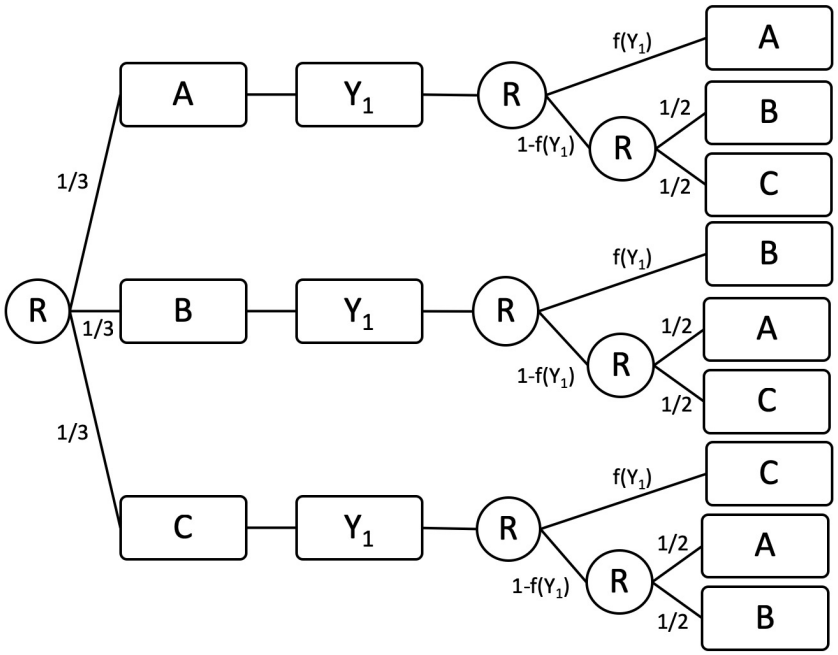
Web Figure 1: The proposed snSMART design with a mapping function and two-step randomization. A, B, and C are treatments, R indicates a randomization point, and $f(Y_1)$ is the mapping function. Numbers indicate probability of assignment to the treatment following.



Web Table 1: Coverage probability (CP) and credible interval width (CW) for the ideal scenarios 1-3 (section 3.2.1) where $n = 30$ for mapping functions and dichotomized outcomes. CP should be close to 0.95 and for CW smaller is better. MF = mapping function, DO = dichotomized outcome, $\beta_j, j = A, B, C$ parameters indicate treatment effects.

CP								
		MF				DO		
Scenario	MF	β_A	β_B	β_C	DO	β_A	β_B	β_C
1	MF 1	0.949	0.935	0.949	DO 50	0.816	0.772	0.820
	MF 1/2	0.944	0.950	0.949	DO 30	0.675	0.811	0.875
	MF 2	0.939	0.934	0.923	DO 70	0.916	0.857	0.698
2	MF 1	0.933	0.942	0.947	DO 50	0.914	0.858	0.696
	MF 1/2	0.930	0.945	0.940	DO 30	0.820	0.793	0.825
	MF 2	0.939	0.939	0.934	DO 70	0.926	0.915	0.898
3	MF 1	0.943	0.944	0.949	DO 50	0.687	0.822	0.888
	MF 1/2	0.941	0.948	0.941	DO 30	0.947	0.934	0.937
	MF 2	0.933	0.933	0.935	DO 70	0.803	0.760	0.810
CP								
		MF				DO		
Scenario	MF	β_A	β_B	β_C	DO	β_A	β_B	β_C
1	MF 1	11.560	11.358	11.239	DO 50	14.926	14.655	14.050
	MF 1/2	11.561	11.263	11.071	DO 30	11.605	10.376	9.791
	MF 2	11.192	11.187	11.260	DO 70	10.223	10.342	10.891
2	MF 1	11.395	11.221	11.164	DO 50	10.213	10.374	10.910
	MF 1/2	11.840	11.356	11.091	DO 30	15.223	14.854	14.086
	MF 2	11.090	10.959	11.049	DO 70	10.939	10.767	10.952
3	MF 1	11.783	11.554	11.373	DO 50	11.650	10.431	9.854
	MF 1/2	11.483	11.334	11.194	DO 30	11.172	10.849	10.739
	MF 2	11.863	11.837	11.727	DO 70	14.795	14.519	14.049

Web Table 2: Coverage probability (CP) and credible interval width (CW) for ideal scenarios 1-3 (section 3.2.1), n per arm $= 100, 15$. MF = mapping function, $\beta_j, j = A, B, C$ parameters indicate treatment effects.

