

# heemod-Markov.R

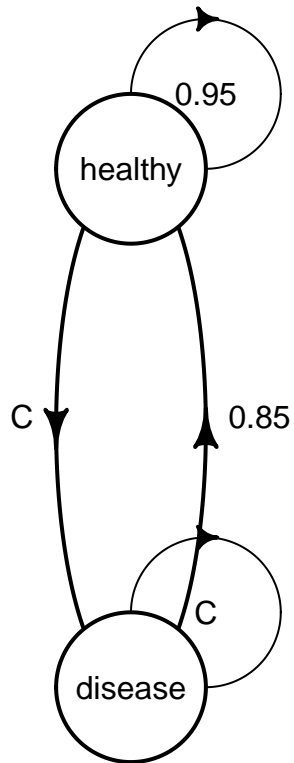
*ngreen1*

*2020-01-20*

```
#  
# heemod example  
# 2 state model  
# drug A vs drug B  
#  
# Nathan Green  
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library(heemod)  
  
## Registered S3 method overwritten by 'pryr':  
##   method      from  
##   print.bytes Rcpp
```

```
#####  
# single intervention #  
#####  
  
mat_drugA <-  
  define_transition(  
    state_names = c("healthy", "disease"),  
    0.95, C,  
    0.85, C  
  )  
  
plot(mat_drugA)
```

```
## Loading required namespace: diagram
```



```

healthy_drugA <-
  define_state(
    cost = 50,
    qaly = 0.75
  )
healthy_drugA

```

```

## A state with 2 values.
##
## cost = 50
## qaly = 0.75

```

```

disease_drugA <-
  define_state(
    cost = 150,
    qaly = 0.73
  )

```

```

# combine information

```

```

strat_drugA <-
  define_strategy(
    transition = mat_drugA,
    healthy = healthy_drugA,

