**Supplementary Material**
**Supplementary Table 1: Life expectancy from patient-level simulation**

| Group | Transition | No. in the initial state | No. changing state | Cause-specific transition probability (95% CI) | Mean age at transition (95% CI) | Mean life expectancy (95% CI) |
|---|---|---|---|---|---|---|
| SOC | ICF -> CKD | 1000000 | 179441 | 0.179 (0.179, 0.180) | 71.39 (71.36, 71.43) | 79.82 (79.79, 79.86) |
| SOC | ICF -> T2DM | 1000000 | 74430 | 0.074 (0.074, 0.075) | 68.80 (68.75, 68.87) | 78.87 (78.83, 78.93) |
| SOC | ICF -> HF | 1000000 | 81119 | 0.081 (0.081, 0.082) | 69.86 (69.80, 69.92) | 76.69 (76.64, 76.74) |
| SOC | ICF -> Death | 1000000 | 665010 | 0.665 (0.664, 0.666) | 77.73 (77.71, 77.75) | 77.73 (77.71, 77.75) |
| SGLT-2 Inhibitor | CKD -> CKD-T2DM | 179441 | 11646 | 0.065 (0.049, 0.083) | 74.73 (73.85, 75.72) | 82.25 (80.87, 83.81) |
| SOC | CKD -> CKD-T2DM | 179441 | 13735 | 0.077 (0.075, 0.078) | 73.36 (73.24, 73.49) | 80.01 (79.92, 80.10) |
| SGLT-2 Inhibitor | CKD -> CKD-HF | 179441 | 17381 | 0.097 (0.073, 0.123) | 77.42 (76.61, 78.34) | 83.92 (81.94, 86.29) |
| SOC | CKD -> CKD-HF | 179441 | 19320 | 0.108 (0.106, 0.109) | 76.06 (75.96, 76.18) | 80.16 (80.06, 80.26) |
| SGLT-2 Inhibitor | CKD -> Death | 179441 | 150414 | 0.838 (0.807, 0.871) | 82.12 (80.49, 83.92) | 82.12 (80.49, 83.92) |
| SOC | CKD -> Death | 179441 | 146387 | 0.816 (0.814, 0.817) | 79.76 (79.73, 79.80) | 79.76 (79.73, 79.80) |
| SGLT-2 Inhibitor | T2DM -> T2DM-CKD | 74430 | 10939 | 0.147 (0.130, 0.166) | 73.52 (73.24, 73.83) | 84.34 (81.64, 87.46) |
| SOC | T2DM -> T2DM-CKD | 74430 | 13711 | 0.184 (0.181, 0.187) | 73.20 (73.07, 73.33) | 82.08 (81.93, 82.21) |
| SGLT-2 Inhibitor | T2DM -> T2DM-HF | 74430 | 7228 | 0.097 (0.085, 0.109) | 74.53 (74.03, 75.08) | 79.99 (79.02, 80.93) |
| SOC | T2DM -> T2DM-HF | 74430 | 8064 | 0.108 (0.106, 0.111) | 74.02 (73.88, 74.16) | 78.80 (78.68, 78.92) |
| SGLT-2 Inhibitor | T2DM -> Death | 74430 | 56264 | 0.756 (0.734, 0.775) | 78.81 (78.05, 79.69) | 78.81 (78.05, 79.69) |
| SOC | T2DM -> Death | 74430 | 52656 | 0.707 (0.705, 0.711) | 78.05 (77.99, 78.11) | 78.05 (77.99, 78.11) |
| SGLT-2 Inhibitor | HF -> HF-CKD | 81119 | 14280 | 0.176 (0.112, 0.269) | 74.65 (74.15, 75.14) | 81.17 (79.49, 82.85) |
| SOC | HF -> HF-CKD | 81119 | 17052 | 0.210 (0.208, 0.212) | 73.91 (73.80, 74.03) | 78.52 (78.41, 78.62) |

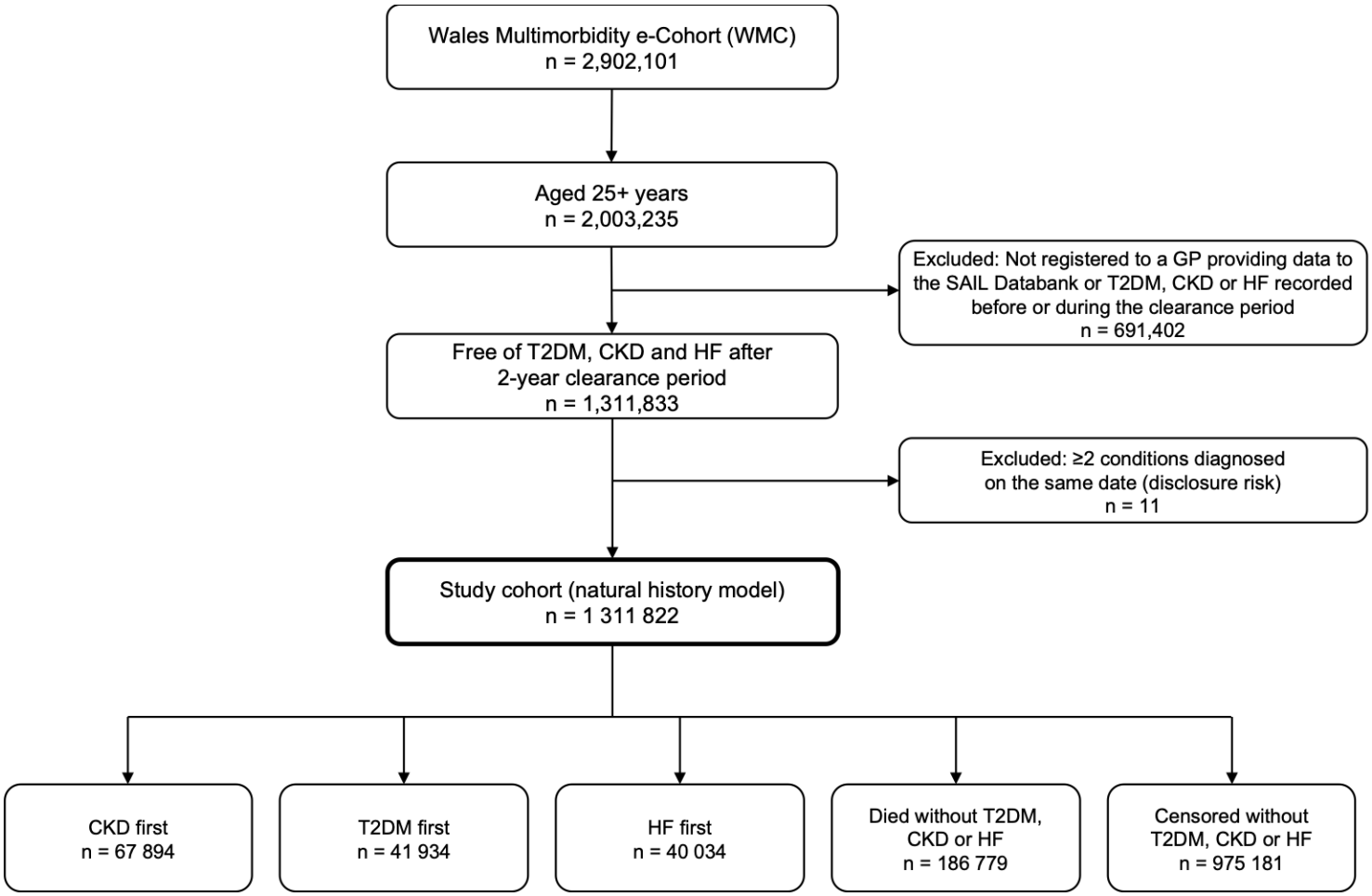
| | | | | | | |
|---|---|---|---|---|---|---|
| SGLT-2 Inhibitor | HF -> HF-T2DM | 81119 | 3944 | 0.049 (0.036, 0.063) | 71.88 (71.32, 72.47) | 77.54 (76.45, 78.63) |
| SOC | HF -> HF-T2DM | 81119 | 4916 | 0.061 (0.059, 0.062) | 71.19 (70.95, 71.38) | 76.14 (75.93, 76.32) |
| SGLT-2 Inhibitor | HF -> Death | 81119 | 62895 | 0.775 (0.686, 0.839) | 77.22 (76.61, 77.94) | 77.22 (76.61, 77.94) |
| SOC | HF -> Death | 81119 | 59150 | 0.729 (0.727, 0.732) | 76.21 (76.16, 76.27) | 76.21 (76.16, 76.27) |
| SGLT-2 Inhibitor | CKD-T2DM -> CKD-T2DM-HF | 11646 | 978 | 0.084 (0.056, 0.115) | 78.99 (77.91, 80.44) | 82.28 (81.08, 83.76) |
| SOC | CKD-T2DM -> CKD-T2DM-HF | 13735 | 1367 | 0.100 (0.093, 0.104) | 77.03 (76.75, 77.36) | 79.92 (79.62, 80.22) |
| SGLT-2 Inhibitor | CKD-T2DM -> Death | 11646 | 10668 | 0.916 (0.885, 0.944) | 82.25 (80.83, 83.83) | 82.25 (80.83, 83.83) |
| SOC | CKD-T2DM -> Death | 13735 | 12368 | 0.900 (0.896, 0.907) | 80.02 (79.92, 80.12) | 80.02 (79.92, 80.12) |
| SGLT-2 Inhibitor | CKD-HF -> CKD-HF-T2DM | 17381 | 991 | 0.057 (0.035, 0.080) | 78.75 (77.01, 80.43) | 81.92 (80.26, 83.74) |
| SOC | CKD-HF -> CKD-HF-T2DM | 19320 | 1017 | 0.053 (0.049, 0.056) | 75.65 (75.17, 76.13) | 78.56 (78.14, 79.00) |
| SGLT-2 Inhibitor | CKD-HF -> Death | 17381 | 16390 | 0.943 (0.920, 0.965) | 84.05 (81.98, 86.54) | 84.05 (81.98, 86.54) |
| SOC | CKD-HF -> Death | 19320 | 18303 | 0.947 (0.944, 0.951) | 80.25 (80.15, 80.35) | 80.25 (80.15, 80.35) |
| SGLT-2 Inhibitor | T2DM-CKD -> T2DM-CKD-HF | 10939 | 1138 | 0.104 (0.064, 0.147) | 78.48 (77.16, 80.26) | 82.26 (80.68, 84.22) |
| SOC | T2DM-CKD -> T2DM-CKD-HF | 13711 | 1668 | 0.122 (0.117, 0.126) | 77.29 (76.95, 77.66) | 80.55 (80.18, 80.88) |
| SGLT-2 Inhibitor | T2DM-CKD -> Death | 10939 | 9801 | 0.896 (0.853, 0.936) | 84.60 (81.71, 87.91) | 84.60 (81.71, 87.91) |
| SOC | T2DM-CKD -> Death | 13711 | 12042 | 0.878 (0.874, 0.883) | 82.29 (82.15, 82.41) | 82.29 (82.15, 82.41) |
| SGLT-2 Inhibitor | T2DM-HF -> T2DM-HF-CKD | 7228 | 972 | 0.135 (0.075, 0.192) | 78.13 (77.54, 78.68) | 82.10 (81.22, 83.06) |
| SOC | T2DM-HF -> T2DM-HF-CKD | 8064 | 1669 | 0.207 (0.200, 0.215) | 77.13 (76.81, 77.46) | 80.75 (80.40, 81.07) |
| SGLT-2 Inhibitor | T2DM-HF -> Death | 7228 | 6256 | 0.865 (0.808, 0.925) | 79.67 (78.71, 80.59) | 79.67 (78.71, 80.59) |

| | | | | | | |
|---|---|---|---|---|---|---|
| SOC | T2DM-HF -> Death | 8064 | 6395 | 0.793 (0.785, 0.800) | 78.29 (78.17, 78.42) | 78.29 (78.17, 78.42) |
| SGLT-2 Inhibitor | HF-CKD -> HF-CKD-T2DM | 14280 | 984 | 0.069 (0.050, 0.093) | 76.52 (75.28, 77.80) | 80.03 (78.48, 81.60) |
| SOC | HF-CKD -> HF-CKD-T2DM | 17052 | 1185 | 0.069 (0.065, 0.072) | 74.49 (74.08, 74.89) | 77.65 (77.30, 77.99) |
| SGLT-2 Inhibitor | HF-CKD -> Death | 14280 | 13296 | 0.931 (0.907, 0.950) | 81.26 (79.48, 83.00) | 81.26 (79.48, 83.00) |
| SOC | HF-CKD -> Death | 17052 | 15868 | 0.931 (0.928, 0.935) | 78.58 (78.47, 78.70) | 78.58 (78.47, 78.70) |
| SGLT-2 Inhibitor | HF-T2DM -> HF-T2DM-CKD | 3944 | 428 | 0.109 (0.066, 0.165) | 75.35 (74.46, 76.20) | 79.78 (78.63, 80.78) |
| SOC | HF-T2DM -> HF-T2DM-CKD | 4916 | 851 | 0.173 (0.161, 0.183) | 74.23 (73.76, 74.62) | 78.13 (77.71, 78.54) |
| SGLT-2 Inhibitor | HF-T2DM -> Death | 3944 | 3516 | 0.891 (0.835, 0.934) | 77.27 (76.17, 78.41) | 77.27 (76.17, 78.41) |
| SOC | HF-T2DM -> Death | 4916 | 4066 | 0.827 (0.817, 0.839) | 75.73 (75.53, 75.91) | 75.73 (75.53, 75.91) |
| SGLT-2 Inhibitor | CKD-T2DM-HF -> Death | 978 | 978 | 1.000 (1.000, 1.000) | 82.28 (81.08, 83.76) | 82.28 (81.08, 83.76) |
| SOC | CKD-T2DM-HF -> Death | 1367 | 1367 | 1.000 (1.000, 1.000) | 79.92 (79.62, 80.22) | 79.92 (79.62, 80.22) |
| SGLT-2 Inhibitor | CKD-HF-T2DM -> Death | 991 | 991 | 1.000 (1.000, 1.000) | 81.92 (80.26, 83.74) | 81.92 (80.26, 83.74) |
| SOC | CKD-HF-T2DM -> Death | 1017 | 1017 | 1.000 (1.000, 1.000) | 78.56 (78.14, 79.00) | 78.56 (78.14, 79.00) |
| SGLT-2 Inhibitor | T2DM-CKD-HF -> Death | 1138 | 1138 | 1.000 (1.000, 1.000) | 82.26 (80.68, 84.22) | 82.26 (80.68, 84.22) |
| SOC | T2DM-CKD-HF -> Death | 1668 | 1668 | 1.000 (1.000, 1.000) | 80.55 (80.18, 80.88) | 80.55 (80.18, 80.88) |
| SGLT-2 Inhibitor | T2DM-HF-CKD -> Death | 972 | 972 | 1.000 (1.000, 1.000) | 82.10 (81.22, 83.06) | 82.10 (81.22, 83.06) |
| SOC | T2DM-HF-CKD -> Death | 1669 | 1669 | 1.000 (1.000, 1.000) | 80.75 (80.40, 81.07) | 80.75 (80.40, 81.07) |
| SGLT-2 Inhibitor | HF-CKD-T2DM -> Death | 984 | 984 | 1.000 (1.000, 1.000) | 80.03 (78.48, 81.60) | 80.03 (78.48, 81.60) |

| | | | | | | |
|---|---|---|---|---|---|---|
| SOC | HF-CKD-T2DM -> Death | 1185 | 1185 | 1.000 (1.000, 1.000) | 77.65 (77.30, 77.99) | 77.65 (77.30, 77.99) |
| SGLT-2 Inhibitor | HF-T2DM-CKD -> Death | 428 | 428 | 1.000 (1.000, 1.000) | 79.78 (78.63, 80.78) | 79.78 (78.63, 80.78) |
| SOC | HF-T2DM-CKD -> Death | 851 | 851 | 1.000 (1.000, 1.000) | 78.13 (77.71, 78.54) | 78.13 (77.71, 78.54) |

ICF: Index Condition Free; CKD: Chronic Kidney Disease; T2DM: Type 2 Diabetes; HF: Heart failure; SOC: Standard of Care; SGLT-2: Sodium Glucose Co-transporter-2