			CP			CW		
n	Scenario	MF	β_A	β_B	β_C	β_A	β_B	β_C
100	1	MF 1	0.949	0.943	0.951	6.511	6.393	6.387
		MF 1/2	0.936	0.934	0.941	6.514	6.350	6.261
		MF 2	0.929	0.918	0.907	6.228	6.185	6.368
	2	MF 1	0.940	0.939	0.935	6.346	6.230	6.302
		MF 1/2	0.923	0.933	0.935	6.681	6.401	6.288
		MF 2	0.951	0.930	0.908	6.159	6.032	6.234
	3	MF 1	0.939	0.934	0.939	6.706	6.559	6.454
		MF 1/2	0.943	0.932	0.936	6.516	6.406	6.323
		MF 2	0.947	0.937	0.943	6.757	6.707	6.738
15	1	MF 1	0.931	0.922	0.935	15.928	15.647	15.402
		MF 1/2	0.938	0.937	0.934	15.878	15.539	15.299
		MF 2	0.929	0.916	0.914	15.566	15.394	15.395
	2	MF 1	0.931	0.919	0.930	15.821	15.523	15.343
		MF 1/2	0.934	0.929	0.941	16.263	15.619	15.239
		MF 2	0.905	0.892	0.893	15.434	15.218	14.992
	3	MF 1	0.929	0.932	0.924	16.112	15.848	15.598
		MF 1/2	0.913	0.920	0.913	15.787	15.669	15.467
		MF 2	0.921	0.916	0.922	16.224	16.010	15.935

Web Table 3: The proportion of trials where best treatment has the highest estimated first stage treatment effect when estimated under various scenarios. MF = mapping function, DO = dichotomized outcome, n = number of patients in one arm of the 3-arm trial.

		n		
Scenario	Design	15	30	100
1	MF 1	0.955	0.995	1
	MF 1/2	0.965	0.994	1
	MF 2	0.945	0.992	1
	DO 50	0.953	0.992	1
	DO 30	0.962	0.994	1
	DO 70	0.933	0.992	1
2	MF 1	0.947	0.993	1
	MF 1/2	0.963	0.996	1
	MF 2	0.928	0.991	1
	DO 50	0.924	0.987	1
	DO 30	0.959	0.994	1
	DO 70	0.913	0.969	1
3	MF 1	0.953	0.997	1
	MF 1/2	0.959	0.995	1
	MF 2	0.952	0.994	1
	DO 50	0.956	0.997	1
	DO 30	0.953	0.993	1
	DO 70	0.957	0.996	1

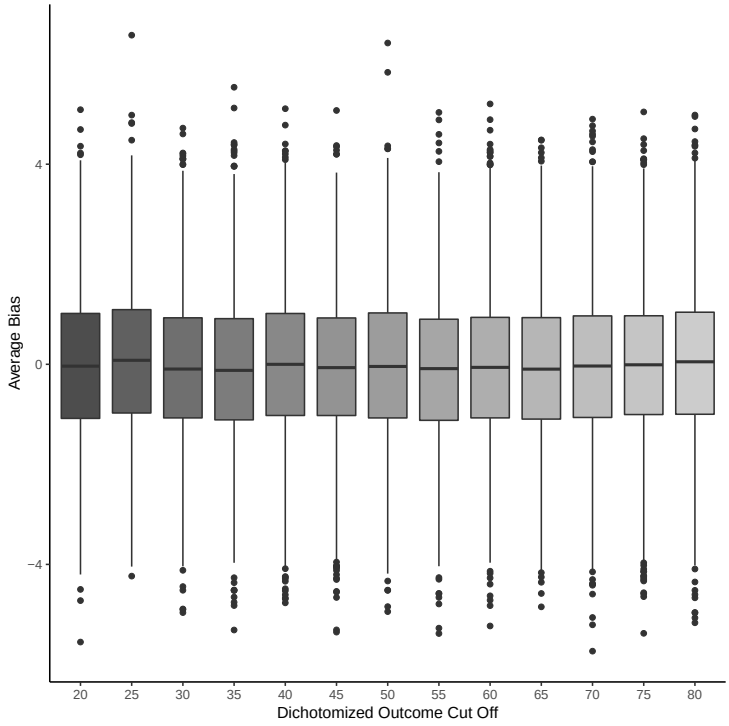
Web Table 4: The bias for each β when estimated under various scenarios. MF = mapping function, $\beta_j, j = A, B, C$ parameters indicate treatment effects.

