(Smaller) Grid Search Results

Contents

We compare results from optimizations using two sets of initial values for $(\log(k_0), k_1)$: $= (-12, 0.02)$ and $(-12, 0.07\overline{3})$.

We define convergence as a relative tolerance less than 0.001 for all parameters, where the relative tolerance between two values x and y is defined as

$$reltol(x, y) = |x - y|/\min(|x|, |y|). \tag{1}$$

For the algorithm to converge on iteration m, all 24 parameters k must have $reltol(k^{(m)}, k^{(m-1)}) < 0.001$.

1 Results

We ran each optimization to convergence. The minimum optimal value of the objective function was 0.3314327, and the larger optimal value was 0.3315864. The smaller optimal value actually had not reached convergence yet, after 40000 iterations. The larger optimal value was reached after 15117 iterations.

1.1 Optimal parameters

The set of optimal parameters, corresponding to the optimization with the smallest optimal value of the objective function, is shown in Table 1.

Table 1: Optimal parameter values

	Lk0	k1
r12	-10.295	0.088
r16	-8.599	0.073
r18	-7.209	0.041
r23	-10.121	0.083
r29	-10.288	0.102
r34	-4.000	0.040
r63	-7.725	0.081
r67	-9.786	0.043
r74	-6.303	0.054
r87	-7.183	0.054
r89	-12.911	0.037
r94	-8.246	0.068

1.2 Transitions

The figures below show the transition probabilities for every transition $r_{ij}(a)$ for ages $a \in (50, \ldots, 95)$. Figure 1 has all y-axes fixed from 0 to 1, while Figure 2 has scales unique to each panel. The red line in each panel corresponds to transition probabilities for the optimal parameters in Table 1.