**Supplementary Figure 1: Study Flow Diagram**



## Supplementary Table 2: Code lists

| Diagnosis | Code | Type | Term |
|---|---|---|---|
| CKD | 1Z1.. | Read code v2 | Chronic renal impairment |
| CKD | 1Z10. | Read code v2 | Chronic kidney disease, stage 1 |
| CKD | 1Z11. | Read code v2 | Chronic kidney disease, stage 2 |
| CKD | 1Z12. | Read code v2 | Chronic kidney disease, stage 3 |
| CKD | 1Z13. | Read code v2 | Chronic kidney disease, stage 4 |
| CKD | 1Z14. | Read code v2 | Chronic kidney disease, stage 5 |
| CKD | 1Z15. | Read code v2 | Chronic kidney disease, stage 3A |
| CKD | 1Z16. | Read code v2 | Chronic kidney disease, stage 3B |
| CKD | 1Z17. | Read code v2 | Chronic kidney disease, stage 1 with proteinuria |
| CKD | 1Z18. | Read code v2 | Chronic kidney disease, stage 1 without proteinuria |
| CKD | 1Z19. | Read code v2 | Chronic kidney disease, stage 2 with proteinuria |
| CKD | 1Z1A. | Read code v2 | Chronic kidney disease, stage 2 without proteinuria |
| CKD | 1Z1B. | Read code v2 | Chronic kidney disease, stage 3 with proteinuria |
| CKD | 1Z1C. | Read code v2 | Chronic kidney disease, stage 3 without proteinuria |
| CKD | 1Z1D. | Read code v2 | Chronic kidney disease, stage 3A with proteinuria |
| CKD | 1Z1E. | Read code v2 | Chronic kidney disease, stage 3A without proteinuria |
| CKD | 1Z1F. | Read code v2 | Chronic kidney disease, stage 3B with proteinuria |
| CKD | 1Z1G. | Read code v2 | Chronic kidney disease, stage 3B without proteinuria |
| CKD | 1Z1H. | Read code v2 | Chronic kidney disease, stage 4 with proteinuria |
| CKD | 1Z1J. | Read code v2 | Chronic kidney disease, stage 4 without proteinuria |
| CKD | 1Z1K. | Read code v2 | Chronic kidney disease, stage 5 with proteinuria |
| CKD | 1Z1L. | Read code v2 | Chronic kidney disease, stage 5 without proteinuria |
| CKD | K051. | Read code v2 | Chronic kidney disease, stage 1 |
| CKD | K052. | Read code v2 | Chronic kidney disease, stage 2 |
| CKD | K053. | Read code v2 | Chronic kidney disease, stage 3 |
| CKD | K054. | Read code v2 | Chronic kidney disease, stage 4 |
| CKD | K055. | Read code v2 | Chronic kidney disease, stage 5 |
| CKD | N180 | ICD-10 | Chronic kidney disease |
| CKD | N180- | ICD-10 | Chronic kidney disease |
| CKD | N180D | ICD-10 | Chronic kidney disease |
| CKD | N181 | ICD-10 | Chronic kidney disease, stage 1 |
| CKD | N181- | ICD-10 | Chronic kidney disease, stage 1 |
| CKD | N182 | ICD-10 | Chronic kidney disease, stage 2 |
| CKD | N183 | ICD-10 | Chronic kidney disease, stage 3 |
| CKD | N183- | ICD-10 | Chronic kidney disease, stage 3 |
| CKD | N183D | ICD-10 | Chronic kidney disease, stage 3 |
| CKD | N184 | ICD-10 | Chronic kidney disease, stage 4 |
| CKD | N184- | ICD-10 | Chronic kidney disease, stage 4 |
| CKD | N185 | ICD-10 | Chronic kidney disease, stage 5 |
| CKD | N185D | ICD-10 | Chronic kidney disease, stage 5 |

| | | | |
|---|---|---|---|
| CKD | N188 | ICD-10 | Other chronic renal failure |
| CKD | N188D | ICD-10 | Other chronic renal failure |
| CKD | N189 | ICD-10 | Chronic kidney disease, unspecified |
| CKD | N189- | ICD-10 | Chronic kidney disease, unspecified |
| CKD | N189D | ICD-10 | Chronic kidney disease, unspecified |
| CKD | N18X | ICD-10 | Chronic kidney disease |
| HF | 14A6.00 | Read code v2 | H/O: heart failure |
| HF | 14AM.00 | Read code v2 | H/O: Heart failure in last year |
| HF | 1O1..00 | Read code v2 | Heart failure confirmed |
| HF | 388D.00 | Read code v2 | New York Heart Assoc classification heart failure symptoms |
| HF | 661M500 | Read code v2 | Heart failure self-management plan agreed |
| HF | 662T.00 | Read code v2 | Congestive heart failure monitoring |
| HF | 662W.00 | Read code v2 | Heart failure annual review |
| HF | 662f.00 | Read code v2 | New York Heart Association classification - class I |
| HF | 662g.00 | Read code v2 | New York Heart Association classification - class II |
| HF | 662h.00 | Read code v2 | New York Heart Association classification - class III |
| HF | 662i.00 | Read code v2 | New York Heart Association classification - class IV |
| HF | 662p.00 | Read code v2 | Heart failure 6 month review |
| HF | 679W100 | Read code v2 | Education about deteriorating heart failure |
| HF | 679X.00 | Read code v2 | Heart failure education |
| HF | 8B29.00 | Read code v2 | Cardiac failure therapy |
| HF | 8CL3.00 | Read code v2 | Heart failure care plan discussed with patient |
| HF | 8CMK.00 | Read code v2 | Has heart failure management plan |
| HF | 8CMW800 | Read code v2 | Heart failure clinical pathway |
| HF | 8CeC.00 | Read code v2 | Preferred place of care for next exacerbation heart failure |
| HF | 8H2S.00 | Read code v2 | Admit heart failure emergency |
| HF | 8HBE.00 | Read code v2 | Heart failure follow-up |
| HF | 8HHz.00 | Read code v2 | Referral to heart failure exercise programme |
| HF | 8Hk0.00 | Read code v2 | Referred to heart failure education group |
| HF | 9N2p.00 | Read code v2 | Seen by community heart failure nurse |
| HF | 9N6T.00 | Read code v2 | Referred by heart failure nurse specialist |
| HF | 9On..00 | Read code v2 | Left ventricular dysfunction monitoring administration |
| HF | 9On0.00 | Read code v2 | Left ventricular dysfunction monitoring first letter |
| HF | 9On1.00 | Read code v2 | Left ventricular dysfunction monitoring second letter |
| HF | 9On2.00 | Read code v2 | Left ventricular dysfunction monitoring third letter |
| HF | 9On3.00 | Read code v2 | Left ventricular dysfunction monitoring verbal invite |
| HF | 9On4.00 | Read code v2 | Left ventricular dysfunction monitoring telephone invite |
| HF | 9Or..00 | Read code v2 | Heart failure monitoring administration |
| HF | 9Or0.00 | Read code v2 | Heart failure review completed |
| HF | 9Or1.00 | Read code v2 | Heart failure monitoring telephone invite |
| HF | 9Or2.00 | Read code v2 | Heart failure monitoring verbal invite |
| HF | 9Or3.00 | Read code v2 | Heart failure monitoring first letter |

| | | | |
|---|---|---|---|
| HF | 9Or4.00 | Read code v2 | Heart failure monitoring second letter |
| HF | 9Or5.00 | Read code v2 | Heart failure monitoring third letter |
| HF | 9h1..00 | Read code v2 | Exception reporting: LVD quality indicators |
| HF | 9h11.00 | Read code v2 | Excepted from LVD quality indicators: Patient unsuitable |
| HF | 9h12.00 | Read code v2 | Excepted from LVD quality indicators: Informed dissent |
| HF | 9hH..00 | Read code v2 | Exception reporting: heart failure quality indicators |
| HF | 9hH0.00 | Read code v2 | Excepted heart failure quality indicators: Patient unsuitabl |
| HF | 9hH1.00 | Read code v2 | Excepted heart failure quality indicators: Informed dissent |
| HF | G1yz100 | Read code v2 | Rheumatic left ventricular failure |
| HF | G210100 | Read code v2 | Malignant hypertensive heart disease with CCF |
| HF | G211100 | Read code v2 | Benign hypertensive heart disease with CCF |
| HF | G21z100 | Read code v2 | Hypertensive heart disease NOS with CCF |
| HF | G232.00 | Read code v2 | Hypertensive heart&renal dis wth (congestive) heart failure |
| HF | G234.00 | Read code v2 | Hyperten heart&renal dis+both(congestv)heart and renal fail |
| HF | G400.00 | Read code v2 | Acute cor pulmonale |
| HF | G41z.11 | Read code v2 | Chronic cor pulmonale |
| HF | G554000 | Read code v2 | Congestive cardiomyopathy |
| HF | G554011 | Read code v2 | Congestive obstructive cardiomyopathy |
| HF | G58..00 | Read code v2 | Heart failure |
| HF | G58..11 | Read code v2 | Cardiac failure |
| HF | G580.00 | Read code v2 | Congestive heart failure |
| HF | G580.11 | Read code v2 | Congestive cardiac failure |
| HF | G580.12 | Read code v2 | Right heart failure |
| HF | G580.13 | Read code v2 | Right ventricular failure |
| HF | G580.14 | Read code v2 | Biventricular failure |
| HF | G580000 | Read code v2 | Acute congestive heart failure |
| HF | G580100 | Read code v2 | Chronic congestive heart failure |
| HF | G580200 | Read code v2 | Decompensated cardiac failure |
| HF | G580300 | Read code v2 | Compensated cardiac failure |
| HF | G580400 | Read code v2 | Congestive heart failure due to valvular disease |
| HF | G581.00 | Read code v2 | Left ventricular failure |
| HF | G581.11 | Read code v2 | Asthma - cardiac |
| HF | G581.13 | Read code v2 | Impaired left ventricular function |
| HF | G581000 | Read code v2 | Acute left ventricular failure |
| HF | G582.00 | Read code v2 | Acute heart failure |
| HF | G584.00 | Read code v2 | Right ventricular failure |
| HF | G58z.00 | Read code v2 | Heart failure NOS |
| HF | G58z.12 | Read code v2 | Cardiac failure NOS |
| HF | G5yy900 | Read code v2 | Left ventricular systolic dysfunction |
| HF | G5yyA00 | Read code v2 | Left ventricular diastolic dysfunction |
| HF | ZRad.00 | Read code v2 | New York Heart Assoc classification heart failure symptoms |
| HF | I11.0 | ICD-10 | Hypertensive heart disease with (congestive) heart failure |

| | | | |
|---|---|---|---|
| HF | I13.0 | ICD-10 | Hypertensive heart and renal disease with (congestive) heart failure |
| HF | I13.2 | ICD-10 | Hypertensive heart and renal disease with both (congestive) heart failure and renal failure |
| HF | I50 | ICD-10 | Heart failure |
| T2DM | C109. | Read code v2 | Non-insulin dependent diabetes mellitus |
| T2DM | C109 | Read code v2 | Non-insulin dependent diabetes mellitus |
| T2DM | C1090 | Read code v2 | Non-insulin-dependent diabetes mellitus with renal comps |
| T2DM | C1091 | Read code v2 | Non-insulin-dependent diabetes mellitus with ophthalm comps |
| T2DM | C1092 | Read code v2 | Non-insulin-dependent diabetes mellitus with neuro comps |
| T2DM | C1093 | Read code v2 | Non-insulin-dependent diabetes mellitus with multiple comps |
| T2DM | C1094 | Read code v2 | Non-insulin dependent diabetes mellitus with ulcer |
| T2DM | C1095 | Read code v2 | Non-insulin dependent diabetes mellitus with gangrene |
| T2DM | C1096 | Read code v2 | Non-insulin-dependent diabetes mellitus with retinopathy |
| T2DM | C1097 | Read code v2 | Non-insulin dependent diabetes mellitus - poor control |
| T2DM | C1099 | Read code v2 | Non-insulin-dependent diabetes mellitus without complication |
| T2DM | C109A | Read code v2 | Non-insulin dependent diabetes mellitus with mononeuropathy |
| T2DM | C109B | Read code v2 | Non-insulin dependent diabetes mellitus with polyneuropathy |
| T2DM | C109C | Read code v2 | Non-insulin dependent diabetes mellitus with nephropathy |
| T2DM | C109D | Read code v2 | Non-insulin dependent diabetes mellitus with hypoglyca coma |
| T2DM | C109E | Read code v2 | Non-insulin depend diabetes mellitus with diabetic cataract |
| T2DM | C109F | Read code v2 | Non-insulin-dependent d m with peripheral angiopath |
| T2DM | C109G | Read code v2 | Non-insulin dependent diabetes mellitus with arthropathy |
| T2DM | C109H | Read code v2 | Non-insulin dependent d m with neuropathic arthropathy |
| T2DM | C109J | Read code v2 | Insulin treated Type 2 diabetes mellitus |
| T2DM | C109K | Read code v2 | Hyperosmolar non-ketotic state in type 2 diabetes mellitus |
| T2DM | C10.. | Read code v2 | Diabetes mellitus |
| T2DM | C100 | Read code v2 | Diabetes mellitus with no mention of complication |
| T2DM | C100. | Read code v2 | Diabetes mellitus with no mention of complication |
| T2DM | C1000 | Read code v2 | Diabetes mellitus, juvenile type, no mention of complication |
| T2DM | C1001 | Read code v2 | Diabetes mellitus, adult onset, no mention of complication |
| T2DM | C10F. | Read code v2 | Type 2 diabetes mellitus |
| T2DM | C10F0 | Read code v2 | Type 2 diabetes mellitus with renal complications |
| T2DM | C10F1 | Read code v2 | Type 2 diabetes mellitus with ophthalmic complications |
| T2DM | C10F2 | Read code v2 | Type 2 diabetes mellitus with neurological complications |
| T2DM | C10F3 | Read code v2 | Type 2 diabetes mellitus with multiple complications |
| T2DM | C10F4 | Read code v2 | Type 2 diabetes mellitus with ulcer |
| T2DM | C10F5 | Read code v2 | Type 2 diabetes mellitus with gangrene |
| T2DM | C10F6 | Read code v2 | Type 2 diabetes mellitus with retinopathy |
| T2DM | C10F7 | Read code v2 | Type 2 diabetes mellitus - poor control |

| | | | |
|---|---|---|---|
| T2DM | C10F9 | Read code v2 | Type 2 diabetes mellitus without complication |
| T2DM | C10FA | Read code v2 | Type 2 diabetes mellitus with mononeuropathy |
| T2DM | C10FB | Read code v2 | Type 2 diabetes mellitus with polyneuropathy |
| T2DM | C10FC | Read code v2 | Type 2 diabetes mellitus with nephropathy |
| T2DM | C10FD | Read code v2 | Type 2 diabetes mellitus with hypoglycaemic coma |
| T2DM | C10FE | Read code v2 | Type 2 diabetes mellitus with diabetic cataract |
| T2DM | C10FF | Read code v2 | Type 2 diabetes mellitus with peripheral angiopathy |
| T2DM | C10FG | Read code v2 | Type 2 diabetes mellitus with arthropathy |
| T2DM | C10FH | Read code v2 | Type 2 diabetes mellitus with neuropathic arthropathy |
| T2DM | C10FJ | Read code v2 | Insulin treated Type 2 diabetes mellitus |
| T2DM | C10FK | Read code v2 | Hyperosmolar non-ketotic state in type 2 diabetes mellitus |
| T2DM | C10FL | Read code v2 | Type 2 diabetes mellitus with persistent proteinuria |
| T2DM | C10FM | Read code v2 | Type 2 diabetes mellitus with persistent microalbuminuria |
| T2DM | C10FN | Read code v2 | Type 2 diabetes mellitus with ketoacidosis |
| T2DM | C10FP | Read code v2 | Type 2 diabetes mellitus with ketoacidotic coma |
| T2DM | C10FQ | Read code v2 | Type 2 diabetes mellitus with exudative maculopathy |
| T2DM | C10FR | Read code v2 | Type 2 diabetes mellitus with gastroparesis |
| T2DM | E110 | ICD-10 | Type 2-diabetes with hyperosomolarity |
| T2DM | E110- | ICD-10 | Type 2-diabetes with hyperosomolarity |
| T2DM | E111 | ICD-10 | Type 2-diabetes with ketoacideosis |
| T2DM | E112-D | ICD-10 | Type-2 Diabetes with kidney complications |
| T2DM | E112D | ICD-10 | Type-2 Diabetes with kidney complications |
| T2DM | E112DN | ICD-10 | Type-2 Diabetes with kidney complications |
| T2DM | E113 | ICD-10 | Type-2 Diabetes with eye complications |
| T2DM | E113-D | ICD-10 | Type-2 Diabetes with eye complications |
| T2DM | E113D | ICD-10 | Type-2 Diabetes with eye complications |
| T2DM | E113DH | ICD-10 | Type-2 Diabetes with eye complications |
| T2DM | E113DR | ICD-10 | Type-2 Diabetes with eye complications |
| T2DM | E114 | ICD-10 | Type-2 Diabetes with nerve complications |
| T2DM | E114- | ICD-10 | Type-2 Diabetes with nerve complications |
| T2DM | E114-D | ICD-10 | Type-2 Diabetes with nerve complications |
| T2DM | E114D | ICD-10 | Type-2 Diabetes with nerve complications |
| T2DM | E115 | ICD-10 | Type-2 Diabetes with peripheral vascular disease |
| T2DM | E115- | ICD-10 | Type-2 Diabetes with peripheral vascular disease |
| T2DM | E115-D | ICD-10 | Type-2 Diabetes with peripheral vascular disease |
| T2DM | E115D | ICD-10 | Type-2 Diabetes with peripheral vascular disease |
| T2DM | E116 | ICD-10 | Type-2 Diabetes with diabetes-related musculoskeletal, oral, or skin complications; hypoglycemia; or hyperclycemia |
| T2DM | E116D | ICD-10 | Type-2 Diabetes with diabetes-related musculoskeletal, oral, or skin complications; hypoglycemia; or hyperclycemia |
| T2DM | E117 | ICD-10 | Type-2 Diabetes with multiple complications |
| T2DM | E118 | ICD-10 | Type-2 Diabetes with other unspecified complication |

| | | | |
|---|---|---|---|
| T2DM | E118- | ICD-10 | Type-2 Diabetes with other unspecified complication |
| T2DM | E119 | ICD-10 | Type-2 Diabetes, well controlled without hyperglycemia, hypoglycemia, or complications. |
| T2DM | E119- | ICD-10 | Type-2 Diabetes, well controlled without hyperglycemia, hypoglycemia, or complications. |
| T2DM | E119D | ICD-10 | Type-2 Diabetes, well controlled without hyperglycemia, hypoglycemia, or complications. |