		Bias		
Scenario	MF	β_A	β_B	β_C
1	MF 1	-0.248	-0.304	-0.283
	MF 1/2	0.247	0.124	0.089
	MF 2	-0.650	-0.791	-1.075
2	MF 1	-0.260	-0.427	-0.388
	MF 1/2	0.576	0.513	0.267
	MF 2	-0.278	-0.463	-0.758
3	MF 1	-0.166	-0.189	-0.130
	MF 1/2	-0.128	0.004	-0.191
	MF 2	-0.485	-0.688	-0.730

Web Table 5: Coverage probability (CP) and credible interval width (CW) for scenarios 4-10 with model assumption violations (section 3.2.3) for other mapping functions. MF = mapping function, $\beta_j, j = A, B, C$ parameters indicate treatment effects.

			CP			CW		
N	Scenario	MF	β_A	β_B	β_C	β_A	β_B	β_C
100	4	MF 1/2	0.265	0.922	0.938	6.873	6.484	6.367
		MF 2	0.867	0.906	0.935	6.738	6.510	6.775
	5	MF 1/2	0.999	0.943	0.851	6.769	6.869	7.270
		MF 2	0.999	0.830	0.424	6.346	6.486	7.430
	6	MF 1/2	0.941	0.937	0.935	6.518	6.341	6.266
		MF 2	0.922	0.910	0.901	6.219	6.179	6.354
	7	MF 1/2	0.414	0.870	0.872	6.870	6.894	7.304
		MF 2	0.975	0.790	0.788	6.539	6.681	7.981
	8	MF 1/2	0.258	0.915	0.940	6.859	6.473	6.354
		MF 2	0.859	0.913	0.942	6.735	6.514	6.763
	9	MF 1/2	1	0.955	0.856	6.779	6.861	7.259
		MF 2	0.999	0.808	0.425	6.349	6.491	7.439
	10	MF 1/2	0.445	0.878	0.885	6.864	6.908	7.303
		MF 2	0.969	0.796	0.774	6.546	6.655	7.972
30	4	MF 1/2	0.692	0.928	0.925	12.182	11.504	11.340
		MF 2	0.888	0.920	0.944	12.201	11.604	12.156
	5	MF 1/2	0.999	0.958	0.875	11.877	12.121	12.882
		MF 2	0.998	0.914	0.725	11.397	11.738	13.398
	6	MF 1/2	0.942	0.936	0.944	11.514	11.217	11.035
		MF 2	0.930	0.933	0.928	11.277	11.191	11.269
	7	MF 1/2	0.899	0.904	0.856	12.040	12.157	12.908
		MF 2	0.988	0.878	0.809	11.816	11.858	14.253
	8	MF 1/2	0.701	0.918	0.939	12.184	11.493	11.323
		MF 2	0.894	0.929	0.947	12.256	11.657	12.199
	9	MF 1/2	0.998	0.958	0.876	11.802	12.095	12.810
		MF 2	0.998	0.918	0.718	11.436	11.752	13.425
	10	MF 1/2	0.896	0.893	0.847	12.042	12.061	12.842
		MF 2	0.983	0.899	0.804	11.853	11.898	14.278
15	4	MF 1/2	0.827	0.925	0.916	16.716	15.853	15.653
		MF 2	0.885	0.920	0.935	16.991	16.110	16.716
	5	MF 1/2	0.994	0.935	0.848	15.890	16.518	17.818
		MF 2	0.998	0.920	0.789	15.708	16.217	18.582
	6	MF 1/2	0.933	0.932	0.930	15.889	15.541	15.274
		MF 2	0.926	0.921	0.921	15.662	15.489	15.497
	7	MF 1/2	0.953	0.889	0.827	16.208	16.572	17.929
		MF 2	0.974	0.897	0.827	16.159	16.237	19.274
	8	MF 1/2	0.832	0.919	0.923	16.685	15.858	15.615
		MF 2	0.883	0.926	0.945	16.965	16.077	16.669
	9	MF 1/2	0.995	0.934	0.843	15.893	16.508	17.775
		MF 2	0.997	0.924	0.772	15.723	16.227	18.681
	10	MF 1/2	0.947	0.889	0.836	16.195	16.525	17.981
		MF 2	0.973	0.903	0.825	16.190	16.292	19.377