Figure 1: Transition rates after optimization using different initial values

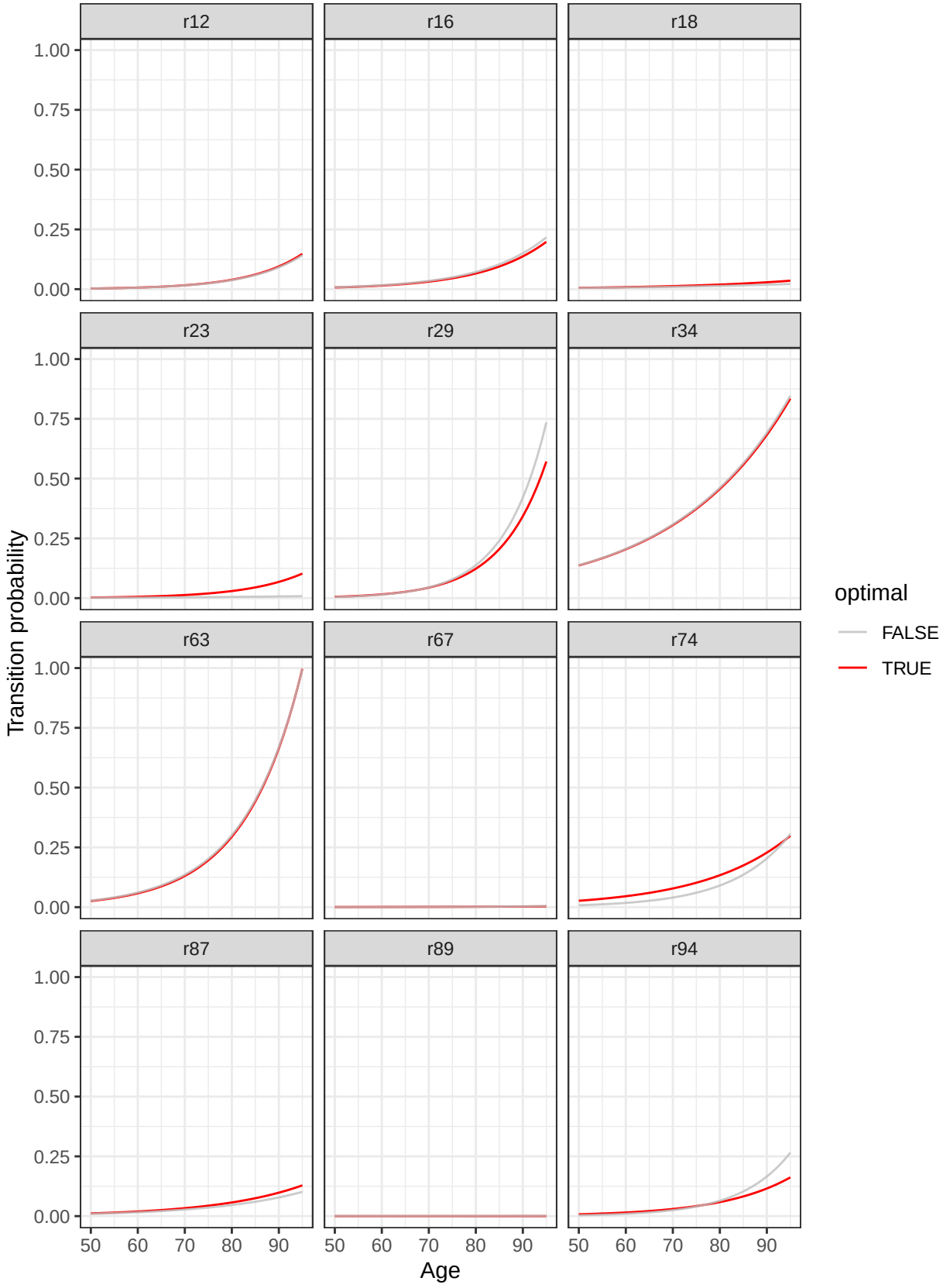
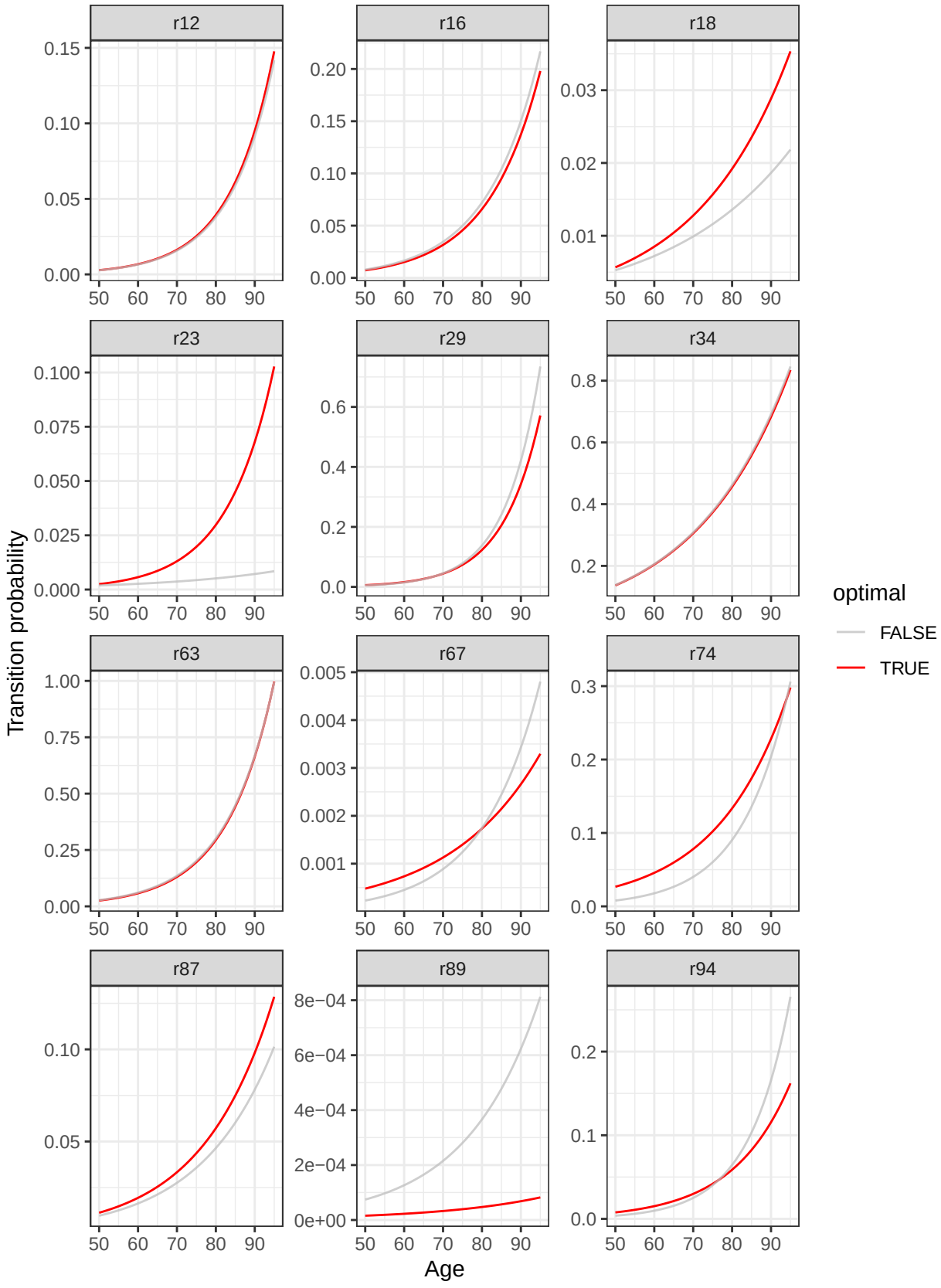


