```
$Single.Stage.Equal.Alpha.Allocation.Design
$Single.Stage.Equal.Alpha.Allocation.Design$design.parameters
$Single.Stage.Equal.Alpha.Allocation.Design$design.parameters$cumulative.sample.sizes.and.c
alendar.time.per.stage
  Stage C1 C2 A1 A2 Analysis.Time.In.Years
1
      1 292 438 292 438
                                           3.65
$Single.Stage.Equal.Alpha.Allocation.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
           0.025
      1
                    0.025
$Single.Stage.Equal.Alpha.Allocation.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
1
      1
              NA
                       NA
$Single.Stage.Equal.Alpha.Allocation.Design$design.performance
$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Power
  Scenario Power.H01 Power.H02 Prob.Reject.All.False.Null.Hypotheses
1
         1
              0.8649
                        0.9401
                                                               0.8241
2
         2
              0.7987
                                                               0.7987
                            NA
3
         3
                  NA
                            NA
                                                                    NA
$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Type.1.Error
  Scenario Type.I.Error.H01 Type.I.Error.H02 Familywise.Type.I.Error
         1
                         NA
                                           NA
1
                                                                    NA
         2
2
                         NA
                                       0.0477
                                                               0.0477
         3
3
                     0.0256
                                       0.0279
                                                               0.0511
$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                             Scenario expected.sample.size
                                                       1460
1
                                     1
                                     2
                                                       1460
2
3
                                     3
                                                       1460
4 Weighted.Combination.Over.Scenarios
                                                       1460
$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Duration
                             Scenario expected.duration
                                                    3.65
1
                                     1
                                     2
2
                                                    3.65
3
                                     3
                                                    3.65
4 Weighted.Combination.Over.Scenarios
                                                    3.65
$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Distribution.of.sample.size.
and.duration.per.scenario
  scenario C1 C2 A1 A2 sample.size duration frequency proportion
         1
           1 1 1 1
                                                 10000
                                                                1
1
                              1460
                                        3.65
         2
                                                 10000
                                                                1
2
           1
              1
                  1
                    1
                              1460
                                        3.65
         3 1 1 1 1
                              1460
                                        3.65
                                                 10000
                                                                1
3
```

