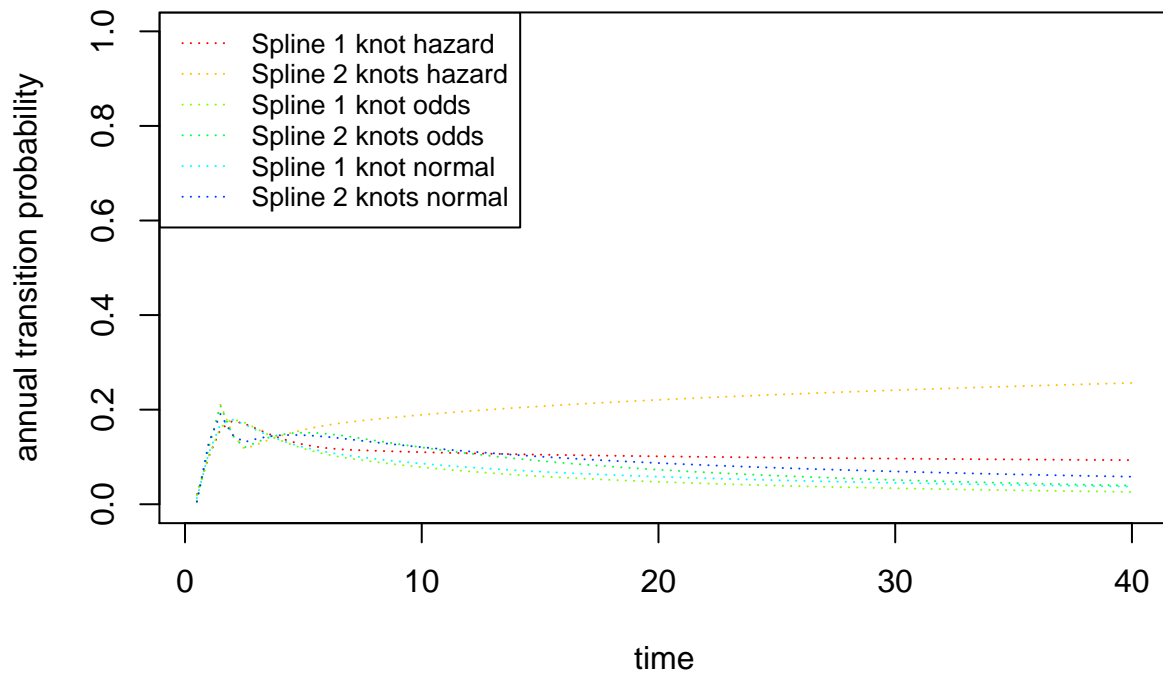


### C: Annual transition probability (parametric curves)





## D: Annual transition probability (spline curves)



### Group Poor

Time	Exponential	Weibull	Gompertz	Lognormal	Loglogistic	Gamma	Generalised Gamma
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	0.755	0.817	0.776	0.820	0.819	0.829	0.810
2	0.570	0.608	0.588	0.572	0.568	0.605	0.555
3	0.430	0.430	0.436	0.401	0.389	0.420	0.399
4	0.325	0.292	0.315	0.289	0.275	0.283	0.302
5	0.245	0.193	0.221	0.214	0.203	0.187	0.237
10	0.060	0.017	0.022	0.063	0.069	0.020	0.100
15	0.015	0.001	0.001	0.025	0.034	0.002	0.057
20	0.004	0.000	0.000	0.012	0.021	0.000	0.037
25	0.001	0.000	0.000	0.006	0.014	0.000	0.026
30	0.000	0.000	0.000	0.004	0.010	0.000	0.019
35	0.000	0.000	0.000	0.002	0.008	0.000	0.015

Time	Spline 1 knot normal	Spline 2 knots normal
0	1.000	1.000
1	0.811	0.815
2	0.549	0.546
3	0.398	0.392
4	0.305	0.303
5	0.242	0.245

Time	Spline 1 knot normal	Spline 2 knots normal
10	0.102	0.113
15	0.054	0.065
20	0.033	0.042
25	0.021	0.029
30	0.015	0.021
35	0.011	0.016