## Supplementary Table 3: Model fit statistics

| Trans # | Transition | model | AIC | BIC | n | events | delta_AIC | delta_BIC | rank_AIC | rank_BIC |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ICF -> CKD | gengamma | 734395.60 | 734504.38 | 1311822 | 67894 | 0.00 | 0.00 | 1 | 1 |
| 1 | ICF -> CKD | lnorm | 734573.89 | 734670.59 | 1311822 | 67894 | 178.29 | 166.20 | 2 | 2 |
| 1 | ICF -> CKD | llogis | 736811.40 | 736908.09 | 1311822 | 67894 | 2415.80 | 2403.71 | 3 | 3 |
| 1 | ICF -> CKD | gamma | 737544.85 | 737641.55 | 1311822 | 67894 | 3149.25 | 3137.17 | 4 | 4 |
| 1 | ICF -> CKD | weibullPH | 739702.20 | 739750.50 | 1311822 | 67894 | 5128.31 | 5079.91 | 5 | 5 |
| 1 | ICF -> CKD | weibull | 739702.20 | 739750.50 | 1311822 | 67894 | 5128.31 | 5079.91 | 6 | 6 |
| 1 | ICF -> CKD | gompertz | 745371.29 | 745467.99 | 1311822 | 67894 | 10975.69 | 10963.61 | 7 | 8 |
| 1 | ICF -> CKD | exp | 745371.94 | 745456.55 | 1311822 | 67894 | 10976.34 | 10952.17 | 8 | 7 |
| 2 | ICF -> T2DM | llogis | 533642.91 | 533739.60 | 1311822 | 41934 | 0.00 | 0.00 | 1 | 1 |
| 2 | ICF -> T2DM | weibullPH | 533675.75 | 533772.45 | 1311822 | 41934 | 32.85 | 32.85 | 2 | 2 |
| 2 | ICF -> T2DM | weibull | 533675.75 | 533772.45 | 1311822 | 41934 | 32.85 | 32.85 | 3 | 3 |
| 2 | ICF -> T2DM | gamma | 533684.53 | 533781.23 | 1311822 | 41934 | 41.63 | 41.63 | 4 | 4 |
| 2 | ICF -> T2DM | gengamma | 533721.50 | 533830.29 | 1311822 | 41934 | 78.60 | 90.69 | 5 | 5 |
| 2 | ICF -> T2DM | gompertz | 534068.15 | 534164.85 | 1311822 | 41934 | 425.25 | 425.25 | 6 | 6 |
| 2 | ICF -> T2DM | exp | 534683.08 | 534767.69 | 1311822 | 41934 | 1040.18 | 1028.09 | 7 | 7 |
| 2 | ICF -> T2DM | lnorm | 535454.00 | 535550.69 | 1311822 | 41934 | 1811.09 | 1811.09 | 8 | 8 |
| 3 | ICF -> HF | gengamma | 473448.52 | 473557.31 | 1311822 | 40034 | 0.00 | 0.00 | 1 | 1 |
| 3 | ICF -> HF | llogis | 473626.37 | 473723.06 | 1311822 | 40034 | 177.84 | 165.75 | 2 | 2 |
| 3 | ICF -> HF | weibull | 473893.13 | 473989.83 | 1311822 | 40034 | 444.61 | 432.52 | 3 | 3 |
| 3 | ICF -> HF | weibullPH | 473893.13 | 473989.83 | 1311822 | 40034 | 444.61 | 432.52 | 4 | 4 |
| 3 | ICF -> HF | gamma | 473954.14 | 474050.84 | 1311822 | 40034 | 505.62 | 493.53 | 5 | 5 |
| 3 | ICF -> HF | gompertz | 474110.59 | 474207.28 | 1311822 | 40034 | 662.06 | 649.98 | 6 | 6 |
| 3 | ICF -> HF | lnorm | 474269.99 | 474366.69 | 1311822 | 40034 | 821.47 | 809.38 | 7 | 7 |
| 3 | ICF -> HF | exp | 474469.65 | 474554.26 | 1311822 | 40034 | 1021.13 | 996.96 | 8 | 8 |
| 4 | ICF -> Death | gompertz | 1153717.24 | 1153813.93 | 1311822 | 143963 | 0.00 | 0.00 | 1 | 1 |
| 4 | ICF -> Death | gengamma | 1155612.91 | 1155721.69 | 1311822 | 143963 | 1895.67 | 1907.76 | 2 | 2 |
| 4 | ICF -> Death | weibull | 1156105.39 | 1156202.09 | 1311822 | 143963 | 2388.15 | 2388.15 | 3 | 3 |
| 4 | ICF -> Death | weibullPH | 1156105.39 | 1156202.09 | 1311822 | 143963 | 2388.15 | 2388.15 | 4 | 4 |
| 4 | ICF -> Death | gamma | 1157333.91 | 1157430.60 | 1311822 | 143963 | 3616.67 | 3616.67 | 5 | 5 |
| 4 | ICF -> Death | exp | 1163235.91 | 1163320.52 | 1311822 | 143963 | 9518.67 | 9506.58 | 6 | 6 |
| 4 | ICF -> Death | llogis | 1166357.69 | 1166454.38 | 1311822 | 143963 | 12640.45 | 12640.45 | 7 | 7 |
| 4 | ICF -> Death | lnorm | 1197212.90 | 1197309.60 | 1311822 | 143963 | 43495.66 | 43495.66 | 8 | 8 |
| 5 | CKD -> CKD-T2DM | gompertz | 39386.13 | 39459.13 | 67894 | 3590 | 0.00 | 0.00 | 1 | 1 |
| 5 | CKD -> CKD-T2DM | llogis | 39390.10 | 39463.11 | 67894 | 3590 | 3.98 | 3.98 | 2 | 3 |
| 5 | CKD -> CKD-T2DM | gengamma | 39390.94 | 39473.08 | 67894 | 3590 | 4.82 | 13.94 | 3 | 7 |
| 5 | CKD -> CKD-T2DM | weibullPH | 39392.76 | 39465.76 | 67894 | 3590 | 6.63 | 6.63 | 4 | 4 |
| 5 | CKD -> CKD-T2DM | weibull | 39392.76 | 39465.76 | 67894 | 3590 | 6.63 | 6.63 | 5 | 4 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **5** | CKD -> CKD-T2DM | gamma | 39393.02 | 39466.02 | 67894 | 3590 | 6.89 | 6.89 | 6 | 6 |
| **5** | CKD -> CKD-T2DM | exp | 39395.34 | 39459.22 | 67894 | 3590 | 9.22 | 0.09 | 7 | 2 |
| **5** | CKD -> CKD-T2DM | lnorm | 39443.34 | 39516.34 | 67894 | 3590 | 57.21 | 57.21 | 8 | 8 |
| **6** | CKD -> CKD-HF | gengamma | 42789.76 | 42871.89 | 67894 | 4130 | 0.00 | 2.73 | 1 | 4 |
| **6** | CKD -> CKD-HF | llogis | 42796.15 | 42869.16 | 67894 | 4130 | 6.39 | 0.00 | 2 | 1 |
| **6** | CKD -> CKD-HF | gompertz | 42796.62 | 42869.62 | 67894 | 4130 | 6.86 | 0.46 | 3 | 3 |
| **6** | CKD -> CKD-HF | weibullPH | 42804.68 | 42877.69 | 67894 | 4130 | 14.92 | 8.53 | 4 | 5 |
| **6** | CKD -> CKD-HF | weibull | 42804.68 | 42877.69 | 67894 | 4130 | 14.92 | 8.53 | 5 | 5 |
| **6** | CKD -> CKD-HF | gamma | 42805.20 | 42878.20 | 67894 | 4130 | 15.44 | 9.04 | 6 | 7 |
| **6** | CKD -> CKD-HF | exp | 42805.32 | 42869.20 | 67894 | 4130 | 15.56 | 0.04 | 7 | 2 |
| **6** | CKD -> CKD-HF | lnorm | 42838.34 | 42911.34 | 67894 | 4130 | 48.58 | 42.18 | 8 | 8 |
| **7** | CKD -> Death | gompertz | 97936.29 | 98009.29 | 67894 | 14912 | 0.00 | 0.00 | 1 | 1 |
| **7** | CKD -> Death | gengamma | 97979.00 | 98061.13 | 67894 | 14912 | 42.71 | 51.84 | 2 | 2 |
| **7** | CKD -> Death | weibullPH | 98231.98 | 98304.98 | 67894 | 14912 | 295.69 | 295.69 | 3 | 3 |
| **7** | CKD -> Death | weibull | 98231.98 | 98304.98 | 67894 | 14912 | 295.69 | 295.69 | 4 | 3 |
| **7** | CKD -> Death | gamma | 98726.34 | 98799.35 | 67894 | 14912 | 790.06 | 790.06 | 5 | 5 |
| **7** | CKD -> Death | llogis | 99775.40 | 99848.40 | 67894 | 14912 | 1839.11 | 1839.11 | 6 | 6 |
| **7** | CKD -> Death | exp | 100846.84 | 100910.72 | 67894 | 14912 | 2910.56 | 2901.43 | 7 | 7 |
| **7** | CKD -> Death | lnorm | 102841.41 | 102914.41 | 67894 | 14912 | 4905.12 | 4905.12 | 8 | 8 |
| **8** | T2DM -> T2DM-CKD | gompertz | 35965.42 | 36034.57 | 41934 | 3867 | 0.00 | 0.00 | 1 | 1 |
| **8** | T2DM -> T2DM-CKD | gengamma | 36150.41 | 36228.21 | 41934 | 3867 | 185.00 | 193.64 | 2 | 2 |
| **8** | T2DM -> T2DM-CKD | lnorm | 36176.01 | 36245.16 | 41934 | 3867 | 210.59 | 210.59 | 3 | 3 |
| **8** | T2DM -> T2DM-CKD | llogis | 36187.19 | 36256.35 | 41934 | 3867 | 221.78 | 221.78 | 4 | 4 |
| **8** | T2DM -> T2DM-CKD | weibullPH | 36234.26 | 36303.41 | 41934 | 3867 | 268.84 | 268.84 | 5 | 5 |
| **8** | T2DM -> T2DM-CKD | weibull | 36234.26 | 36303.41 | 41934 | 3867 | 268.84 | 268.84 | 6 | 5 |
| **8** | T2DM -> T2DM-CKD | gamma | 36241.58 | 36310.73 | 41934 | 3867 | 276.17 | 276.17 | 7 | 7 |
| **8** | T2DM -> T2DM-CKD | exp | 36266.37 | 36326.88 | 41934 | 3867 | 300.96 | 292.31 | 8 | 8 |
| **9** | T2DM -> T2DM-HF | llogis | 18958.88 | 19028.03 | 41934 | 1729 | 0.00 | 5.74 | 1 | 2 |
| **9** | T2DM -> T2DM-HF | gengamma | 18958.90 | 19036.69 | 41934 | 1729 | 0.02 | 14.41 | 2 | 7 |
| **9** | T2DM -> T2DM-HF | gompertz | 18960.70 | 19029.85 | 41934 | 1729 | 1.82 | 7.56 | 3 | 3 |
| **9** | T2DM -> T2DM-HF | exp | 18961.78 | 19022.28 | 41934 | 1729 | 2.90 | 0.00 | 4 | 1 |
| **9** | T2DM -> T2DM-HF | weibullPH | 18962.43 | 19031.58 | 41934 | 1729 | 3.56 | 9.30 | 5 | 4 |
| **9** | T2DM -> T2DM-HF | weibull | 18962.43 | 19031.58 | 41934 | 1729 | 3.56 | 9.30 | 6 | 4 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **9** | T2DM -> T2DM-HF | gamma | 18962.66 | 19031.81 | 41934 | 1729 | 3.78 | 9.53 | 7 | 6 |
| **9** | T2DM -> T2DM-HF | lnorm | 18994.73 | 19063.88 | 41934 | 1729 | 35.85 | 41.59 | 8 | 8 |
| **10** | T2DM -> Death | gompertz | 38810.34 | 38879.49 | 41934 | 5155 | 0.00 | 0.00 | 1 | 1 |
| **10** | T2DM -> Death | gengamma | 38900.84 | 38978.63 | 41934 | 5155 | 90.50 | 99.14 | 2 | 2 |
| **10** | T2DM -> Death | weibullPH | 38960.66 | 39029.81 | 41934 | 5155 | 150.32 | 150.32 | 3 | 3 |
| **10** | T2DM -> Death | weibull | 38960.66 | 39029.81 | 41934 | 5155 | 150.32 | 150.32 | 4 | 3 |
| **10** | T2DM -> Death | gamma | 39031.75 | 39100.90 | 41934 | 5155 | 221.41 | 221.41 | 5 | 5 |
| **10** | T2DM -> Death | exp | 39313.84 | 39374.35 | 41934 | 5155 | 503.50 | 494.86 | 6 | 6 |
| **10** | T2DM -> Death | llogis | 39357.26 | 39426.42 | 41934 | 5155 | 546.92 | 546.92 | 7 | 7 |
| **10** | T2DM -> Death | lnorm | 40368.57 | 40437.72 | 41934 | 5155 | 1558.23 | 1558.23 | 8 | 8 |
| **11** | HF -> HF-CKD | llogis | 43304.95 | 43373.73 | 40034 | 5207 | 0.00 | 0.00 | 1 | 1 |
| **11** | HF -> HF-CKD | gengamma | 43306.64 | 43384.02 | 40034 | 5207 | 1.69 | 10.29 | 2 | 2 |
| **11** | HF -> HF-CKD | gamma | 43392.70 | 43461.48 | 40034 | 5207 | 87.76 | 87.76 | 3 | 3 |
| **11** | HF -> HF-CKD | weibullPH | 43407.33 | 43476.11 | 40034 | 5207 | 102.38 | 102.38 | 4 | 4 |
| **11** | HF -> HF-CKD | weibull | 43407.33 | 43476.11 | 40034 | 5207 | 102.38 | 102.38 | 5 | 4 |
| **11** | HF -> HF-CKD | lnorm | 43411.44 | 43480.22 | 40034 | 5207 | 106.49 | 106.49 | 6 | 6 |
| **11** | HF -> HF-CKD | gompertz | 43416.54 | 43485.32 | 40034 | 5207 | 111.60 | 111.60 | 7 | 7 |
| **11** | HF -> HF-CKD | exp | 43449.49 | 43509.67 | 40034 | 5207 | 144.55 | 135.95 | 8 | 8 |
| **12** | HF -> HF-T2DM | llogis | 18402.11 | 18470.89 | 40034 | 1676 | 0.00 | 5.01 | 1 | 2 |
| **12** | HF -> HF-T2DM | weibullPH | 18402.68 | 18471.46 | 40034 | 1676 | 0.57 | 5.58 | 2 | 3 |
| **12** | HF -> HF-T2DM | weibull | 18402.68 | 18471.46 | 40034 | 1676 | 0.57 | 5.58 | 3 | 3 |
| **12** | HF -> HF-T2DM | gamma | 18402.79 | 18471.57 | 40034 | 1676 | 0.68 | 5.70 | 4 | 5 |
| **12** | HF -> HF-T2DM | gompertz | 18403.14 | 18471.92 | 40034 | 1676 | 1.03 | 6.04 | 5 | 6 |
| **12** | HF -> HF-T2DM | gengamma | 18403.94 | 18481.32 | 40034 | 1676 | 1.83 | 15.44 | 6 | 7 |
| **12** | HF -> HF-T2DM | exp | 18405.69 | 18465.88 | 40034 | 1676 | 3.59 | 0.00 | 7 | 1 |
| **12** | HF -> HF-T2DM | lnorm | 18435.20 | 18503.98 | 40034 | 1676 | 33.09 | 38.10 | 8 | 8 |
| **13** | HF -> Death | gompertz | 79231.64 | 79300.42 | 40034 | 14124 | 0.00 | 0.00 | 1 | 1 |
| **13** | HF -> Death | gengamma | 79763.36 | 79840.74 | 40034 | 14124 | 531.73 | 540.32 | 2 | 2 |
| **13** | HF -> Death | weibullPH | 80042.08 | 80110.86 | 40034 | 14124 | 810.44 | 810.44 | 3 | 3 |
| **13** | HF -> Death | weibull | 80042.08 | 80110.86 | 40034 | 14124 | 810.44 | 810.44 | 4 | 3 |
| **13** | HF -> Death | gamma | 80423.30 | 80492.08 | 40034 | 14124 | 1191.66 | 1191.66 | 5 | 5 |
| **13** | HF -> Death | exp | 81886.76 | 81946.94 | 40034 | 14124 | 2655.12 | 2646.52 | 6 | 6 |
| **13** | HF -> Death | llogis | 81938.08 | 82006.86 | 40034 | 14124 | 2706.45 | 2706.45 | 7 | 7 |
| **13** | HF -> Death | lnorm | 84426.36 | 84495.14 | 40034 | 14124 | 5194.73 | 5194.73 | 8 | 8 |
| **14** | CKD-T2DM -> CKD-T2DM-HF | exp | 1427.98 | 1471.29 | 3590 | 135 | 0.00 | 0.00 | 1 | 1 |
| **14** | CKD-T2DM -> CKD-T2DM-HF | gompertz | 1429.42 | 1478.91 | 3590 | 135 | 1.44 | 7.62 | 2 | 2 |
| **14** | CKD-T2DM -> CKD-T2DM-HF | weibullPH | 1429.69 | 1479.18 | 3590 | 135 | 1.70 | 7.89 | 3 | 3 |
| **14** | CKD-T2DM -> CKD-T2DM-HF | weibull | 1429.69 | 1479.18 | 3590 | 135 | 1.70 | 7.89 | 4 | 3 |
| **14** | CKD-T2DM -> CKD-T2DM-HF | gamma | 1429.71 | 1479.19 | 3590 | 135 | 1.72 | 7.91 | 5 | 5 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **14** | CKD-T2DM -> CKD-T2DM-HF | llogis | 1429.81 | 1479.30 | 3590 | 135 | 1.83 | 8.01 | 6 | 6 |
| **14** | CKD-T2DM -> CKD-T2DM-HF | gengamma | 1431.62 | 1487.29 | 3590 | 135 | 3.63 | 16.01 | 7 | 7 |
| **14** | CKD-T2DM -> CKD-T2DM-HF | lnorm | 1438.64 | 1488.13 | 3590 | 135 | 10.66 | 16.84 | 8 | 8 |
| **15** | CKD-T2DM -> Death | gompertz | 3895.89 | 3945.37 | 3590 | 605 | 0.00 | 0.00 | 1 | 1 |
| **15** | CKD-T2DM -> Death | gengamma | 3899.53 | 3955.20 | 3590 | 605 | 3.64 | 9.82 | 2 | 2 |
| **15** | CKD-T2DM -> Death | weibullPH | 3906.27 | 3955.76 | 3590 | 605 | 10.39 | 10.39 | 3 | 3 |
| **15** | CKD-T2DM -> Death | weibull | 3906.27 | 3955.76 | 3590 | 605 | 10.39 | 10.39 | 4 | 3 |
| **15** | CKD-T2DM -> Death | gamma | 3915.58 | 3965.06 | 3590 | 605 | 19.69 | 19.69 | 5 | 5 |
| **15** | CKD-T2DM -> Death | exp | 3949.73 | 3993.03 | 3590 | 605 | 53.84 | 47.65 | 6 | 6 |
| **15** | CKD-T2DM -> Death | llogis | 3957.09 | 4006.58 | 3590 | 605 | 61.21 | 61.21 | 7 | 7 |
| **15** | CKD-T2DM -> Death | lnorm | 4060.04 | 4109.53 | 3590 | 605 | 164.15 | 164.15 | 8 | 8 |
| **16** | CKD-HF -> CKD-HF-T2DM | exp | 1624.75 | 1669.03 | 4130 | 155 | 0.00 | 0.00 | 1 | 1 |
| **16** | CKD-HF -> CKD-HF-T2DM | llogis | 1626.49 | 1677.10 | 4130 | 155 | 1.75 | 8.07 | 2 | 2 |
| **16** | CKD-HF -> CKD-HF-T2DM | gamma | 1626.73 | 1677.34 | 4130 | 155 | 1.98 | 8.31 | 3 | 3 |
| **16** | CKD-HF -> CKD-HF-T2DM | weibullPH | 1626.73 | 1677.34 | 4130 | 155 | 1.99 | 8.31 | 4 | 4 |
| **16** | CKD-HF -> CKD-HF-T2DM | weibull | 1626.73 | 1677.34 | 4130 | 155 | 1.99 | 8.31 | 5 | 4 |
| **16** | CKD-HF -> CKD-HF-T2DM | gompertz | 1626.74 | 1677.35 | 4130 | 155 | 2.00 | 8.32 | 6 | 6 |
| **16** | CKD-HF -> CKD-HF-T2DM | gengamma | 1628.66 | 1685.60 | 4130 | 155 | 3.92 | 16.57 | 7 | 8 |
| **16** | CKD-HF -> CKD-HF-T2DM | lnorm | 1632.57 | 1683.18 | 4130 | 155 | 7.83 | 14.15 | 8 | 7 |
| **17** | CKD-HF -> Death | gompertz | 9104.89 | 9155.50 | 4130 | 1915 | 0.00 | 0.00 | 1 | 1 |
| **17** | CKD-HF -> Death | gengamma | 9129.23 | 9186.16 | 4130 | 1915 | 24.33 | 30.66 | 2 | 2 |
| **17** | CKD-HF -> Death | weibullPH | 9191.35 | 9241.96 | 4130 | 1915 | 86.46 | 86.46 | 3 | 3 |
| **17** | CKD-HF -> Death | weibull | 9191.35 | 9241.96 | 4130 | 1915 | 86.46 | 86.46 | 4 | 3 |
| **17** | CKD-HF -> Death | gamma | 9241.99 | 9292.60 | 4130 | 1915 | 137.10 | 137.10 | 5 | 5 |
| **17** | CKD-HF -> Death | exp | 9370.89 | 9415.17 | 4130 | 1915 | 265.99 | 259.67 | 6 | 6 |
| **17** | CKD-HF -> Death | llogis | 9487.18 | 9537.79 | 4130 | 1915 | 382.28 | 382.28 | 7 | 7 |
| **17** | CKD-HF -> Death | lnorm | 9802.80 | 9853.41 | 4130 | 1915 | 697.91 | 697.91 | 8 | 8 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **18** | T2DM-CKD -> T2DM-CKD-HF | gompertz | 2678.48 | 2728.56 | 3867 | 263 | 0.00 | 4.14 | 1 | 2 |
| **18** | T2DM-CKD -> T2DM-CKD-HF | llogis | 2680.24 | 2730.33 | 3867 | 263 | 1.76 | 5.90 | 2 | 3 |
| **18** | T2DM-CKD -> T2DM-CKD-HF | exp | 2680.60 | 2724.42 | 3867 | 263 | 2.12 | 0.00 | 3 | 1 |
| **18** | T2DM-CKD -> T2DM-CKD-HF | weibullPH | 2681.03 | 2731.12 | 3867 | 263 | 2.55 | 6.69 | 4 | 4 |
| **18** | T2DM-CKD -> T2DM-CKD-HF | weibull | 2681.03 | 2731.12 | 3867 | 263 | 2.55 | 6.69 | 5 | 4 |
| **18** | T2DM-CKD -> T2DM-CKD-HF | gamma | 2681.16 | 2731.24 | 3867 | 263 | 2.67 | 6.82 | 6 | 6 |
| **18** | T2DM-CKD -> T2DM-CKD-HF | gengamma | 2681.97 | 2738.31 | 3867 | 263 | 3.49 | 13.89 | 7 | 8 |
| **18** | T2DM-CKD -> T2DM-CKD-HF | lnorm | 2683.60 | 2733.68 | 3867 | 263 | 5.12 | 9.26 | 8 | 7 |
| **19** | T2DM-CKD -> Death | gengamma | 5969.02 | 6025.36 | 3867 | 912 | 0.00 | 0.00 | 1 | 1 |
| **19** | T2DM-CKD -> Death | gompertz | 5975.70 | 6025.78 | 3867 | 912 | 6.68 | 0.42 | 2 | 2 |
| **19** | T2DM-CKD -> Death | weibullPH | 5976.88 | 6026.96 | 3867 | 912 | 7.86 | 1.60 | 3 | 3 |
| **19** | T2DM-CKD -> Death | weibull | 5976.88 | 6026.96 | 3867 | 912 | 7.86 | 1.60 | 4 | 3 |
| **19** | T2DM-CKD -> Death | gamma | 6000.44 | 6050.53 | 3867 | 912 | 31.43 | 25.17 | 5 | 5 |
| **19** | T2DM-CKD -> Death | llogis | 6057.09 | 6107.17 | 3867 | 912 | 88.08 | 81.82 | 6 | 6 |
| **19** | T2DM-CKD -> Death | exp | 6128.30 | 6172.12 | 3867 | 912 | 159.28 | 146.76 | 7 | 7 |
| **19** | T2DM-CKD -> Death | lnorm | 6209.50 | 6259.58 | 3867 | 912 | 240.48 | 234.22 | 8 | 8 |
| **20** | T2DM-HF -> T2DM-HF-CKD | gompertz | 1658.64 | 1702.28 | 1729 | 213 | 0.00 | 0.00 | 1 | 1 |
| **20** | T2DM-HF -> T2DM-HF-CKD | llogis | 1666.05 | 1709.70 | 1729 | 213 | 7.41 | 7.41 | 2 | 3 |
| **20** | T2DM-HF -> T2DM-HF-CKD | weibullPH | 1668.09 | 1711.73 | 1729 | 213 | 9.45 | 9.45 | 3 | 4 |
| **20** | T2DM-HF -> T2DM-HF-CKD | weibull | 1668.09 | 1711.73 | 1729 | 213 | 9.45 | 9.45 | 4 | 4 |
| **20** | T2DM-HF -> T2DM-HF-CKD | gengamma | 1668.19 | 1717.29 | 1729 | 213 | 9.55 | 15.00 | 5 | 8 |
| **20** | T2DM-HF -> T2DM-HF-CKD | gamma | 1668.61 | 1712.25 | 1729 | 213 | 9.97 | 9.97 | 6 | 6 |
| **20** | T2DM-HF -> T2DM-HF-CKD | exp | 1670.52 | 1708.71 | 1729 | 213 | 11.88 | 6.42 | 7 | 2 |
| **20** | T2DM-HF -> T2DM-HF-CKD | lnorm | 1672.27 | 1715.91 | 1729 | 213 | 13.63 | 13.63 | 8 | 7 |
| **21** | T2DM-HF -> Death | gompertz | 2955.93 | 2999.57 | 1729 | 531 | 0.00 | 0.00 | 1 | 1 |
| **21** | T2DM-HF -> Death | gengamma | 2980.69 | 3029.79 | 1729 | 531 | 24.76 | 30.22 | 2 | 2 |
| **21** | T2DM-HF -> Death | weibullPH | 2991.87 | 3035.51 | 1729 | 531 | 35.94 | 35.94 | 3 | 3 |