Figure 2: Transition rates after optimization using different initial values



1.3 Fit to Incidence and Prevalence data

Figures 3 and 4 below show the fit of optimized rates to the incidence data and prevalence data. In each plot, the dashed line represents the data from either the systematic review (for incidence) or Jack's 2017 paper (for prevalence), and the solid lines represent optimized estimates. The red line represents the most optimal solution.

Figure 3: Optimized and Empirical Incidence Rates

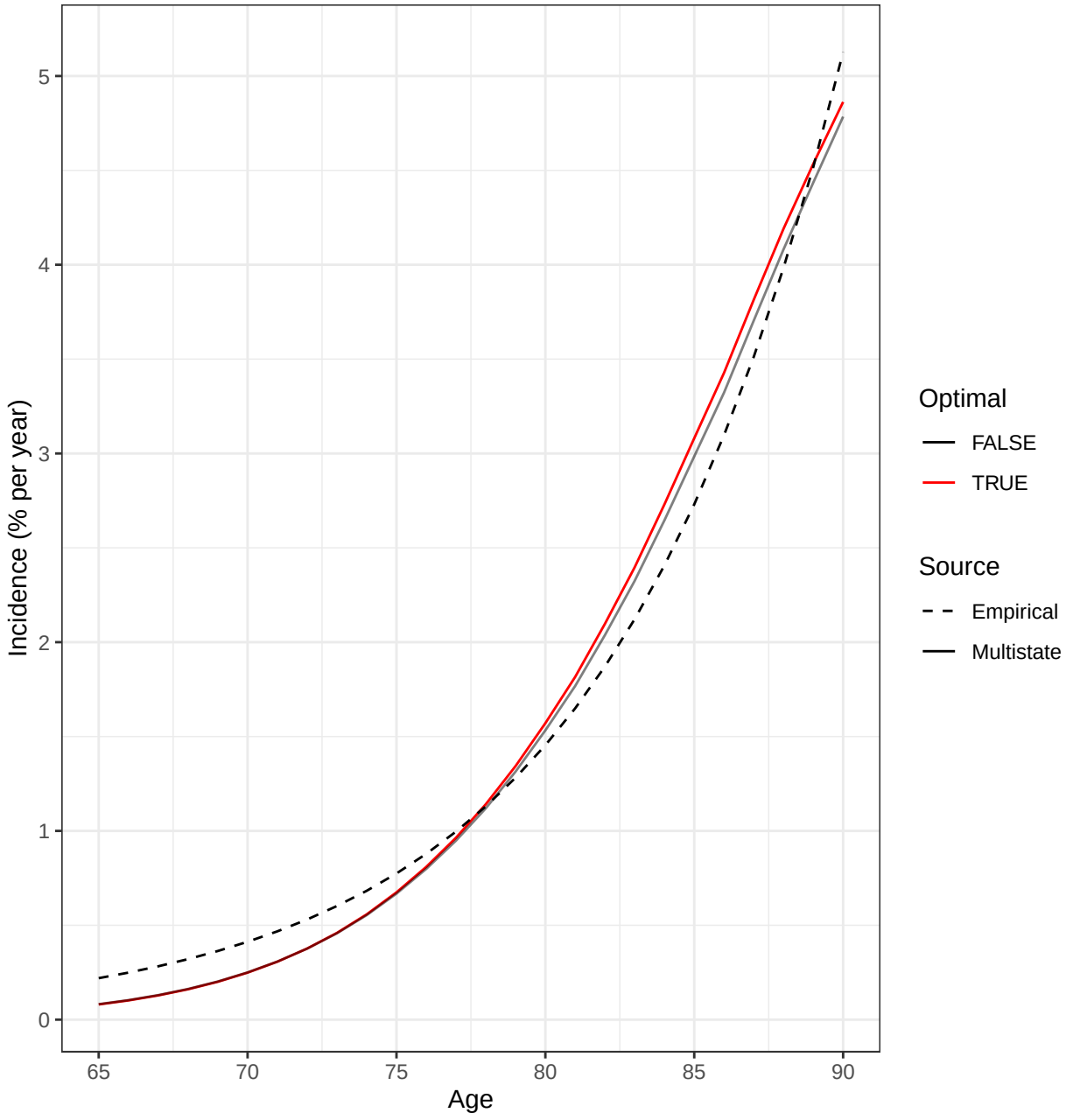
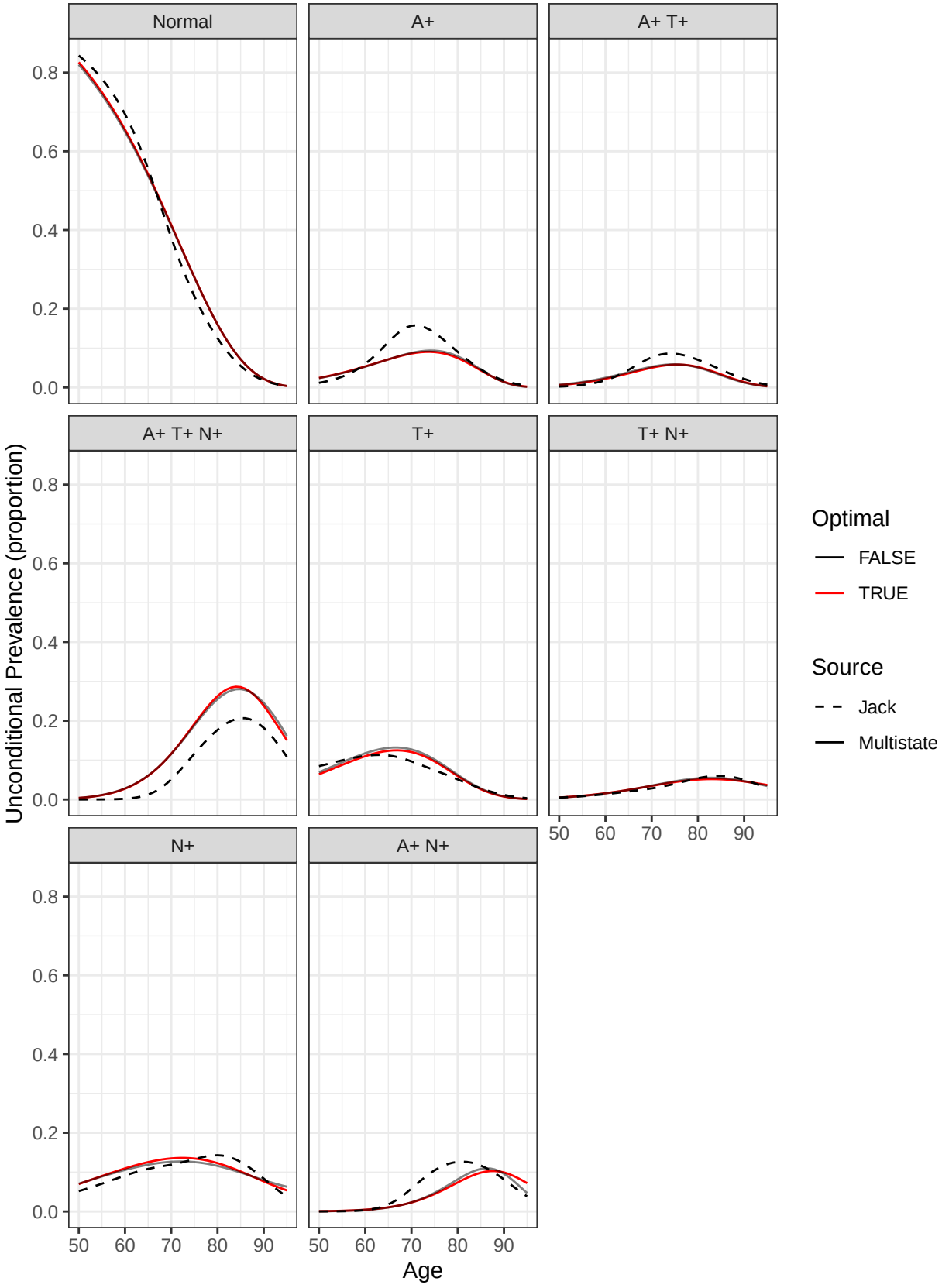