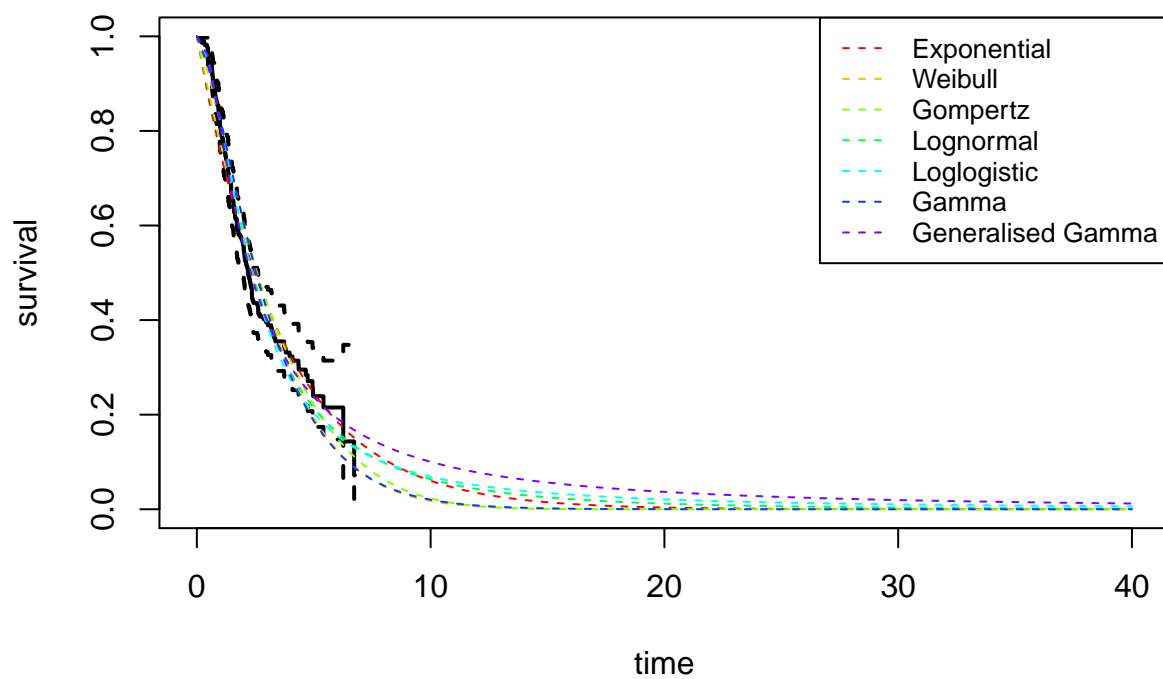
Exponential	Weibull	Gompertz	Lognormal	Loglogistic
Min. :0.2449	Min. :0.1510	Min. :0.2203	Min. :0.08370	Min. :0.04370
1st Qu.:0.2449	1st Qu.:0.4117	1st Qu.:0.3800	1st Qu.:0.09982	1st Qu.:0.05758
Median :0.2449	Median :0.4790	Median :0.6008	Median :0.12730	Median :0.08385
Mean :0.2449	Mean :0.4545	Mean :0.6016	Mean :0.14968	Mean :0.11584
3rd Qu.:0.2449	3rd Qu.:0.5212	3rd Qu.:0.8286	3rd Qu.:0.18238	3rd Qu.:0.14615
Max. :0.2449	Max. :0.5520	Max. :1.0000	Max. :0.30650	Max. :0.31940

NA's :16

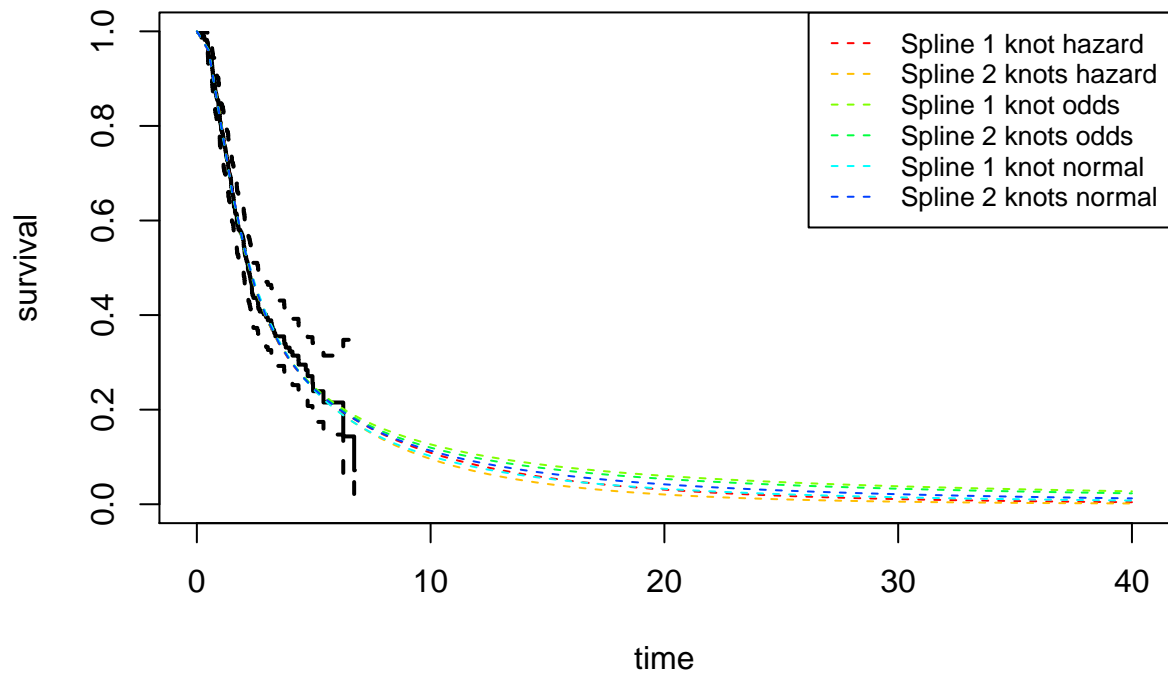
Gamma	Generalised Gamma	Spline 1 knot hazard	Spline 2 knots hazard
Min. :0.1254	Min. :0.04080	Min. :0.08150	Min. :0.0766
1st Qu.:0.3705	1st Qu.:0.05240	1st Qu.:0.09277	1st Qu.:0.1183
Median :0.3852	Median :0.07365	Median :0.10580	Median :0.1308
Mean :0.3703	Mean :0.10141	Mean :0.12547	Mean :0.1470
3rd Qu.:0.3906	3rd Qu.:0.12127	3rd Qu.:0.13140	3rd Qu.:0.1545
Max. :0.3935	Max. :0.32090	Max. :0.33890	Max. :0.3435