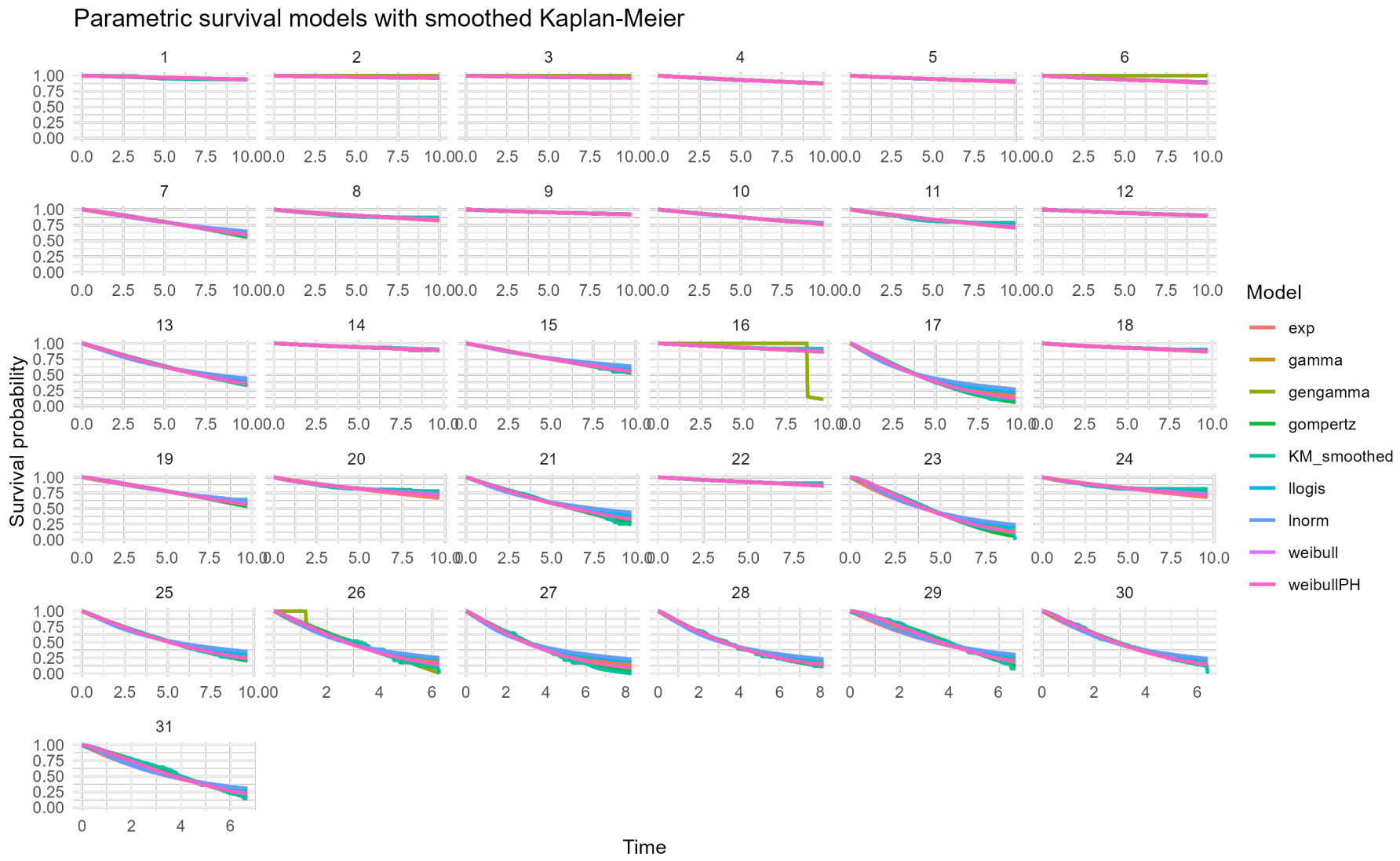
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **21** | T2DM-HF -> Death | weibull | 2991.87 | 3035.51 | 1729 | 531 | 35.94 | 35.94 | 4 | 3 |
| **21** | T2DM-HF -> Death | gamma | 3001.23 | 3044.88 | 1729 | 531 | 45.31 | 45.31 | 5 | 5 |
| **21** | T2DM-HF -> Death | exp | 3031.39 | 3069.58 | 1729 | 531 | 75.46 | 70.01 | 6 | 6 |
| **21** | T2DM-HF -> Death | llogis | 3053.72 | 3097.36 | 1729 | 531 | 97.79 | 97.79 | 7 | 7 |
| **21** | T2DM-HF -> Death | lnorm | 3130.06 | 3173.70 | 1729 | 531 | 174.13 | 174.13 | 8 | 8 |
| **22** | HF-CKD -> HF-CKD-T2DM | exp | 3122.01 | 3167.92 | 5207 | 305 | 0.00 | 0.00 | 1 | 1 |
| **22** | HF-CKD -> HF-CKD-T2DM | gamma | 3122.99 | 3175.45 | 5207 | 305 | 0.98 | 7.53 | 2 | 2 |
| **22** | HF-CKD -> HF-CKD-T2DM | weibullPH | 3123.00 | 3175.46 | 5207 | 305 | 0.99 | 7.54 | 3 | 3 |
| **22** | HF-CKD -> HF-CKD-T2DM | weibull | 3123.00 | 3175.46 | 5207 | 305 | 0.99 | 7.54 | 4 | 3 |
| **22** | HF-CKD -> HF-CKD-T2DM | llogis | 3123.09 | 3175.55 | 5207 | 305 | 1.08 | 7.63 | 5 | 5 |
| **22** | HF-CKD -> HF-CKD-T2DM | gompertz | 3123.30 | 3175.76 | 5207 | 305 | 1.29 | 7.85 | 6 | 6 |
| **22** | HF-CKD -> HF-CKD-T2DM | gengamma | 3124.98 | 3184.00 | 5207 | 305 | 2.97 | 16.08 | 7 | 7 |
| **22** | HF-CKD -> HF-CKD-T2DM | lnorm | 3136.57 | 3189.03 | 5207 | 305 | 14.55 | 21.11 | 8 | 8 |
| **23** | HF-CKD -> Death | gompertz | 15914.61 | 15967.07 | 5207 | 3256 | 0.00 | 0.00 | 1 | 1 |
| **23** | HF-CKD -> Death | gengamma | 15925.04 | 15984.06 | 5207 | 3256 | 10.43 | 16.99 | 2 | 2 |
| **23** | HF-CKD -> Death | weibullPH | 16101.14 | 16153.61 | 5207 | 3256 | 186.53 | 186.53 | 3 | 3 |
| **23** | HF-CKD -> Death | weibull | 16101.14 | 16153.61 | 5207 | 3256 | 186.53 | 186.53 | 4 | 3 |
| **23** | HF-CKD -> Death | gamma | 16262.31 | 16314.77 | 5207 | 3256 | 347.70 | 347.70 | 5 | 5 |
| **23** | HF-CKD -> Death | llogis | 16632.56 | 16685.02 | 5207 | 3256 | 717.95 | 717.95 | 6 | 6 |
| **23** | HF-CKD -> Death | exp | 16825.45 | 16871.35 | 5207 | 3256 | 910.84 | 904.28 | 7 | 7 |
| **23** | HF-CKD -> Death | lnorm | 17150.05 | 17202.51 | 5207 | 3256 | 1235.44 | 1235.44 | 8 | 8 |
| **24** | HF-T2DM -> HF-T2DM-CKD | gompertz | 1621.63 | 1665.03 | 1676 | 201 | 0.00 | 0.00 | 1 | 1 |
| **24** | HF-T2DM -> HF-T2DM-CKD | lnorm | 1625.11 | 1668.50 | 1676 | 201 | 3.48 | 3.48 | 2 | 2 |
| **24** | HF-T2DM -> HF-T2DM-CKD | gengamma | 1627.08 | 1675.90 | 1676 | 201 | 5.45 | 10.87 | 3 | 5 |
| **24** | HF-T2DM -> HF-T2DM-CKD | llogis | 1630.34 | 1673.73 | 1676 | 201 | 8.70 | 8.70 | 4 | 3 |
| **24** | HF-T2DM -> HF-T2DM-CKD | weibullPH | 1635.37 | 1678.76 | 1676 | 201 | 13.74 | 13.74 | 5 | 6 |
| **24** | HF-T2DM -> HF-T2DM-CKD | weibull | 1635.37 | 1678.76 | 1676 | 201 | 13.74 | 13.74 | 6 | 6 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **24** | HF-T2DM -> HF-T2DM-CKD | exp | 1636.15 | 1674.12 | 1676 | 201 | 14.52 | 9.09 | 7 | 4 |
| **24** | HF-T2DM -> HF-T2DM-CKD | gamma | 1636.17 | 1679.56 | 1676 | 201 | 14.54 | 14.54 | 8 | 8 |
| **25** | HF-T2DM -> Death | gompertz | 3505.91 | 3549.30 | 1676 | 656 | 0.00 | 0.00 | 1 | 1 |
| **25** | HF-T2DM -> Death | gengamma | 3518.86 | 3567.68 | 1676 | 656 | 12.95 | 18.38 | 2 | 2 |
| **25** | HF-T2DM -> Death | weibullPH | 3529.44 | 3572.83 | 1676 | 656 | 23.54 | 23.54 | 3 | 3 |
| **25** | HF-T2DM -> Death | weibull | 3529.44 | 3572.83 | 1676 | 656 | 23.54 | 23.54 | 4 | 3 |
| **25** | HF-T2DM -> Death | gamma | 3541.26 | 3584.65 | 1676 | 656 | 35.35 | 35.35 | 5 | 5 |
| **25** | HF-T2DM -> Death | exp | 3576.41 | 3614.37 | 1676 | 656 | 70.50 | 65.08 | 6 | 6 |
| **25** | HF-T2DM -> Death | llogis | 3613.40 | 3656.80 | 1676 | 656 | 107.50 | 107.50 | 7 | 7 |
| **25** | HF-T2DM -> Death | lnorm | 3714.58 | 3757.98 | 1676 | 656 | 208.68 | 208.68 | 8 | 8 |
| **26** | CKD-T2DM-HF -> Death | gompertz | 286.73 | 309.97 | 135 | 65 | 0.00 | 0.00 | 1 | 1 |
| **26** | CKD-T2DM-HF -> Death | weibullPH | 289.96 | 313.20 | 135 | 65 | 3.23 | 3.23 | 2 | 2 |
| **26** | CKD-T2DM-HF -> Death | weibull | 289.96 | 313.20 | 135 | 65 | 3.23 | 3.23 | 3 | 2 |
| **26** | CKD-T2DM-HF -> Death | gamma | 290.58 | 313.82 | 135 | 65 | 3.85 | 3.85 | 4 | 5 |
| **26** | CKD-T2DM-HF -> Death | gengamma | 291.12 | 317.27 | 135 | 65 | 4.39 | 7.29 | 5 | 6 |
| **26** | CKD-T2DM-HF -> Death | exp | 293.35 | 313.69 | 135 | 65 | 6.62 | 3.72 | 6 | 4 |
| **26** | CKD-T2DM-HF -> Death | lnorm | 297.97 | 321.22 | 135 | 65 | 11.24 | 11.24 | 7 | 7 |
| **26** | CKD-T2DM-HF -> Death | llogis | 298.30 | 321.54 | 135 | 65 | 11.57 | 11.57 | 8 | 8 |
| **27** | CKD-HF-T2DM -> Death | gompertz | 330.65 | 355.00 | 155 | 71 | 0.00 | 0.00 | 1 | 1 |
| **27** | CKD-HF-T2DM -> Death | gengamma | 334.50 | 361.89 | 155 | 71 | 3.85 | 6.90 | 2 | 6 |
| **27** | CKD-HF-T2DM -> Death | weibullPH | 335.37 | 359.72 | 155 | 71 | 4.72 | 4.72 | 3 | 2 |
| **27** | CKD-HF-T2DM -> Death | weibull | 335.37 | 359.72 | 155 | 71 | 4.72 | 4.72 | 4 | 2 |
| **27** | CKD-HF-T2DM -> Death | gamma | 336.86 | 361.21 | 155 | 71 | 6.21 | 6.21 | 5 | 5 |
| **27** | CKD-HF-T2DM -> Death | exp | 339.82 | 361.13 | 155 | 71 | 9.17 | 6.13 | 6 | 4 |
| **27** | CKD-HF-T2DM -> Death | llogis | 344.35 | 368.70 | 155 | 71 | 13.70 | 13.70 | 7 | 7 |
| **27** | CKD-HF-T2DM -> Death | lnorm | 351.11 | 375.46 | 155 | 71 | 20.46 | 20.46 | 8 | 8 |
| **28** | T2DM-CKD-HF -> Death | gengamma | 661.15 | 693.30 | 263 | 142 | 0.00 | 2.06 | 1 | 2 |