\$Single.Stage.Optimized.Alpha.Allocation.Design \$Single.Stage.Optimized.Alpha.Allocation.Design\$design.parameters \$Single.Stage.Optimized.Alpha.Allocation.Design\$design.parameters\$cumulative.sample.sizes.a nd.calendar.time.per.stage

```
Stage C1 C2 A1 A2 Analysis.Time.In.Years
      1 283 424 283 424
$Single.Stage.Optimized.Alpha.Allocation.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
      1
          0.0309
                   0.0191
$Single.Stage.Optimized.Alpha.Allocation.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
      1
              NA
                       NA
$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance
$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Power
  Scenario Power.H01 Power.H02 Prob.Reject.All.False.Null.Hypotheses
1
                         0.931
         1
              0.8605
                                                               0.8143
2
         2
              0.8137
                            NA
                                                               0.8137
         3
3
                  NA
                            NA
                                                                   NA
$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Type.1.Error
  Scenario Type.I.Error.H01 Type.I.Error.H02 Familywise.Type.I.Error
1
         1
                         NA
                                          NA
                                                                   NA
2
         2
                         NA
                                      0.0470
                                                               0.0470
3
         3
                     0.0309
                                      0.0209
                                                               0.0506
$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                             Scenario expected.sample.size
1
                                    1
2
                                    2
                                                       1414
3
                                    3
                                                       1414
4 Weighted.Combination.Over.Scenarios
                                                       1414
$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Duration
                             Scenario expected.duration
                                                    3.54
1
                                    1
2
                                    2
                                                    3.54
                                                    3.54
3
                                    3
                                                    3.54
4 Weighted.Combination.Over.Scenarios
$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Distribution.of.sample.s
ize.and.duration.per.scenario
  scenario C1 C2 A1 A2 sample.size duration frequency proportion
1
         1 1 1 1 1
                              1414
                                      3.535
                                                 10000
                                                                1
                                                 10000
                                                                1
2
         2
            1
              1
                  1
                    1
                              1414
                                      3.535
3
         3
           1 1 1 1
                              1414
                                      3.535
                                                 10000
                                                                1
$Two.Stage.Group.Sequential.Design
$Two.Stage.Group.Sequential.Design$design.parameters
$Two.Stage.Group.Sequential.Design$design.parameters$cumulative.sample.sizes.and.calendar.t
ime.per.stage
  Stage C1 C2 A1
                     A2 Analysis.Time.In.Years
         33 49
1
                 33 49
                                        0.4125
      2 330 495 330 495
                                         4.1250
2
```

```
$Two.Stage.Group.Sequential.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
      1
          0.0189
                    0.0065
1
2
      2
          0.0181
                    0.0066
$Two.Stage.Group.Sequential.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
1
         -4.8112
                  -3.2498
2
      2
              NA
                        NA
$Two.Stage.Group.Sequential.Design$design.performance
$Two.Stage.Group.Sequential.Design$design.performance$Power
  Scenario Power.H01 Power.H02 Prob.Reject.All.False.Null.Hypotheses
                         0.9447
1
         1
              0.8717
                                                                  0.8424
         2
2
              0.8324
                             NA
                                                                  0.8324
3
         3
                             NA
                   NA
                                                                      NA
$Two.Stage.Group.Sequential.Design$design.performance$Type.1.Error
  Scenario Type.I.Error.H01 Type.I.Error.H02 Familywise.Type.I.Error
1
         1
                          NA
                                            NA
                                                                      NA
2
         2
                          NA
                                        0.0412
                                                                  0.0412
3
         3
                       0.041
                                        0.0149
                                                                  0.0536
$Two.Stage.Group.Sequential.Design$design.performance$Expected.Sample.Size
                              Scenario expected.sample.size
1
                                      1
                                                         1636
2
                                      2
                                                         1648
3
                                                         1650
4 Weighted.Combination.Over.Scenarios
                                                         1645
$Two.Stage.Group.Sequential.Design$design.performance$Expected.Duration
                              Scenario expected.duration
1
                                      1
                                                      4.09
2
                                      2
                                                      4.12
3
                                      3
                                                      4.13
4 Weighted.Combination.Over.Scenarios
                                                      4.12
$Two.Stage.Group.Sequential.Design$design.performance$Distribution.of.sample.size.and.durat
ion.per.scenario
   scenario C1 C2 A1 A2 sample.size duration frequency proportion
1
                1
                    1
                       1
                                 164 0.412500
                                                       93
                                                              0.0093
2
          1
             1
                2
                    1
                                 1056 4.129167
                                                       NA
                                                                  NA
3
          1
             2
                1
                    2
                                 758 4.125000
                                                       NA
                                                                   NA
4
          1
             2
                2
                    2
                       2
                                1650 4.129167
                                                     9907
                                                              0.9907
5
          2
             1
                1
                    1
                       1
                                 164 0.412500
                                                       12
                                                              0.0012
6
          2
             1
                2
                    1
                       2
                                                       NA
                                 1056 4.129167
                                                                  NA
          2
             2
                    2
7
                1
                       1
                                 758 4.125000
                                                       NA
                                                                   NA
          2
             2
                2
                    2
                       2
                                 1650 4.129167
                                                     9988
                                                              0.9988
8
                                                              0.0002
9
          3
                1
                    1
                                                        2
             1
                       1
                                 164 0.412500
10
          3
             1
                2
                    1
                       2
                                 1056 4.129167
                                                       NA
                                                                   NA
11
          3
             2
                1
                    2
                                 758 4.125000
                                                       NA
                                                                   NA
```

1650 4.129167

9998

0.9998

2 2 2

12

```
$Two.Stage.Equal.Alpha.Allocation.Design
$Two.Stage.Equal.Alpha.Allocation.Design$design.parameters
$Two.Stage.Equal.Alpha.Allocation.Design$design.parameters$cumulative.sample.sizes.and.cale
ndar.time.per.stage
  Stage C1 C2 A1 A2 Analysis.Time.In.Years
1
      1 146 219 146 219
                                          1.8275
                                          3.6550
      2 292 438 292 438
$Two.Stage.Equal.Alpha.Allocation.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
      1
          0.0125
                   0.0125
1
2
      2
          0.0125
                   0.0125
$Two.Stage.Equal.Alpha.Allocation.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
      1
              -3
                        -3
1
2
      2
              NA
                        NA
$Two.Stage.Equal.Alpha.Allocation.Design$design.performance
$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Power
  Scenario Power.H01 Power.H02 Prob.Reject.All.False.Null.Hypotheses
1
         1
              0.8517
                         0.9314
                                                                 0.8091
         2
              0.7658
                                                                 0.7658
2
                             NA
3
         3
                             NA
                  NA
                                                                     NA
$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Type.1.Error
  Scenario Type.I.Error.H01 Type.I.Error.H02 Familywise.Type.I.Error
1
         1
                          NA
                                           NA
                                                                     NA
         2
2
                          NA
                                       0.0439
                                                                 0.0439
3
         3
                     0.0232
                                       0.0247
                                                                 0.0467
$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                              Scenario expected.sample.size
1
                                                        1113
                                     1
2
                                     2
                                                        1338
3
                                     3
                                                        1450
4 Weighted.Combination.Over.Scenarios
                                                        1302
$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Duration
                              Scenario expected.duration
1
                                     1
                                                     3.27
2
                                     2
                                                     3.64
                                     3
                                                     3.65
4 Weighted.Combination.Over.Scenarios
                                                     3.52
$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Distribution.of.sample.size.and
.duration.per.scenario
   scenario C1 C2 A1 A2 sample.size duration frequency proportion
                                 730
                                                    2093
1
                1
                   1
                      1
                                        1.825
                                                             0.2093
2
                2
                   1
                                1168
                                        3.650
                                                    1870
                                                             0.1870
3
             2
                1
                   2
                       1
                                1022
                                        3.650
                                                    3188
                                                             0.3188
             2
                2
                   2
                       2
                                1460
                                        3.650
                                                    2849
                                                             0.2849
4
          1
          2
                                 730
                                                             0.0055
5
             1
                1
                   1
                       1
                                        1.825
                                                      55
6
          2
                2
                       2
                                1168
                                        3.650
                                                    3887
                                                             0.3887
             1
                   1
```