```

```
    disease = disease_drugA
  )
```

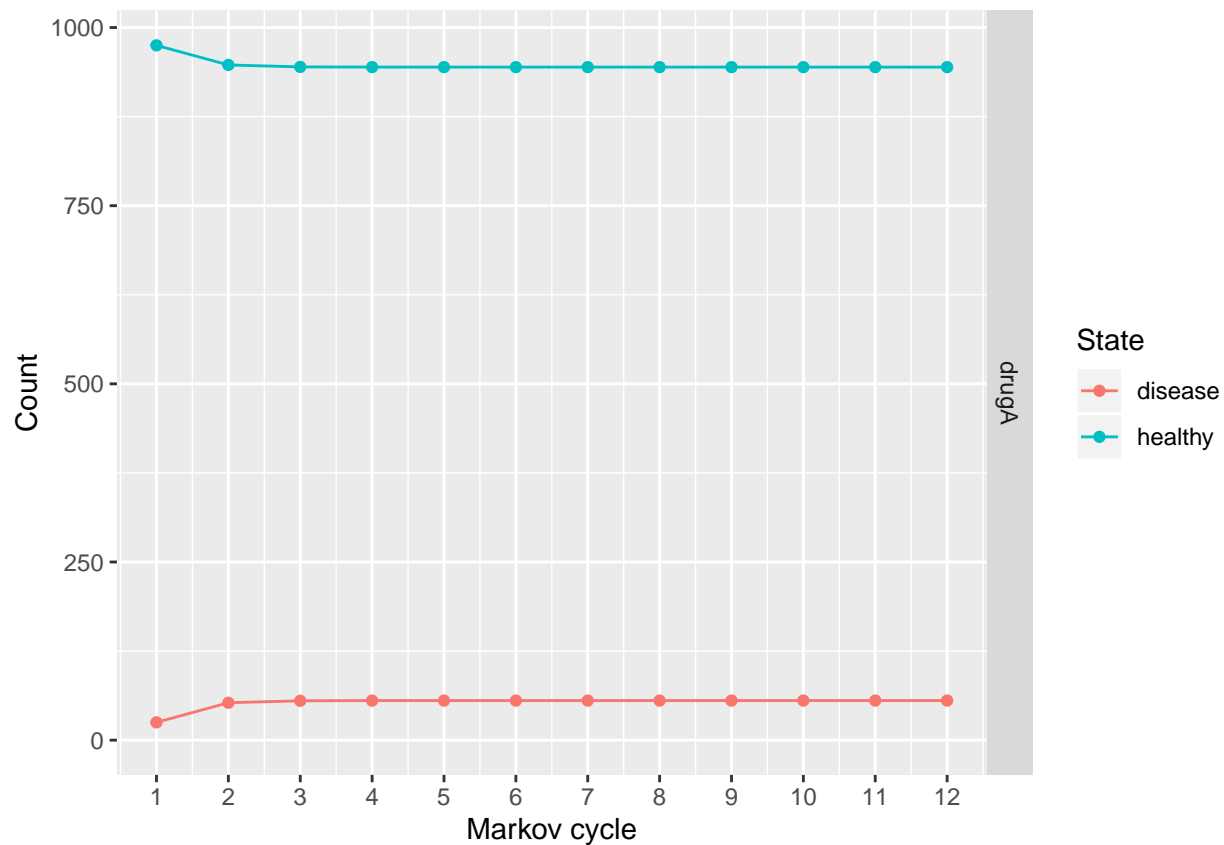
```
# simulation
```

```
res_mod <- run_model(  
  drugA = strat_drugA,  
  cycles = 12,  
  cost = cost,  
  effect = qaly  
)
```

```
res_mod
```

```
## 1 strategy run for 12 cycles.  
##  
## Initial state counts:  
##  
## healthy = 1000L  
## disease = 0L  
##  
## Counting method: 'life-table'.  
##  
## Values:  
##  
##          cost      qaly  
## drugA 663271.6 8987.346
```

```
plot(res_mod)
```



```
heemod::get_counts(res_mod)
```

```
##      .strategy_names markov_cycle state_names    count
## 1      drugA           1      healthy 975.00000
## 2      drugA           2      healthy 947.50000
## 3      drugA           3      healthy 944.75000
## 4      drugA           4      healthy 944.47500
## 5      drugA           5      healthy 944.44750
## 6      drugA           6      healthy 944.44475
## 7      drugA           7      healthy 944.44448
## 8      drugA           8      healthy 944.44445
## 9      drugA           9      healthy 944.44444
## 10     drugA          10      healthy 944.44444
## 11     drugA          11      healthy 944.44444
## 12     drugA          12      healthy 944.44444
## 13     drugA           1      disease 25.00000
## 14     drugA           2      disease 52.50000
## 15     drugA           3      disease 55.25000
## 16     drugA           4      disease 55.52500
## 17     drugA           5      disease 55.55250
## 18     drugA           6      disease 55.55525
## 19     drugA           7      disease 55.55553
## 20     drugA           8      disease 55.55555
## 21     drugA           9      disease 55.55556
## 22     drugA          10      disease 55.55556
```

```
## 23          drugA          11    disease  55.55556
## 24          drugA          12    disease  55.55556
```

```
#####
# drug A vs drug B #
#####
```

```
mat_drugB <-
  define_transition(
    state_names = c("healthy", "disease"),
    0.975, C,
    0.95, C
  )
```

```
# define states with multiple strategies
```

```
state_healthy <-
  define_state(
    cost = dispatch_strategy(
      drugA = 50,
      drugB = 100
    ),
    qaly = dispatch_strategy(
      drugA = 0.75,
      drugB = 0.75
    )
  )
state_healthy
```

```
## A state with 2 values.
##
## cost = dispatch_strategy(drugA = 50, drugB = 100)
## qaly = dispatch_strategy(drugA = 0.75, drugB = 0.75)
```

```
state_disease <-
  define_state(
    cost = dispatch_strategy(
      drugA = 150,
      drugB = 200
    ),
    qaly = dispatch_strategy(
      drugA = 0.73,
      drugB = 0.74
    )
  )
state_disease
```

```
## A state with 2 values.
##
## cost = dispatch_strategy(drugA = 150, drugB = 200)
## qaly = dispatch_strategy(drugA = 0.73, drugB = 0.74)
```

```

# combine for strategy

strat_drugA <-
  define_strategy(
    transition = mat_drugA,
    healthy = state_healthy,
    disease = state_disease
  )

strat_drugB <-
  define_strategy(
    transition = mat_drugB,
    healthy = state_healthy,
    disease = state_disease
  )

# run model

res_mod <-
  run_model(
    init = c(1, 0),
    method = "end",
    drugA = strat_drugA,
    drugB = strat_drugB,
    cycles = 12,
    cost = cost,
    effect = qaly
  )

summary(res_mod)