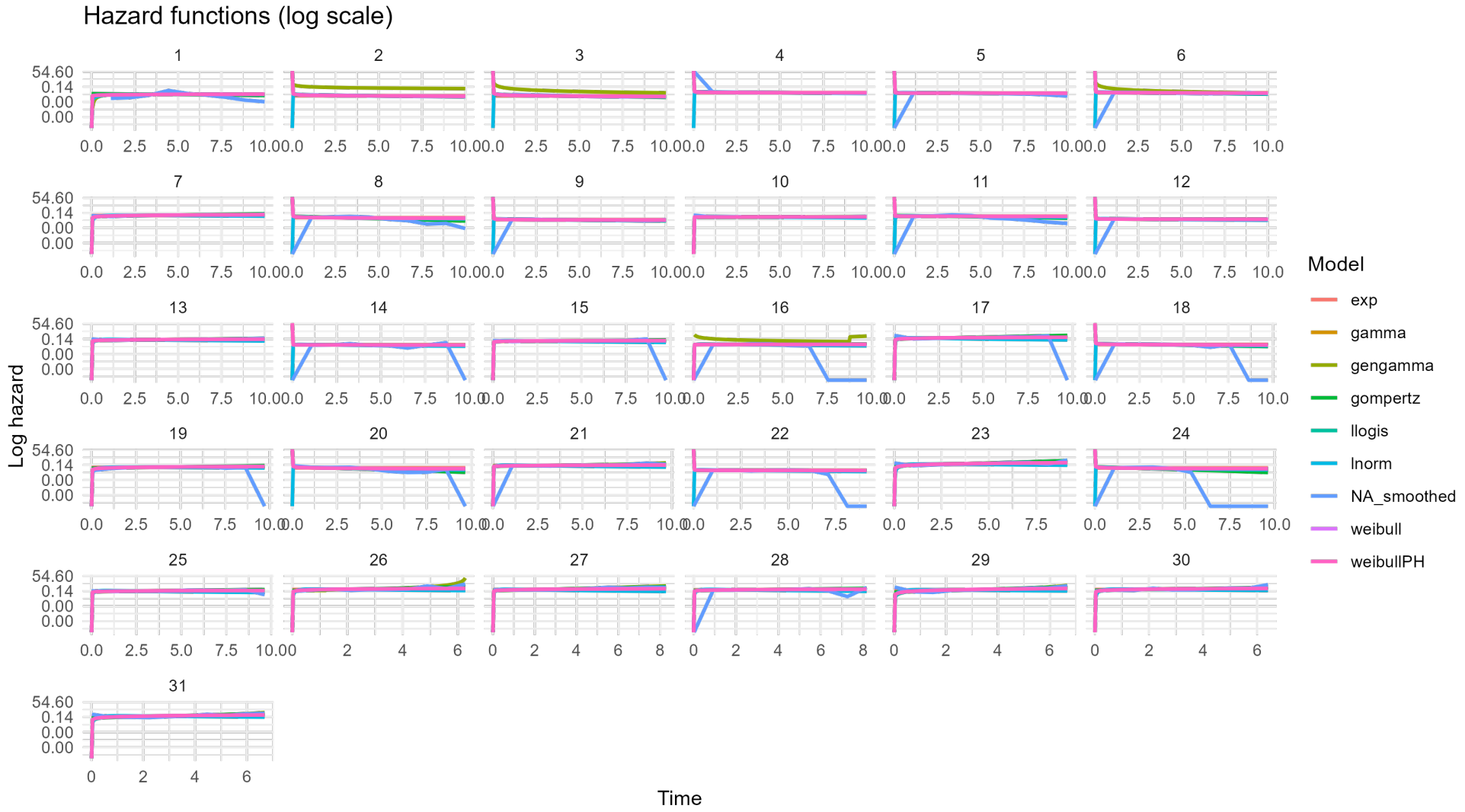
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **28** | T2DM-CKD-HF -> Death | gompertz | 662.67 | 691.24 | 263 | 142 | 1.51 | 0.00 | 2 | 1 |
| **28** | T2DM-CKD-HF -> Death | weibullPH | 664.90 | 693.48 | 263 | 142 | 3.75 | 2.23 | 3 | 3 |
| **28** | T2DM-CKD-HF -> Death | weibull | 664.90 | 693.48 | 263 | 142 | 3.75 | 2.23 | 4 | 3 |
| **28** | T2DM-CKD-HF -> Death | gamma | 667.37 | 695.95 | 263 | 142 | 6.21 | 4.70 | 5 | 5 |
| **28** | T2DM-CKD-HF -> Death | exp | 673.02 | 698.03 | 263 | 142 | 11.87 | 6.78 | 6 | 6 |
| **28** | T2DM-CKD-HF -> Death | llogis | 685.56 | 714.14 | 263 | 142 | 24.41 | 22.90 | 7 | 7 |
| **28** | T2DM-CKD-HF -> Death | lnorm | 694.64 | 723.22 | 263 | 142 | 33.49 | 31.97 | 8 | 8 |
| **29** | T2DM-HF-CKD -> Death | gompertz | 706.86 | 733.75 | 213 | 154 | 0.00 | 0.00 | 1 | 1 |
| **29** | T2DM-HF-CKD -> Death | gengamma | 709.05 | 739.30 | 213 | 154 | 2.19 | 5.55 | 2 | 2 |
| **29** | T2DM-HF-CKD -> Death | weibullPH | 736.32 | 763.21 | 213 | 154 | 29.46 | 29.46 | 3 | 3 |
| **29** | T2DM-HF-CKD -> Death | weibull | 736.32 | 763.21 | 213 | 154 | 29.46 | 29.46 | 4 | 3 |
| **29** | T2DM-HF-CKD -> Death | gamma | 749.46 | 776.35 | 213 | 154 | 42.60 | 42.60 | 5 | 5 |
| **29** | T2DM-HF-CKD -> Death | llogis | 771.76 | 798.65 | 213 | 154 | 64.90 | 64.90 | 6 | 7 |
| **29** | T2DM-HF-CKD -> Death | exp | 772.58 | 796.11 | 213 | 154 | 65.72 | 62.36 | 7 | 6 |
| **29** | T2DM-HF-CKD -> Death | lnorm | 811.04 | 837.93 | 213 | 154 | 104.18 | 104.18 | 8 | 8 |
| **30** | HF-CKD-T2DM -> Death | gompertz | 720.48 | 750.24 | 305 | 173 | 0.00 | 0.00 | 1 | 1 |
| **30** | HF-CKD-T2DM -> Death | gengamma | 724.08 | 757.56 | 305 | 173 | 3.60 | 7.32 | 2 | 4 |
| **30** | HF-CKD-T2DM -> Death | weibullPH | 725.98 | 755.74 | 305 | 173 | 5.49 | 5.49 | 3 | 2 |
| **30** | HF-CKD-T2DM -> Death | weibull | 725.98 | 755.74 | 305 | 173 | 5.49 | 5.49 | 4 | 2 |
| **30** | HF-CKD-T2DM -> Death | gamma | 730.44 | 760.20 | 305 | 173 | 9.96 | 9.96 | 5 | 5 |
| **30** | HF-CKD-T2DM -> Death | llogis | 749.04 | 778.81 | 305 | 173 | 28.56 | 28.56 | 6 | 6 |
| **30** | HF-CKD-T2DM -> Death | exp | 753.19 | 779.24 | 305 | 173 | 32.71 | 28.99 | 7 | 7 |
| **30** | HF-CKD-T2DM -> Death | lnorm | 764.60 | 794.36 | 305 | 173 | 44.12 | 44.12 | 8 | 8 |
| **31** | HF-T2DM-CKD -> Death | gompertz | 682.35 | 708.77 | 201 | 145 | 0.00 | 0.00 | 1 | 1 |
| **31** | HF-T2DM-CKD -> Death | gengamma | 690.33 | 720.06 | 201 | 145 | 7.99 | 11.29 | 2 | 2 |
| **31** | HF-T2DM-CKD -> Death | weibull | 704.66 | 731.09 | 201 | 145 | 22.32 | 22.32 | 3 | 3 |
| **31** | HF-T2DM-CKD -> Death | weibullPH | 704.66 | 731.09 | 201 | 145 | 22.32 | 22.32 | 4 | 4 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **31** | HF-T2DM-CKD -> Death | gamma | 712.31 | 738.74 | 201 | 145 | 29.97 | 29.97 | 5 | 5 |
| **31** | HF-T2DM-CKD -> Death | exp | 727.66 | 750.78 | 201 | 145 | 45.31 | 42.01 | 6 | 6 |
| **31** | HF-T2DM-CKD -> Death | llogis | 732.83 | 759.25 | 201 | 145 | 50.48 | 50.48 | 7 | 7 |
| **31** | HF-T2DM-CKD -> Death | lnorm | 754.79 | 781.22 | 201 | 145 | 72.45 | 72.45 | 8 | 8 |