Web Figure 2: Average bias across all $\beta_j, j = A, B, C$ parameters for various dichotomized outcome (DO) cutoffs when $\alpha_i = 0, i = 1, 3$ and $\tau_j = 0, j = 1, 2$. β_j parameters indicate treatment effect, $\alpha_i, i = 1, 3$ is the relationship between the treatments between stages, and τ is the correlation between outcomes for each stage. If a patient had a first stage outcome higher than the cutoff, then the patient stayed on the treatment. Otherwise, they were re-randomized to one of the remaining treatments.



Web Table 6: The proportion of patients that stayed on the same treatment for ideal scenarios 1-3 (section 3.2.1) when using a dichotomized outcome (DO) compared to a mapping function (MF), $n = 30$.

	MF			DO		
Scenario	1	1/2	2	50	30	70
1	0.500	0.687	0.296	0.501	0.821	0.178
2	0.308	0.508	0.135	0.178	0.501	0.032
3	0.692	0.821	0.522	0.823	0.968	0.500

Web Table 7: Bias and root mean squared error (rMSE) for scenarios 4-10 with model assumption violations (section 3.2.3) for other mapping functions, $n = 30$. $\beta_j, j = A, B, C$ parameters indicate treatment effects.

		Bias			rMSE		
Scenario	MF	β_A	β_B	β_C	β_A	β_B	β_C
4	MF 1/2	4.331	-1.404	-1.295	5.417	3.192	3.145
	MF 2	1.587	-1.075	0.020	3.814	3.298	3.102
5	MF 1/2	-0.163	-0.034	0.259	1.753	2.953	4.189
	MF 2	-0.199	-1.656	-3.882	1.676	3.426	5.938
6	MF 1/2	0.043	0.199	0.078	2.996	3.016	2.901
	MF 2	-0.607	-0.880	-1.014	3.081	3.037	3.154
7	MF 1/2	3.270	-2.137	-1.356	3.890	3.677	4.289
	MF 2	1.282	-2.155	-2.953	2.469	3.721	5.430
8	MF 1/2	4.280	-1.398	-1.380	5.395	3.229	3.068
	MF 2	1.594	-1.138	0.011	3.801	3.195	3.127
9	MF 1/2	-0.108	-0.077	0.167	1.777	2.965	4.089
	MF 2	-0.242	-1.680	-3.964	1.723	3.417	6.068
10	MF 1/2	3.283	-2.127	-1.475	3.907	3.708	4.414
	MF 2	1.367	-1.988	-2.925	2.544	3.645	5.475

Web Table 8: Performance results for scenarios 4-10 with model assumption violations (section 3.2.3), $n = 30$, linear mapping function (MF 1). $\beta_j, j = A, B, C$ parameters indicate treatment effects.