```

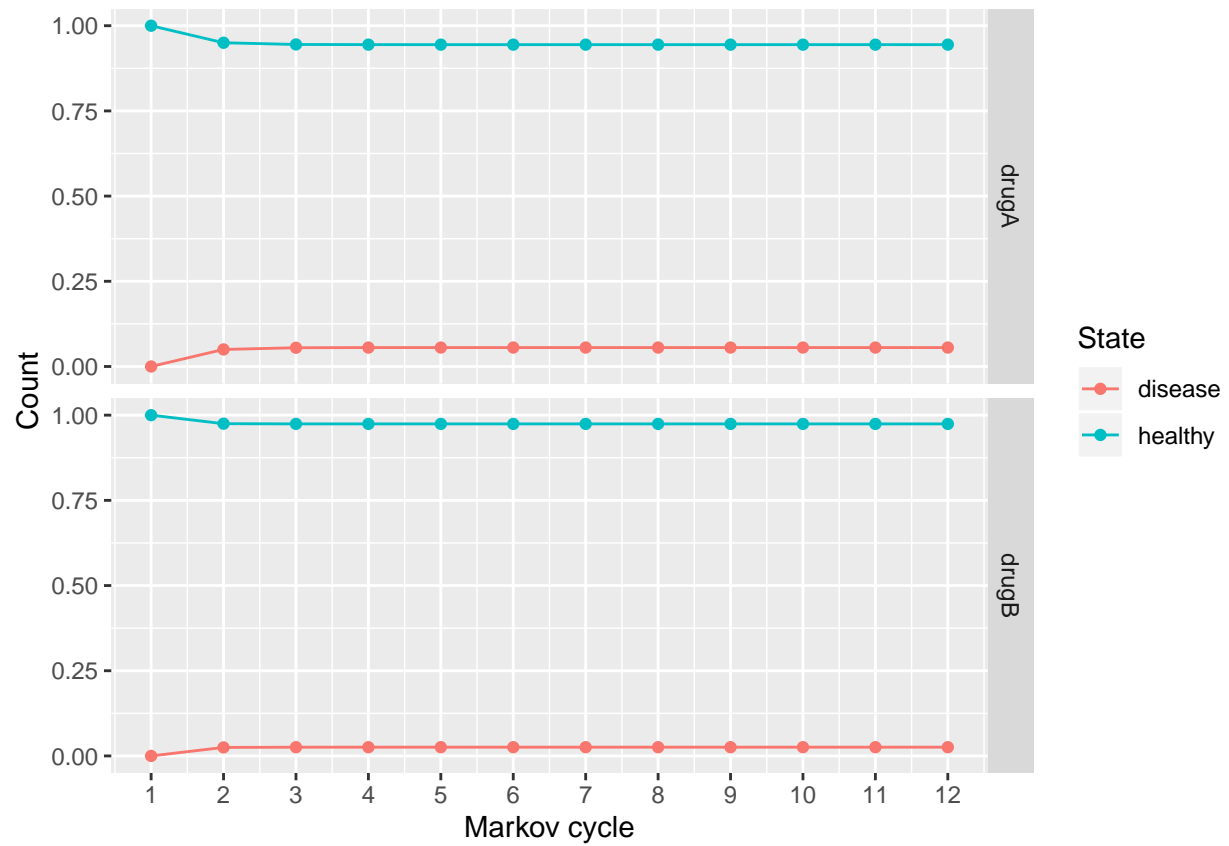
```

## 2 strategies run for 12 cycles.
##
## Initial state counts:
##
## healthy = 1
## disease = 0
##
## Counting method: 'end'.
##
## Values:
##
##           cost      qaly
## drugA  660.4938  8.987901
## drugB 1228.1394  8.997186
##
## Efficiency frontier:
##
## drugA -> drugB
##
## Differences:
##
##           Cost Diff. Effect Diff.    ICER  Ref.

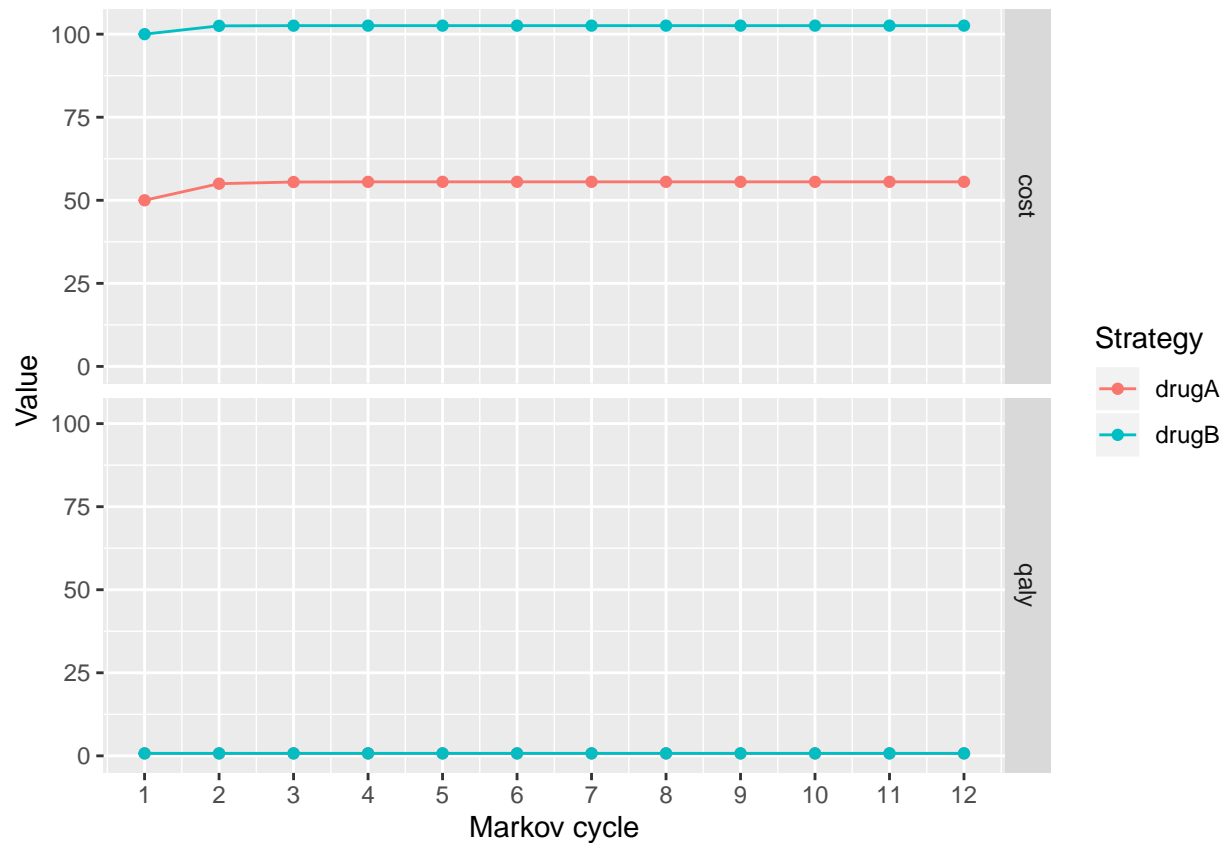
```

```
## drugB 567.6456 0.009284827 61136.9 drugA
```

```
plot(res_mod)
```



```
plot(res_mod, type = "values", panel = "by_value")#, free_y = TRUE)
```



```
heemod::get_counts(res_mod)
```

```
## # A tibble: 48 x 4
##   .strategy_names markov_cycle state_names count
##   <chr>           <int> <chr>      <dbl>
## 1 drugA           1 healthy     1
## 2 drugA           2 healthy  0.95
## 3 drugA           3 healthy  0.945
## 4 drugA           4 healthy  0.945
## 5 drugA           5 healthy  0.944
## 6 drugA           6 healthy  0.944
## 7 drugA           7 healthy  0.944
## 8 drugA           8 healthy  0.944
## 9 drugA           9 healthy  0.944
## 10 drugA          10 healthy  0.944
## # ... with 38 more rows
```

```
heemod::get_values(res_mod)
```

```
##   markov_cycle .strategy_names value_names      value
## 1           1           drugA      cost 50.0000000
## 2           2           drugA      cost 55.0000000
## 3           3           drugA      cost 55.5000000
## 4           4           drugA      cost 55.5500000
## 5           5           drugA      cost 55.5550000
```