**Supplementary Figure 2: Parametric survival models obtained from the natural history of disease model**



**Supplementary Figure 3: Hazard functions from parametric survival models obtained from the natural history of disease model**



## Supplementary Table 4: Parameter estimates from best fitting model

| trans | | model | param | estimate | se | type |
|---|---|---|---|---|---|---|
| **1** | ICF -> CKD | gengamma | mu | 3.877369289 | 0.010691694 | distribution |
| **1** | ICF -> CKD | gengamma | sigma | 1.4045898 | 0.011714239 | distribution |
| **1** | ICF -> CKD | gengamma | Q | 0.158642963 | 0.011571515 | distribution |
| **1** | ICF -> CKD | gengamma | AGE_tc | -0.056554279 | 0.000240037 | covariate |
| **1** | ICF -> CKD | gengamma | GNDR_CDFemale | -0.093073569 | 0.006065851 | covariate |
| **1** | ICF -> CKD | gengamma | WIMD2011_QUINTILE_INCEPTIONMostDep | -0.097954576 | 0.009163457 | covariate |
| **1** | ICF -> CKD | gengamma | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.023793745 | 0.009222834 | covariate |
| **1** | ICF -> CKD | gengamma | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.047788718 | 0.009466981 | covariate |
| **1** | ICF -> CKD | gengamma | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.218979324 | 0.009510679 | covariate |
| **2** | ICF -> T2DM | llogis | shape | 0.87729847 | 0.004031637 | distribution |
| **2** | ICF -> T2DM | llogis | scale | 170.1528526 | 3.534763537 | distribution |
| **2** | ICF -> T2DM | llogis | AGE_tc | -0.042041469 | 0.000391688 | covariate |
| **2** | ICF -> T2DM | llogis | GNDR_CDFemale | 0.460691184 | 0.011682455 | covariate |
| **2** | ICF -> T2DM | llogis | WIMD2011_QUINTILE_INCEPTIONMostDep | -0.3394655 | 0.017120754 | covariate |
| **2** | ICF -> T2DM | llogis | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.170205542 | 0.01756065 | covariate |
| **2** | ICF -> T2DM | llogis | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.103126331 | 0.018852258 | covariate |
| **2** | ICF -> T2DM | llogis | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.299391929 | 0.018981705 | covariate |
| **3** | ICF -> HF | gengamma | mu | 5.312611656 | 0.028970093 | distribution |
| **3** | ICF -> HF | gengamma | sigma | 1.749994836 | 0.029799172 | distribution |
| **3** | ICF -> HF | gengamma | Q | 0.513518268 | 0.017698748 | distribution |
| **3** | ICF -> HF | gengamma | AGE_tc | -0.085154877 | 0.000495496 | covariate |
| **3** | ICF -> HF | gengamma | GNDR_CDFemale | 0.272441461 | 0.011835157 | covariate |
| **3** | ICF -> HF | gengamma | WIMD2011_QUINTILE_INCEPTIONMostDep | -0.076238541 | 0.018316157 | covariate |
| **3** | ICF -> HF | gengamma | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.045569159 | 0.018216062 | covariate |
| **3** | ICF -> HF | gengamma | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.017152551 | 0.018598008 | covariate |
| **3** | ICF -> HF | gengamma | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.080823869 | 0.018156976 | covariate |
| **4** | ICF -> Death | gompertz | shape | 0.096178859 | 0.000974279 | distribution |
| **4** | ICF -> Death | gompertz | rate | 0.025201874 | 0.000196017 | covariate |
| **4** | ICF -> Death | gompertz | AGE_tc | 0.111307366 | 0.000199608 | covariate |
| **4** | ICF -> Death | gompertz | GNDR_CDFemale | -0.36034644 | 0.005348101 | covariate |
| **4** | ICF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.253223308 | 0.007969305 | covariate |
| **4** | ICF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.106260504 | 0.008108965 | covariate |
| **4** | ICF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.086509711 | 0.008578355 | covariate |
| **4** | ICF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.208521612 | 0.008550826 | covariate |
| **5** | CKD -> CKD-T2DM | gompertz | shape | -0.030164837 | 0.009047946 | distribution |
| **5** | CKD -> CKD-T2DM | gompertz | rate | 0.013595271 | 0.000647499 | covariate |
| **5** | CKD -> CKD-T2DM | gompertz | AGE_tc | 0.001275694 | 0.001363836 | covariate |
| **5** | CKD -> CKD-T2DM | gompertz | GNDR_CDFemale | -0.343791966 | 0.03356578 | covariate |

| | | | | | | |
|---|---|---|---|---|---|---|
| **5** | CKD -> CKD-T2DM | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.288065528 | 0.04937545 | covariate |
| **5** | CKD -> CKD-T2DM | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.169114704 | 0.050835275 | covariate |
| **5** | CKD -> CKD-T2DM | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.123986621 | 0.056223301 | covariate |
| **5** | CKD -> CKD-T2DM | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.118472001 | 0.057162403 | covariate |
| **6** | CKD -> CKD-HF | gengamma | mu | 4.657185467 | 0.088509293 | distribution |
| **6** | CKD -> CKD-HF | gengamma | sigma | 1.526627972 | 0.109981335 | distribution |
| **6** | CKD -> CKD-HF | gengamma | Q | 0.551090243 | 0.080638969 | distribution |
| **6** | CKD -> CKD-HF | gengamma | AGE_tc | -0.056533379 | 0.001643778 | covariate |
| **6** | CKD -> CKD-HF | gengamma | GNDR_CDFemale | 0.26371162 | 0.034317688 | covariate |
| **6** | CKD -> CKD-HF | gengamma | WIMD2011_QUINTILE_INCEPTIONMostDep | -0.022821087 | 0.051225651 | covariate |
| **6** | CKD -> CKD-HF | gengamma | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.046646636 | 0.051264786 | covariate |
| **6** | CKD -> CKD-HF | gengamma | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.108150331 | 0.052533527 | covariate |
| **6** | CKD -> CKD-HF | gengamma | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.065598927 | 0.052561613 | covariate |
| **7** | CKD -> Death | gompertz | shape | 0.241106826 | 0.004362911 | distribution |
| **7** | CKD -> Death | gompertz | rate | 0.014074871 | 0.000383954 | covariate |
| **7** | CKD -> Death | gompertz | AGE_tc | 0.125900637 | 0.000915671 | covariate |
| **7** | CKD -> Death | gompertz | GNDR_CDFemale | -0.442785001 | 0.016704414 | covariate |
| **7** | CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.179558155 | 0.025069382 | covariate |
| **7** | CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.050925535 | 0.025080904 | covariate |
| **7** | CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.046636535 | 0.02563275 | covariate |
| **7** | CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.09086918 | 0.025983081 | covariate |
| **8** | T2DM -> T2DM-CKD | gompertz | shape | -0.136420221 | 0.008196342 | distribution |
| **8** | T2DM -> T2DM-CKD | gompertz | rate | 0.037056282 | 0.001617107 | covariate |
| **8** | T2DM -> T2DM-CKD | gompertz | AGE_tc | 0.049365044 | 0.001326141 | covariate |
| **8** | T2DM -> T2DM-CKD | gompertz | GNDR_CDFemale | 0.1876622 | 0.032467864 | covariate |
| **8** | T2DM -> T2DM-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.079973671 | 0.048214268 | covariate |
| **8** | T2DM -> T2DM-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.053255973 | 0.049001282 | covariate |
| **8** | T2DM -> T2DM-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.000896419 | 0.052392074 | covariate |
| **8** | T2DM -> T2DM-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.149910517 | 0.054944941 | covariate |
| **9** | T2DM -> T2DM-HF | llogis | shape | 0.99720399 | 0.020862644 | distribution |

| | | | | | | |
|---|---|---|---|---|---|---|
| **9** | T2DM -> T2DM-HF | llogis | scale | 68.37181106 | 5.601879096 | distribution |
| **9** | T2DM -> T2DM-HF | llogis | AGE_tc | -0.058958574 | 0.002234441 | covariate |
| **9** | T2DM -> T2DM-HF | llogis | GNDR_CDFemale | 0.188337578 | 0.051141948 | covariate |
| **9** | T2DM -> T2DM-HF | llogis | WIMD2011_QUINTILE_INCEPTIONMostDep | -0.044884918 | 0.075557751 | covariate |
| **9** | T2DM -> T2DM-HF | llogis | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.055054046 | 0.07599739 | covariate |
| **9** | T2DM -> T2DM-HF | llogis | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.004003913 | 0.080852926 | covariate |
| **9** | T2DM -> T2DM-HF | llogis | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.140476535 | 0.08397151 | covariate |
| **10** | T2DM -> Death | gompertz | shape | 0.140435872 | 0.006064472 | distribution |
| **10** | T2DM -> Death | gompertz | rate | 0.026175744 | 0.001033866 | covariate |
| **10** | T2DM -> Death | gompertz | AGE_tc | 0.115411961 | 0.001298013 | covariate |
| **10** | T2DM -> Death | gompertz | GNDR_CDFemale | -0.268804163 | 0.028475727 | covariate |
| **10** | T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.253999844 | 0.040878367 | covariate |
| **10** | T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.037903313 | 0.042342707 | covariate |
| **10** | T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.153106537 | 0.046258103 | covariate |
| **10** | T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.238405604 | 0.047503978 | covariate |
| **11** | HF -> HF-CKD | llogis | shape | 1.166593186 | 0.013647675 | distribution |
| **11** | HF -> HF-CKD | llogis | scale | 21.1992477 | 0.784477021 | distribution |
| **11** | HF -> HF-CKD | llogis | AGE_tc | -0.046799933 | 0.001135324 | covariate |
| **11** | HF -> HF-CKD | llogis | GNDR_CDFemale | 0.005295368 | 0.026945579 | covariate |
| **11** | HF -> HF-CKD | llogis | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.004855984 | 0.040904596 | covariate |
| **11** | HF -> HF-CKD | llogis | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.068332893 | 0.041050687 | covariate |
| **11** | HF -> HF-CKD | llogis | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.056276495 | 0.041525998 | covariate |
| **11** | HF -> HF-CKD | llogis | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.133568594 | 0.04120608 | covariate |
| **12** | HF -> HF-T2DM | llogis | shape | 0.970516675 | 0.020580351 | distribution |
| **12** | HF -> HF-T2DM | llogis | scale | 88.88381297 | 7.966242355 | distribution |
| **12** | HF -> HF-T2DM | llogis | AGE_tc | -0.003291404 | 0.001903475 | covariate |
| **12** | HF -> HF-T2DM | llogis | GNDR_CDFemale | 0.258127764 | 0.053026445 | covariate |
| **12** | HF -> HF-T2DM | llogis | WIMD2011_QUINTILE_INCEPTIONMostDep | -0.242136218 | 0.07969553 | covariate |
| **12** | HF -> HF-T2DM | llogis | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.16555554 | 0.080476836 | covariate |
| **12** | HF -> HF-T2DM | llogis | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.054737334 | 0.086077585 | covariate |
| **12** | HF -> HF-T2DM | llogis | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.103101474 | 0.084802606 | covariate |
| **13** | HF -> Death | gompertz | shape | 0.202875007 | 0.00377216 | distribution |
| **13** | HF -> Death | gompertz | rate | 0.037836674 | 0.000980446 | covariate |
| **13** | HF -> Death | gompertz | AGE_tc | 0.092136904 | 0.000838662 | covariate |
| **13** | HF -> Death | gompertz | GNDR_CDFemale | -0.26983963 | 0.017205374 | covariate |

| | | | | | | |
|---|---|---|---|---|---|---|
| **13** | HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.176944088 | 0.02556719 | covariate |
| **13** | HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.050967822 | 0.025858277 | covariate |
| **13** | HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.088669013 | 0.027197095 | covariate |
| **13** | HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.196816345 | 0.027275553 | covariate |
| **14** | CKD-T2DM -> CKD-T2DM-HF | exp | rate | 0.014600875 | 0.002854188 | covariate |
| **14** | CKD-T2DM -> CKD-T2DM-HF | exp | AGE_tc | 0.049311522 | 0.008681371 | covariate |
| **14** | CKD-T2DM -> CKD-T2DM-HF | exp | GNDR_CDFemale | 0.003611195 | 0.174944229 | covariate |
| **14** | CKD-T2DM -> CKD-T2DM-HF | exp | WIMD2011_QUINTILE_INCEPTIONMostDep | -0.25764591 | 0.245374266 | covariate |
| **14** | CKD-T2DM -> CKD-T2DM-HF | exp | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.52523266 | 0.268467504 | covariate |
| **14** | CKD-T2DM -> CKD-T2DM-HF | exp | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.386588323 | 0.280421573 | covariate |
| **14** | CKD-T2DM -> CKD-T2DM-HF | exp | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.08755282 | 0.261938332 | covariate |
| **15** | CKD-T2DM -> Death | gompertz | shape | 0.195134888 | 0.02507338 | distribution |
| **15** | CKD-T2DM -> Death | gompertz | rate | 0.021859788 | 0.002767741 | covariate |
| **15** | CKD-T2DM -> Death | gompertz | AGE_tc | 0.125165917 | 0.004697458 | covariate |
| **15** | CKD-T2DM -> Death | gompertz | GNDR_CDFemale | -0.296018866 | 0.083759267 | covariate |
| **15** | CKD-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.223866264 | 0.121549367 | covariate |
| **15** | CKD-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.05842933 | 0.128073688 | covariate |
| **15** | CKD-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.08135458 | 0.13517636 | covariate |
| **15** | CKD-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.035473344 | 0.134372156 | covariate |
| **16** | CKD-HF -> CKD-HF-T2DM | exp | rate | 0.018450987 | 0.00344747 | covariate |
| **16** | CKD-HF -> CKD-HF-T2DM | exp | AGE_tc | -0.016687283 | 0.007002643 | covariate |
| **16** | CKD-HF -> CKD-HF-T2DM | exp | GNDR_CDFemale | -0.306203763 | 0.162122542 | covariate |
| **16** | CKD-HF -> CKD-HF-T2DM | exp | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.030380122 | 0.239493055 | covariate |
| **16** | CKD-HF -> CKD-HF-T2DM | exp | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.213785932 | 0.23260583 | covariate |
| **16** | CKD-HF -> CKD-HF-T2DM | exp | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.35421095 | 0.279147776 | covariate |
| **16** | CKD-HF -> CKD-HF-T2DM | exp | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.030373706 | 0.254995634 | covariate |
| **17** | CKD-HF -> Death | gompertz | shape | 0.242812631 | 0.014150254 | distribution |
| **17** | CKD-HF -> Death | gompertz | rate | 0.057285598 | 0.004162862 | covariate |
| **17** | CKD-HF -> Death | gompertz | AGE_tc | 0.089583882 | 0.002783568 | covariate |

| | | | | | | |
|---|---|---|---|---|---|---|
| **17** | CKD-HF -> Death | gompertz | GNDR_CDFemale | -0.397118495 | 0.0468949 | covariate |
| **17** | CKD-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.067645567 | 0.067441493 | covariate |
| **17** | CKD-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.021136952 | 0.06878601 | covariate |
| **17** | CKD-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.198586486 | 0.072187164 | covariate |
| **17** | CKD-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.289200336 | 0.074054986 | covariate |
| **18** | T2DM-CKD -> T2DM-CKD-HF | gompertz | shape | -0.074340079 | 0.037040711 | distribution |
| **18** | T2DM-CKD -> T2DM-CKD-HF | gompertz | rate | 0.014295743 | 0.002677327 | covariate |
| **18** | T2DM-CKD -> T2DM-CKD-HF | gompertz | AGE_tc | 0.048321687 | 0.006109492 | covariate |
| **18** | T2DM-CKD -> T2DM-CKD-HF | gompertz | GNDR_CDFemale | -0.077463511 | 0.124753859 | covariate |
| **18** | T2DM-CKD -> T2DM-CKD-HF | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.212806333 | 0.19879444 | covariate |
| **18** | T2DM-CKD -> T2DM-CKD-HF | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.324919704 | 0.194874712 | covariate |
| **18** | T2DM-CKD -> T2DM-CKD-HF | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.379758217 | 0.201164742 | covariate |
| **18** | T2DM-CKD -> T2DM-CKD-HF | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.183933887 | 0.217525405 | covariate |
| **19** | T2DM-CKD -> Death | gengamma | mu | 2.72508485 | 0.059870837 | distribution |
| **19** | T2DM-CKD -> Death | gengamma | sigma | 0.577348024 | 0.035591496 | distribution |
| **19** | T2DM-CKD -> Death | gengamma | Q | 1.282545952 | 0.097093763 | distribution |
| **19** | T2DM-CKD -> Death | gengamma | AGE_tc | -0.079364506 | 0.00320353 | covariate |
| **19** | T2DM-CKD -> Death | gengamma | GNDR_CDFemale | 0.206410831 | 0.043707317 | covariate |
| **19** | T2DM-CKD -> Death | gengamma | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.009627569 | 0.062900419 | covariate |
| **19** | T2DM-CKD -> Death | gengamma | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.008854556 | 0.061865611 | covariate |
| **19** | T2DM-CKD -> Death | gengamma | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.104092706 | 0.066943285 | covariate |
| **19** | T2DM-CKD -> Death | gengamma | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.163409271 | 0.0715821 | covariate |
| **20** | T2DM-HF -> T2DM-HF-CKD | gompertz | shape | -0.161873677 | 0.045736854 | distribution |
| **20** | T2DM-HF -> T2DM-HF-CKD | gompertz | rate | 0.047618784 | 0.009088836 | covariate |
| **20** | T2DM-HF -> T2DM-HF-CKD | gompertz | AGE_tc | 0.057681961 | 0.006512275 | covariate |
| **20** | T2DM-HF -> T2DM-HF-CKD | gompertz | GNDR_CDFemale | 0.103269861 | 0.139969301 | covariate |
| **20** | T2DM-HF -> T2DM-HF-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | -0.000767109 | 0.211558387 | covariate |