Figure 4: Optimized vs Jack unconditional prevalence rates



1.4 Lifetime risks

Tables 2 and 3 show the lifetime risks for ages $a \in (60, 65, \ldots, 90)$ for males and females using the transition parameters in Table 1.

Table 2: Lifetime risks for females

Age	Normal	A	A+T	A+T+N	A+T+N + MCI	T	T+N	N	A+N
60	17.91 %	18.83 %	54.33 %	58.4 %	95.63 %	42.22 %	41.17 %	16.94 %	26.14 %
65	16.52 %	17.71 %	51.45 %	56.21 %	93.57 %	39.79 %	38.24 %	15.01 %	24.35 %
70	14.63 %	16.06 %	47.29 %	52.82 %	90.06 %	36.25 %	34.29 %	12.67 %	21.89 %
75	12.22 %	13.81 %	41.56 %	47.89 %	84.71 %	31.41 %	29.22 %	10.01 %	18.71 %
80	9.37 %	10.97 %	33.95 %	40.91 %	76.19 %	25.1 %	22.99 %	7.21 %	14.81 %
85	6.51 %	7.88 %	24.73 %	31.79 %	63.81 %	17.78 %	16.17 %	4.7 %	10.57 %
90	4.49 %	5.44 %	15.83 %	21.73 %	46.77 %	11.44 %	10.39 %	3.02 %	7.06 %

Table 3: Lifetime risks for males

Age	Normal	A	A+T	A+T+N	A+T+N + MCI	T	T+N	N	A+N
60	12.06 %	12.97 %	44.85 %	49.4 %	92.93 %	32.54 %	32.05 %	11.61 %	19.23 %
65	11.08 %	12.2 %	42.27 %	47.5 %	90.37 %	30.57 %	29.61 %	10.19 %	17.86 %
70	9.69 %	10.96 %	38.37 %	44.28 %	85.99 %	27.53 %	26.21 %	8.45 %	15.9 %
75	7.91 %	9.27 %	33.07 %	39.61 %	79.54 %	23.39 %	21.89 %	6.49 %	13.36 %
80	5.84 %	7.14 %	26.19 %	33.05 %	69.91 %	18.11 %	16.7 %	4.47 %	10.28 %
85	3.81 %	4.88 %	18.3 %	24.88 %	56.66 %	12.25 %	11.22 %	2.72 %	7.02 %
90	2.44 %	3.14 %	10.89 %	16.17 %	40.19 %	7.27 %	6.68 %	1.61 %	4.36 %