## 6	6	drugA	cost	55.5555000
## 7	7	drugA	cost	55.5555500
## 8	8	drugA	cost	55.5555550
## 9	9	drugA	cost	55.5555555
## 10	10	drugA	cost	55.5555556
## 11	11	drugA	cost	55.5555556
## 12	12	drugA	cost	55.5555556
## 13	1	drugB	cost	100.0000000
## 14	2	drugB	cost	102.5000000
## 15	3	drugB	cost	102.5625000
## 16	4	drugB	cost	102.5640625
## 17	5	drugB	cost	102.5641016
## 18	6	drugB	cost	102.5641025
## 19	7	drugB	cost	102.5641026
## 20	8	drugB	cost	102.5641026
## 21	9	drugB	cost	102.5641026
## 22	10	drugB	cost	102.5641026
## 23	11	drugB	cost	102.5641026
## 24	12	drugB	cost	102.5641026
## 25	1	drugA	qaly	0.7500000
## 26	2	drugA	qaly	0.7490000
## 27	3	drugA	qaly	0.7489000
## 28	4	drugA	qaly	0.7488900
## 29	5	drugA	qaly	0.7488890
## 30	6	drugA	qaly	0.7488889
## 31	7	drugA	qaly	0.7488889
## 32	8	drugA	qaly	0.7488889
## 33	9	drugA	qaly	0.7488889
## 34	10	drugA	qaly	0.7488889
## 35	11	drugA	qaly	0.7488889
## 36	12	drugA	qaly	0.7488889
## 37	1	drugB	qaly	0.7500000
## 38	2	drugB	qaly	0.7497500
## 39	3	drugB	qaly	0.7497437
## 40	4	drugB	qaly	0.7497436
## 41	5	drugB	qaly	0.7497436
## 42	6	drugB	qaly	0.7497436
## 43	7	drugB	qaly	0.7497436
## 44	8	drugB	qaly	0.7497436
## 45	9	drugB	qaly	0.7497436
## 46	10	drugB	qaly	0.7497436
## 47	11	drugB	qaly	0.7497436
## 48	12	drugB	qaly	0.7497436