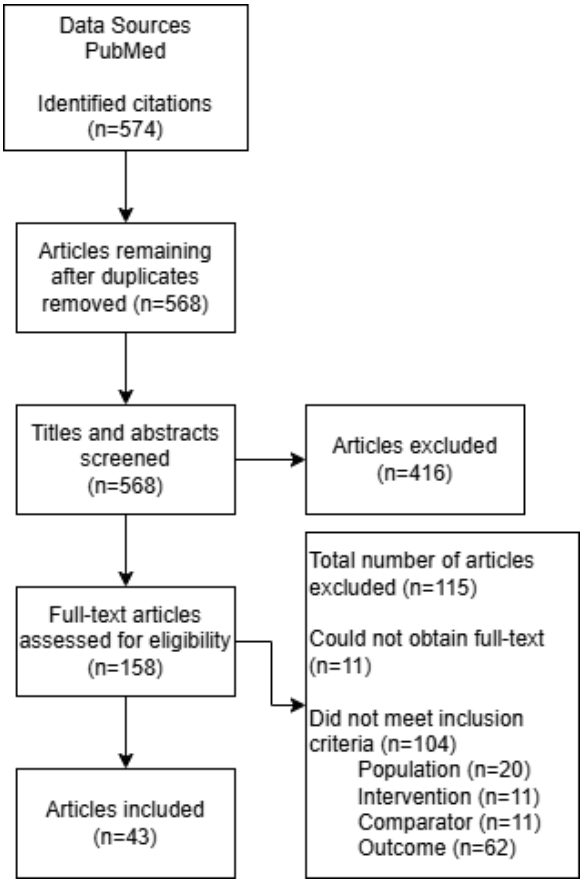
| | | | | | | |
|---|---|---|---|---|---|---|
| **20** | T2DM-HF -> T2DM-HF-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.275854261 | 0.202815302 | covariate |
| **20** | T2DM-HF -> T2DM-HF-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.115320873 | 0.214641143 | covariate |
| **20** | T2DM-HF -> T2DM-HF-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.530759098 | 0.272123983 | covariate |
| **21** | T2DM-HF -> Death | gompertz | shape | 0.205246883 | 0.022339314 | distribution |
| **21** | T2DM-HF -> Death | gompertz | rate | 0.051002846 | 0.006552534 | covariate |
| **21** | T2DM-HF -> Death | gompertz | AGE_tc | 0.092699109 | 0.004603306 | covariate |
| **21** | T2DM-HF -> Death | gompertz | GNDR_CDFemale | -0.272069443 | 0.08995839 | covariate |
| **21** | T2DM-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.144284703 | 0.128832499 | covariate |
| **21** | T2DM-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.171475705 | 0.130161714 | covariate |
| **21** | T2DM-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.290128317 | 0.146601008 | covariate |
| **21** | T2DM-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.261285948 | 0.154144185 | covariate |
| **22** | HF-CKD -> HF-CKD-T2DM | exp | rate | 0.015978921 | 0.002342842 | covariate |
| **22** | HF-CKD -> HF-CKD-T2DM | exp | AGE_tc | -0.008035117 | 0.005153548 | covariate |
| **22** | HF-CKD -> HF-CKD-T2DM | exp | GNDR_CDFemale | -0.151763902 | 0.116258472 | covariate |
| **22** | HF-CKD -> HF-CKD-T2DM | exp | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.484209486 | 0.170709617 | covariate |
| **22** | HF-CKD -> HF-CKD-T2DM | exp | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.174044213 | 0.1828622 | covariate |
| **22** | HF-CKD -> HF-CKD-T2DM | exp | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.130855857 | 0.198738833 | covariate |
| **22** | HF-CKD -> HF-CKD-T2DM | exp | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.051782268 | 0.188531524 | covariate |
| **23** | HF-CKD -> Death | gompertz | shape | 0.321955233 | 0.010483872 | distribution |
| **23** | HF-CKD -> Death | gompertz | rate | 0.038839338 | 0.002357592 | covariate |
| **23** | HF-CKD -> Death | gompertz | AGE_tc | 0.076557898 | 0.002096325 | covariate |
| **23** | HF-CKD -> Death | gompertz | GNDR_CDFemale | -0.238072519 | 0.03578244 | covariate |
| **23** | HF-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.152193139 | 0.053907014 | covariate |
| **23** | HF-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.041942389 | 0.054563933 | covariate |
| **23** | HF-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.090435922 | 0.0548953 | covariate |
| **23** | HF-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.081030936 | 0.054642576 | covariate |
| **24** | HF-T2DM -> HF-T2DM-CKD | gompertz | shape | -0.182471725 | 0.047643441 | distribution |

| | | | | | | |
|---|---|---|---|---|---|---|
| **24** | HF-T2DM -> HF-T2DM-CKD | gompertz | rate | 0.060586699 | 0.011231986 | covariate |
| **24** | HF-T2DM -> HF-T2DM-CKD | gompertz | AGE_tc | 0.048460265 | 0.006673671 | covariate |
| **24** | HF-T2DM -> HF-T2DM-CKD | gompertz | GNDR_CDFemale | -0.091980876 | 0.145293929 | covariate |
| **24** | HF-T2DM -> HF-T2DM-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | -0.170060883 | 0.212042882 | covariate |
| **24** | HF-T2DM -> HF-T2DM-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.116310036 | 0.210887029 | covariate |
| **24** | HF-T2DM -> HF-T2DM-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.083896813 | 0.22932332 | covariate |
| **24** | HF-T2DM -> HF-T2DM-CKD | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.1792278 | 0.227251556 | covariate |
| **25** | HF-T2DM -> Death | gompertz | shape | 0.176137575 | 0.019850158 | distribution |
| **25** | HF-T2DM -> Death | gompertz | rate | 0.067467804 | 0.007713671 | covariate |
| **25** | HF-T2DM -> Death | gompertz | AGE_tc | 0.078932603 | 0.003955896 | covariate |
| **25** | HF-T2DM -> Death | gompertz | GNDR_CDFemale | -0.183347168 | 0.080338855 | covariate |
| **25** | HF-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.112175753 | 0.117547285 | covariate |
| **25** | HF-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.154215529 | 0.118742628 | covariate |
| **25** | HF-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.046439688 | 0.131672367 | covariate |
| **25** | HF-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.193689472 | 0.13649621 | covariate |
| **26** | CKD-T2DM-HF -> Death | gompertz | shape | 0.268891761 | 0.087960621 | distribution |
| **26** | CKD-T2DM-HF -> Death | gompertz | rate | 0.059648109 | 0.023161901 | covariate |
| **26** | CKD-T2DM-HF -> Death | gompertz | AGE_tc | 0.079816214 | 0.01648687 | covariate |
| **26** | CKD-T2DM-HF -> Death | gompertz | GNDR_CDFemale | 0.054889713 | 0.263474134 | covariate |
| **26** | CKD-T2DM-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.638133039 | 0.386593675 | covariate |
| **26** | CKD-T2DM-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.315253478 | 0.407701052 | covariate |
| **26** | CKD-T2DM-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.119111758 | 0.401946319 | covariate |
| **26** | CKD-T2DM-HF -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.434409183 | 0.375640188 | covariate |
| **27** | CKD-HF-T2DM -> Death | gompertz | shape | 0.280503472 | 0.079196496 | distribution |
| **27** | CKD-HF-T2DM -> Death | gompertz | rate | 0.084889253 | 0.030630136 | covariate |
| **27** | CKD-HF-T2DM -> Death | gompertz | AGE_tc | 0.069535799 | 0.013513641 | covariate |
| **27** | CKD-HF-T2DM -> Death | gompertz | GNDR_CDFemale | -0.005506994 | 0.254601866 | covariate |

| | | | | | | |
|---|---|---|---|---|---|---|
| **27** | CKD-HF-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.445299915 | 0.387070993 | covariate |
| **27** | CKD-HF-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.119992565 | 0.319206862 | covariate |
| **27** | CKD-HF-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.256626217 | 0.396469366 | covariate |
| **27** | CKD-HF-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.312802359 | 0.44674432 | covariate |
| **28** | T2DM-CKD-HF -> Death | gengamma | mu | 1.962820293 | 0.199161837 | distribution |
| **28** | T2DM-CKD-HF -> Death | gengamma | sigma | 0.528770689 | 0.116090528 | distribution |
| **28** | T2DM-CKD-HF -> Death | gengamma | Q | 1.938412277 | 0.541870913 | distribution |
| **28** | T2DM-CKD-HF -> Death | gengamma | AGE_tc | -0.047777489 | 0.007033548 | covariate |
| **28** | T2DM-CKD-HF -> Death | gengamma | GNDR_CDFemale | 0.015592332 | 0.114764252 | covariate |
| **28** | T2DM-CKD-HF -> Death | gengamma | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.187682298 | 0.165949882 | covariate |
| **28** | T2DM-CKD-HF -> Death | gengamma | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | 0.142380869 | 0.171629864 | covariate |
| **28** | T2DM-CKD-HF -> Death | gengamma | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.13164675 | 0.170705339 | covariate |
| **28** | T2DM-CKD-HF -> Death | gengamma | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.134571902 | 0.191890293 | covariate |
| **29** | T2DM-HF-CKD -> Death | gompertz | shape | 0.429128767 | 0.052127326 | distribution |
| **29** | T2DM-HF-CKD -> Death | gompertz | rate | 0.045403822 | 0.013025656 | covariate |
| **29** | T2DM-HF-CKD -> Death | gompertz | AGE_tc | 0.074555343 | 0.010223778 | covariate |
| **29** | T2DM-HF-CKD -> Death | gompertz | GNDR_CDFemale | -0.446369542 | 0.173037804 | covariate |
| **29** | T2DM-HF-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.067292026 | 0.25744492 | covariate |
| **29** | T2DM-HF-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.006418197 | 0.250138009 | covariate |
| **29** | T2DM-HF-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | -0.234540503 | 0.267499607 | covariate |
| **29** | T2DM-HF-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | -0.545758639 | 0.336661935 | covariate |
| **30** | HF-CKD-T2DM -> Death | gompertz | shape | 0.349587162 | 0.057092689 | distribution |
| **30** | HF-CKD-T2DM -> Death | gompertz | rate | 0.069598843 | 0.017777771 | covariate |
| **30** | HF-CKD-T2DM -> Death | gompertz | AGE_tc | 0.092622801 | 0.009483473 | covariate |
| **30** | HF-CKD-T2DM -> Death | gompertz | GNDR_CDFemale | -0.422673827 | 0.158184203 | covariate |
| **30** | HF-CKD-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | -0.100677954 | 0.230590484 | covariate |
| **30** | HF-CKD-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.0052844 | 0.243598725 | covariate |

| | | | | | | |
|---|---|---|---|---|---|---|
| **30** | HF-CKD-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.128351171 | 0.26247599 | covariate |
| **30** | HF-CKD-T2DM -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.035093535 | 0.261828921 | covariate |
| **31** | HF-T2DM-CKD -> Death | gompertz | shape | 0.357486027 | 0.051626712 | distribution |
| **31** | HF-T2DM-CKD -> Death | gompertz | rate | 0.042953964 | 0.012517458 | covariate |
| **31** | HF-T2DM-CKD -> Death | gompertz | AGE_tc | 0.074485127 | 0.011541936 | covariate |
| **31** | HF-T2DM-CKD -> Death | gompertz | GNDR_CDFemale | -0.371093296 | 0.170787343 | covariate |
| **31** | HF-T2DM-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONMostDep | 0.299920775 | 0.245323787 | covariate |
| **31** | HF-T2DM-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondMostDep | -0.130122787 | 0.267185462 | covariate |
| **31** | HF-T2DM-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONSecondLeastDep | 0.253627319 | 0.283694958 | covariate |
| **31** | HF-T2DM-CKD -> Death | gompertz | WIMD2011_QUINTILE_INCEPTIONLeastDep | 0.42461362 | 0.262892903 | covariate |

**Supplementary Figure 4: PRISMA flow diagram of targeted literature review**



**Supplementary Table 5: Search strategy**

| Element | Detail |
|---|---|
| Database | PubMed |
| Search date | 13th September 2024 |
| Search terms | ("Sodium-glucose co-transporter 2" OR "sodium glucose co-transporter 2" OR "sodium glucose co-transporter-2" OR "sodium-glucose co-transporter-2" OR "SGLT2" OR "SGLT-2" OR "Canagliflozin" OR "Invokana" OR "Dapagliflozin" OR "Farxiga" OR "Forxiga" OR "Empagliflozin" OR "Jardiance" OR "Ertugliflozin" OR "Ipragliflozin" OR "Suglat" OR "Luseogliflozin" OR "Lusefi" OR "Remogliflozin" OR "Sergliflozin" OR "Sotagliflozin" OR "Tofogliflozin" OR "Apleway" OR "Deberza") AND ("Type 2 diabetes" OR "type 2 diabetes mellitus" OR "T2D" OR "T2DM" OR "Chronic kidney disease" OR "CKD" OR "heart failure" OR "HF") |
| Fields searched | All fields |
| Filters applied | Systematic Review |