Spline 1 knot odds	Spline 2 knots odds	Spline 1 knot normal	Spline 2 knots normal
Min. :0.02850	Min. :0.03060	Min. :0.05520	Min. :0.04740
1st Qu.:0.03735	1st Qu.:0.04005	1st Qu.:0.06732	1st Qu.:0.05805
Median :0.05410	Median :0.05805	Median :0.08660	Median :0.07645
Mean :0.08287	Mean :0.08680	Mean :0.11146	Mean :0.10119
3rd Qu.:0.09352	3rd Qu.:0.10028	3rd Qu.:0.12950	3rd Qu.:0.11453
Max. :0.34410	Max. :0.34360	Max. :0.33070	Max. :0.33230

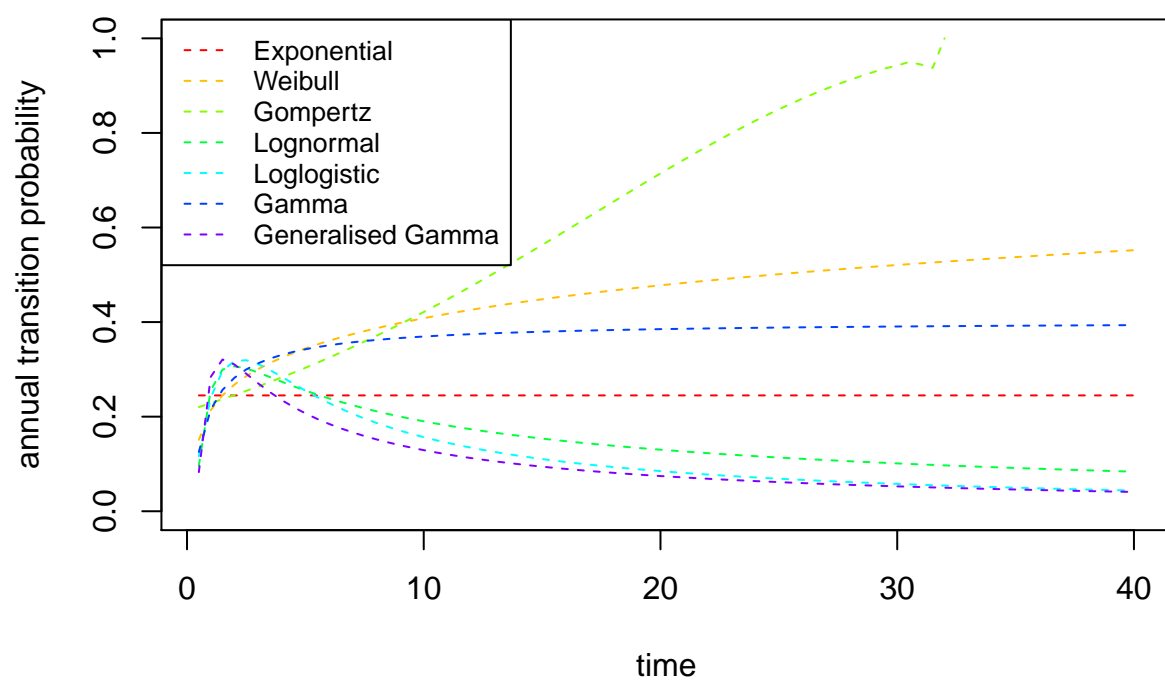
### A: Kaplan–Meier (parametric curves)



## B: Kaplan–Meier (spline curves)



### C: Annual transition probability (parametric curves)



### D: Annual transition probability (spline curves)