	Bias			rMSE		
Scenario	β_A	β_B	β_C	β_A	β_B	β_C
4	3.227	-1.117	-0.619	4.816	3.220	2.960
5	-0.247	-0.743	-1.261	1.741	3.206	4.722
6	-0.258	-0.276	-0.273	2.990	2.952	2.853
7	2.188	-2.158	-1.737	3.083	3.737	4.771
8	3.181	-1.146	-0.636	4.692	3.227	3.021
9	-0.257	-0.829	-1.228	1.777	3.212	4.604
10	2.214	-2.234	-1.824	3.101	3.890	4.775
	CP			CW		
Scenario	β_A	β_B	β_C	β_A	β_B	β_C
4	0.792	0.930	0.954	12.500	11.728	11.740
5	0.998	0.941	0.855	11.866	12.283	13.695
6	0.943	0.941	0.951	11.556	11.330	11.208
7	0.953	0.901	0.851	12.092	12.210	13.793
8	0.801	0.930	0.942	12.469	11.689	11.704
9	0.998	0.937	0.865	11.819	12.256	13.731
10	0.953	0.889	0.842	12.077	12.202	13.771

Web Table 9: The root mean squared error (rMSE) for each $\beta_j, j = A, B, C$ when estimated in a single-stage design and the proposed two-stage snSMART design. β_j indicates the treatment effect. Proportion chosen is the proportion of trials that estimated treatment j to have the highest treatment effect. MF = mapping function, DO = dichotomized outcome (Section 3.1).

		rMSE			Percent Chosen		
Scenario	Design	β_A	β_B	β_C	A	B	C
Null	MF 1	3	2.990	2.940	0.331	0.341	0.328
	MF 1/2	2.890	2.900	2.980	0.345	0.331	0.324
	MF 2	3.160	3.110	3.150	0.324	0.336	0.340
	DO 50	6.540	6.550	6.550	0.316	0.335	0.349
	DO 30	4.120	4.140	4.140	0.325	0.327	0.348
	DO 70	3.610	3.640	3.670	0.322	0.343	0.335

Web Table 10: The root mean squared error (rMSE) for each $\beta_j, j = A, B, C$ when estimated in the proposed two-stage snSMART design when the first stage outcome is distributed as a scaled beta distribution, but analyzed as a normal distribution. β_j indicates the treatment effect. MF = mapping function, DO = dichotomized outcome (Section 3.1).

		rMSE		
Scenario	Design	β_A	β_B	β_C
Beta - 1	MF 1	4.610	4.440	4.420
	MF 1/2	4.360	4.220	4
	MF 2	4.250	4.430	4.470
	DO 50	10.100	9.630	9.300
	DO 30	8.710	7.860	7.200
	DO 70	5.660	6.330	6.860
Beta - 2	MF 1	6.100	6.800	6.880
	MF 2	4.890	5.260	5.650
	MF 1/2	7.530	8.140	8.380
	DO 50	8.950	10.780	12.720
	DO 30	13.220	17.980	22.020
	DO 70	5.490	5.940	6.800
Beta - 3	MF 1	10.070	9.140	12.790
	MF 2	16.130	13.770	14.900
	MF 1/2	6.740	6.300	11.250
	DO 50	16.270	13.240	15.700
	DO 30	9.500	8.420	13.190
	DO 70	25.610	19.970	18.020

Web Table 11: The root mean squared error (rMSE) for each $\beta_j, j = A, B, C$ when estimated in a single-stage design and the proposed two-stage snSMART design. β_j indicates the treatment effect. Here we use mapping functions (MF) where $Y_{min} = 25$ and $Y_{max} = 75$ but are other wise the same as those described in Section 3.1.

		rMSE		
Scenario	Design	β_A	β_B	β_C
1	MF 1	3.700	3.520	3.520
	MF 1/2	3.950	3.520	3.210
	MF 2	3.410	3.930	4.300
2	MF 1	2.990	3.320	3.750
	MF 2	2.820	3.020	3.440
	MF 1/2	3.220	3.470	3.780
3	MF 1	3.890	3.400	3.030
	MF 2	4.650	4.090	3.380
	MF 1/2	3.400	3.070	2.900