## Supplementary Table 6: Summary of included literature reviews

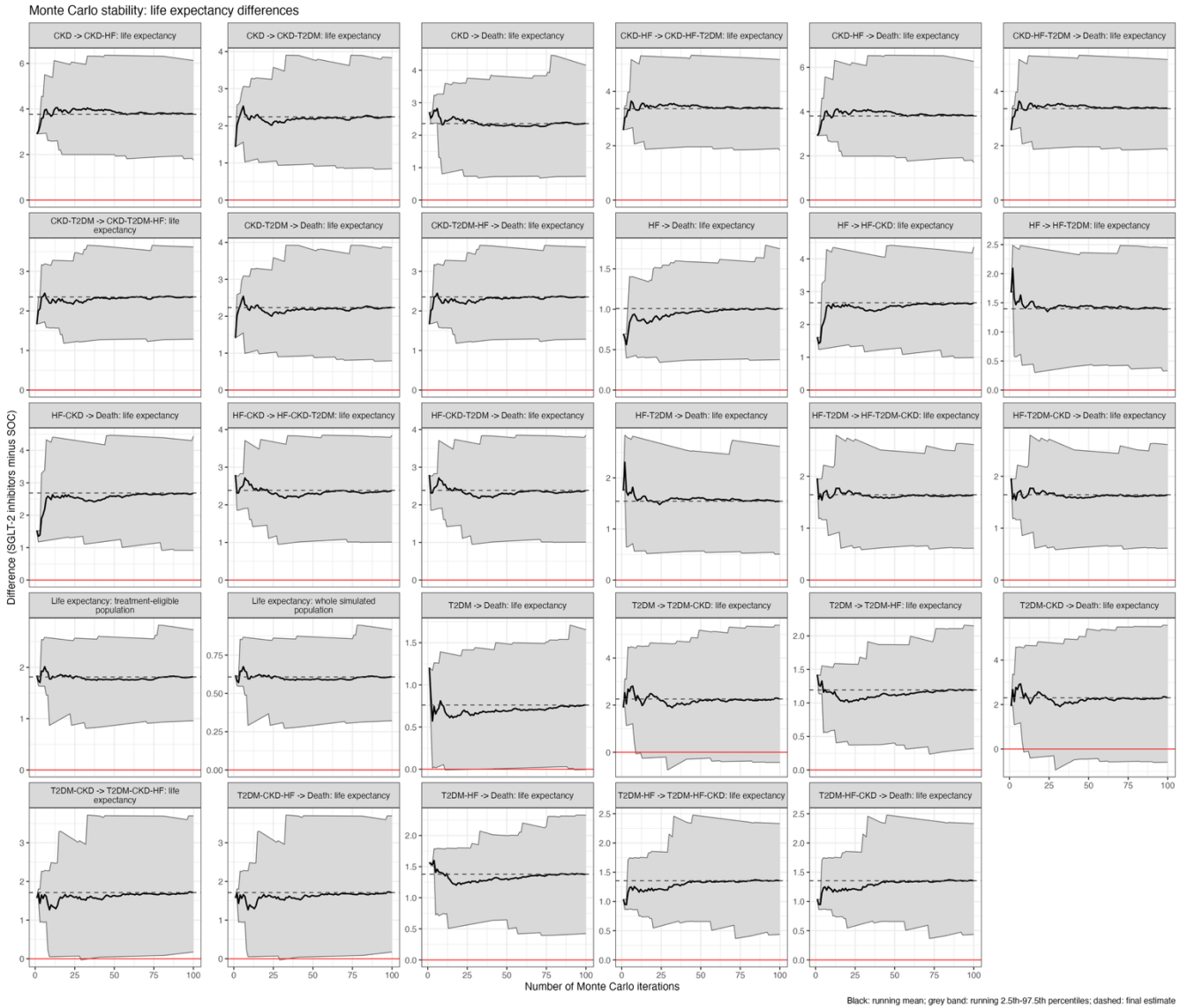
| Authors | Year | Population | Intervention | Comparators | Outcome type |
|---|---|---|---|---|---|
| Aldafas et al. | 2024 | Older people with T2D and HF | SGLT-2 inhibitors | Placebo or OGLD | HF and CKD |
| Alfayez et al. | 2019 | T2D | SGLT-2 inhibitors | Placebo | HF |
| Ali et al. | 2024 | T2D, HF, CKD (separate subgroups) | SGLT-2 inhibitors | Standard of care | ACM, HF, CKD |
| Avgerinos et al. | 2021 | T2D | Sotagliflozin | Placebo or OGLD | ACM, HF |
| Bae et al. | 2019 | T2D | SGLT-2 inhibitors | Placebo or OGLD | CKD |
| Bae et al. | 2020 | T2D | SGLT-2 inhibitors | Placebo or OGLD | CKD |
| Benham et al. | 2020 | T2D | SGLT-2 inhibitors | Placebo | HF |
| Bhatia et al. | 2021 | T2D, HF, and CKD (separate subgroups) | SGLT-2 inhibitors | Placebo | HF |
| Bilal et al. | 2024 | Older people with T2D | SGLT-2 inhibitors | Placebo | HF |
| Cao et al. | 2021 | T2D and CKD | SGLT-2 inhibitors | Placebo | ACM, HF |
| Cao et al. | 2022 | T2D and CKD | SGLT-2 inhibitors | Placebo or OGLD | HF, CKD |
| Chen et al. | 2021 | T2D and HF | SGLT-2 inhibitors | Placebo | ACM, HF, CKD |
| Chen et al. | 2022 | CKD | SGLT-2 inhibitors | Placebo | Cardiorenal composite |
| Chen et al. | 2023 | CKD | SGLT-2 inhibitors | Placebo | ACM, HF |
| Cheng et al. | 2023 | T2D | Ertugliflozin | Placebo | HF, CKD |
| Escobar et al. | 2021 | T2D | SGLT-2 inhibitors | OGLD | HF |
| Felix et al. | 2024 | T2D and CKD | SGLT-2 inhibitors | Placebo | ACM, HF, CKD |
| Gong et al. | 2022 | T2D, CKD, HF (separate subgroups) | SGLT-2 inhibitors | Placebo | ACM, HF |
| Hinton et al. | 2022 | T2D | SGLT-2 inhibitors | OGLD | HF |
| Hussein et al. | 2019 | T2D | SGLT-2 inhibitors | Placebo | ACM, HF |

| | | | | | |
|---|---|---|---|---|---|
| Karagiannis et al. | 2021 | Older people with T2D | SGLT-2 inhibitors | Placebo | HF, CKD |
| Kaze et al. | 2022 | T2D and CKD | SGLT-2 inhibitors | Placebo | ACM, HF, CKD |
| Li et al. | 2021 | T2D | SGLT-2 inhibitors | OGLD | ACM, HF |
| Li, N. et al. | 2022 | CKD | SGLT-2 inhibitors | Placebo | ACM, HF |
| Li, X. et al. | 2022 | T2D | Canagliflozin, Dapagliflozin, Empagliflozin, Ertugliflozin, Sotagliflozin | Placebo | HF |
| Li et al. | 2023 | T2D | SGLT-2 inhibitors | Placebo | HF |
| Marilly et al. | 2022 | T2D | SGLT-2 inhibitors | Placebo | ACM, HF, CKD |
| Mascolo et al. | 2021 | T2D | SGLT-2 inhibitors | DDP-4 inhibitors | ACM, HF |
| Mavrakanas et al. | 2023 | CKD | SGLT-2 inhibitors | Placebo | ACM, HF, CKD |
| Nguyen et al. | 2022 | T2D and CKD | SGLT-2 inhibitors | Placebo | ACM, HF |
| Pan et al. | 2024 | Older people with T2D | SGLT-2 inhibitors | Placebo | HF, CKD |
| Sim et al. | 2021 | T2D | SGLT-2 inhibitors | Standard of care | HF, CKD |
| Singh & Singh (a) | 2020 | T2D | SGLT-2 inhibitors | Placebo | HF |
| Singh & Singh (b) | 2020 | Asians with T2D | SGLT-2 inhibitors | Placebo | HF |
| Theodorakopoulou et al. | 2024 | CKD | SGLT-2 inhibitors | Placebo | HF |
| Tian et al. | 2021 | T2D | Canagliflozin | Placebo | CKD |
| Usman et al. | 2018 | T2D | SGLT-2 inhibitors | Placebo | ACM, HF |
| Yamada et al. | 2021 | T2D | SGLT-2 inhibitors | Placebo | HF, CKD |
| Zelniker et al. | 2019 | T2D | SGLT-2 inhibitors | Placebo | HF |
| Zhang et al. | 2018 | T2D | SGLT-2 inhibitors | Placebo or OGLD | ACM, HF |
| Zheng et al. | 2018 | T2D | SGLT-2 inhibitors | Placebo | ACM, HF |
| Zheng et al. | 2021 | HF | SGLT-2 inhibitors | Placebo | ACM, HF, CKD |

| | | | | | |
|---|---|---|---|---|---|
| Zou et al. | 2019 | T2D | SGLT-2 inhibitors | Placebo or OGLD | HF |

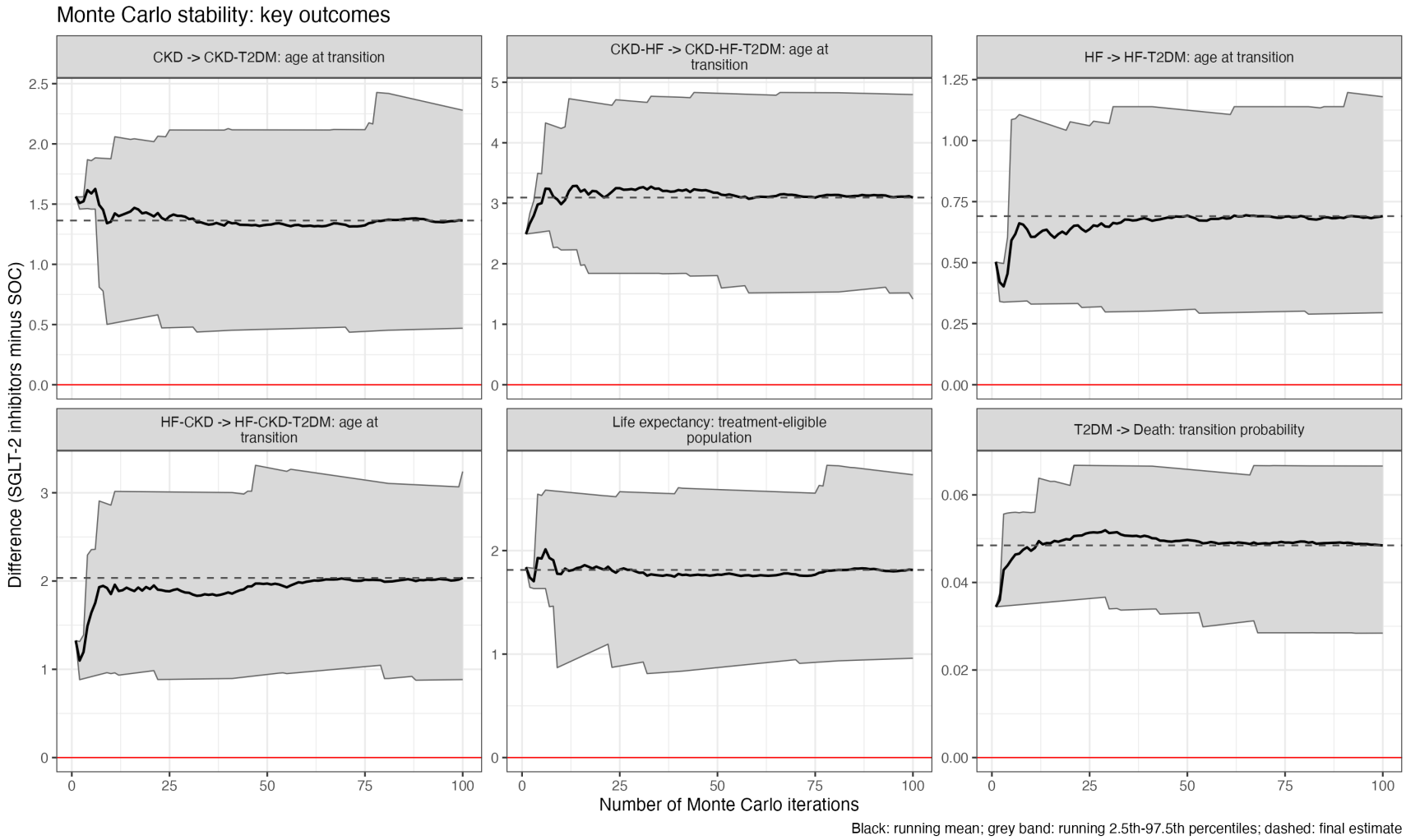
ACM = all-cause mortality, CKD = chronic kidney disease, DDP-4 = dipeptidyl peptidase 4, HF = heart failure, OGLD = other glucose-lowering drug, SGLT-2 = sodium-glucose co-transporter 2, T2D = type 2 diabetes

# Supplementary Figure 5: Monte Carlo stability for life expectancy differences




Black: running mean; grey band: running 2.5th-97.5th percentiles; dashed: final estimate

## Supplementary Figure 6: Monte Carlo stability for key outcomes



**Supplementary Table 7: Parameter estimates from RCTs informing Dapagliflozin transitions obtained from literature reviews**

| From | To | Trans # | Hazard Ratio | 95% CI | | Source |
|---|---|---|---|---|---|---|
| ICF | CKD | 1 | 1 | | | - |
| ICF | T2DM | 2 | 1 | | | - |
| ICF | HF | 3 | 1 | | | - |
| ICF | Death | 4 | 1 | | | - |
| CKD | CKD-T2DM | 5 | 0.67 | 0.51 | 0.88 | DAPA-CKD and DAPA-HF trials[1] |
| CKD | CKD-HF | 6 | 0.71 | 0.55 | 0.92 | DAPA-CKD[2] |
| CKD | Death | 7 | 0.69 | 0.53 | 0.88 | DAPA-CKD[2] |
| T2DM | T2DM-CKD | 8 | 0.76 | 0.67 | 0.87 | DECLARE–TIMI 58[3] |
| T2DM | T2DM-HF | 9 | 0.83 | 0.73 | 0.95 | DECLARE–TIMI 58[3] |
| T2DM | Death | 10 | 0.93 | 0.82 | 1.04 | DECLARE–TIMI 58[3] |
| HF | HF-CKD | 11 | 0.71 | 0.44 | 1.16 | DAPA-HF[4] |
| HF | HF-T2DM | 12 | 0.67 | 0.51 | 0.88 | DAPA-CKD and DAPA-HF trials[1] |
| HF | Death | 13 | 0.83 | 0.71 | 0.97 | DAPA-HF[4] |
| CKD-T2DM | CKD-T2DM-HF | 14 | 0.78 | 0.55 | 1.09 | DECLARE–TIMI 58[3] |
| CKD-T2DM | Death | 15 | 0.91 | 0.67 | 1.25 | DECLARE–TIMI 58[3] |
| CKD-HF | CKD-HF-T2DM | 16 | 0.67 | 0.51 | 0.88 | DAPA-CKD and DAPA-HF trials[1] |
| CKD-HF | Death | 17 | 0.56 | 0.34 | 0.93 | DAPA-CKD[5] |
| T2DM-CKD | T2DM-CKD-HF | 18 | 0.78 | 0.55 | 1.09 | DECLARE–TIMI 58[3] |
| T2DM-CKD | Death | 19 | 0.91 | 0.67 | 1.25 | DECLARE–TIMI 58[3] |
| T2DM-HF | T2DM-HF-CKD | 20 | 0.58 | 0.36 | 0.92 | DECLARE–TIMI 58[3] |

| | | | | | | |
|---|---|---|---|---|---|---|
| T2DM-HF | Death | 21 | 0.87 | 0.68 | 1.12 | DECLARE–TIMI 58[3] |
| HF-CKD | HF-CKD-T2DM | 22 | 0.67 | 0.51 | 0.88 | DAPA-CKD and DAPA-HF trials[1] |
| HF-CKD | Death | 23 | 0.56 | 0.34 | 0.93 | DAPA-CKD[5] |
| HF-T2DM | HF-T2DM-CKD | 24 | 0.58 | 0.36 | 0.92 | DECLARE–TIMI 58[3] |
| HF-T2DM | Death | 25 | 0.87 | 0.68 | 1.12 | DECLARE–TIMI 58[3] |
| CKD-T2DM-HF | Death | 26 | | | | For all states with three conditions, no study provides direct estimates for transitions to death, so all are assumed to be equivalent to most conservative dual condition to death (HR: 0.91, 95%CI: 0.67, 1.25) |
| CKD-HF-T2DM | Death | 27 | | | | |
| T2DM-CKD-HF | Death | 28 | | | | |
| T2DM-HF-CKD | Death | 29 | | | | |
| HF-CKD-T2DM | Death | 30 | | | | |
| HF-T2DM-CKD | Death | 31 | | | | |

## Supplementary References


1. Rossing P, Inzucchi SE, Vart P, et al. Dapagliflozin and new-onset type 2 diabetes in patients with chronic kidney disease or heart failure: pooled analysis of the DAPA-CKD and DAPA-HF trials. *The Lancet Diabetes & Endocrinology* 2022;10(1):24-34. doi: 10.1016/S2213-8587(21)00295-3
2. Heerspink HJL, Stefánsson BV, Correa-Rotter R, et al. Dapagliflozin in Patients with Chronic Kidney Disease. *New England Journal of Medicine* 2020;383(15):1436-46. doi: doi:10.1056/NEJMoa2024816
3. Wiviott SD, Raz I, Bonaca MP, et al. Dapagliflozin and Cardiovascular Outcomes in Type 2 Diabetes. *New England Journal of Medicine* 2019;380(4):347-57. doi: doi:10.1056/NEJMoa1812389
4. McMurray JJV, Solomon SD, Inzucchi SE, et al. Dapagliflozin in Patients with Heart Failure and Reduced Ejection Fraction. *New England Journal of Medicine* 2019;381(21):1995-2008. doi: doi:10.1056/NEJMoa1911303
5. McMurray JJV, Wheeler DC, Stefánsson BV, et al. Effects of Dapagliflozin in Patients With Kidney Disease, With and Without Heart Failure. *JACC: Heart Failure* 2021;9(11):807-20. doi: https://doi.org/10.1016/j.jchf.2021.06.017