7

2 2 1 2 1

1022

3.650

92

0.0092

8	2 2	2 2	2	1460	3.650	5966	0.5966		
9	3 1	1 1	1	730	1.825	2	0.0002		
10	3 1	2 1	2	1168	3.650	126	0.0126		
11	3 2	1 2	1	1022	3.650	136	0.0136		
12	3 2	2 2	2	1460	3.650	9736	0.9736		
			Alpha.All		_				
			•		.Design\$de				
			•	Location	.Design\$de	sign.param	meters\$cumulative.sample.sizes.and.		
	r.time.pe		_						
_			-	sis.Time	.In.Years				
	146 219				1.8275				
2 2	292 438	292 4	138		3.6550				
ΦTwo C+o	\$Two.Stage.Optimized.Alpha.Allocation.Design\$design.parameters\$alpha.allocation								
	Subpop.		•	LOCALION	. Designade	sign.paran	meterspaipha.aiiocation		
•	0.012	•	.0125						
1 1									
2 2	0.012	5 0.	0125						
\$Two.Sta	age.Optir	mized.	Alpha All	location	.Design\$de	sion param	meters\$futility.boundaries		
	Subpop.		•	100011	· Deergn was	orgini par an	no cor our a criricy room and roo		
1 1	-(•	-3						
2 2	N/		NA						
		•	10 (
			•		.Design\$de				
			-		_		ormance\$Power		
Scenar					eject.All.	False.Null	l.Hypotheses		
1		.8621	0.9292				0.8184		
2		.7687	N.A				0.7687		
3	3	NA	N <i>A</i>	4			NA		
ΦTwo C+o	ana Ontir	mi-ad	11nho 111		Dooiantdo	aian nanfa	anmana attuna 1 Ennan		
			•		_		ormance\$Type.1.Error		
		.I.Err	_	/pe.i.Er		milywise.i	Type.I.Error		
1	1		NA		NA 0. 0440		NA O O440		
2	2		NA 0. 0040		0.0448		0.0448		
3	3		0.0246		0.0255		0.0486		
\$Two Sta	ane Ontir	mized	Alnha All	location	Design\$de	sian nerfa	ormance\$Expected.Sample.Size		
φινοιστο	age . op c i	mizcu.	•		expected.		· · · · · · · · · · · · · · · · · · ·		
1			•	1	-	111			
2				2		133			
3				3		145			
	tad Camb	inatio	on.Over.Sc			130			
4 Weight	Leu . Comb.	IIIatit	m.over.sc	Jenai 105		130	J1		
\$Two.Sta	age Optin	mized.	Alpha.All	Location	.Design\$de	sign.perfo	ormance\$Expected.Duration		
Scenario expected.duration									
1				1	-	3.26			
2				2					
3						3.64			
0				3		3.65			
	ted.Comb:	inatio	on.Over.Sc	3					

 $\verb§Two.Stage.Optimized.Alpha.Allocation.Design\$design.performance\$Distribution.of.sample.size.and.duration.per.scenario$

	scenario	C1	C2	Α1	A2	sample.size	duration	frequency	proportion
1	1	1	1	1	1	730	1.825	2128	0.2128
2	1	1	2	1	2	1168	3.650	1784	0.1784
3	1	2	1	2	1	1022	3.650	3224	0.3224
4	1	2	2	2	2	1460	3.650	2864	0.2864
5	2	1	1	1	1	730	1.825	60	0.0060
6	2	1	2	1	2	1168	3.650	3934	0.3934
7	2	2	1	2	1	1022	3.650	90	0.0090
8	2	2	2	2	2	1460	3.650	5916	0.5916
9	3	1	1	1	1	730	1.825	1	0.0001
10	3	1	2	1	2	1168	3.650	127	0.0127
11	3	2	1	2	1	1022	3.650	139	0.0139
12	3	2	2	2	2	1460	3.650	9733	0.9733

Minimum power difference (obtained - desired) for each Design

Design	O a a a a a a a	Minimum difference in power
Design	Scenario	(obtained - desired)
Single.Stage.Equal.Alpha.Allocation.Design	2	-0.0013
Single.Stage.Optimized.Alpha.Allocation.Design	2	0.0137
Two.Stage.Group.Sequential.Design	2	0.0324
Two.Stage.Equal.Alpha.Allocation.Design	2	-0.0342
Two.Stage.Optimized.Alpha.Allocation.Design	2	-0.0313