

Supplemental Material

Supplemental Table S1. Composition of providers by roles in the Whole Health Team and Primary Care Group Education arms across the five different sites.

Arm	Role	Site A	Site B	Site C	Site D	Site E	Total
WHT	Primary PCP	1	1	1	2	1	6
WHT	Backup PCP	1	1	0	0	0	2
WHT	Primary CIH	1	2	1	1	1	6
WHT	Backup CIH	1	2	0	0	0	3
WHT	MH provider	1	0	1	1	1	4
WHT	Primary WHC	1	1	3	2	1	8
WHT	Backup WHC	1	0	0	0	1	2
PC-GE	Primary provider	1	1	1	1	1	5
PC-GE	Backup provider	1	1	1	2	1	6

WHT: Whole Health Team; PC-GE: Primary Care Group Education; PCP: primary care provider; CIH: complementary and integrative health; WHC: Whole Health Coach; MH: mental health.

Supplemental Table S2. Sample mapping of clinicians to patients in the Whole Health Team Arm (A) and patients to clinicians and sessions in the Primary Care Education Group (B)

(A) Whole Health Team Arm (for One Site)

Patient	Provider	Initial Session	Follow-Up			WHC Session								Final Session				
			1	2	3	1	2	3	4	5	6	7	8					
1	Primary PCP	X	X		X												X	
	Backup PCP			X														
	Primary CIH	X		X													X	
	Backup CIH																	
	MH provider				X													
	Primary WHC	X				X		X	X	X	X	X	X	X	X	X	X	X
	Backup WHC			X			X											
2	Primary PCP	X	X	X													X	
	Backup PCP				X													
	Primary CIH	X															X	
	Backup CIH		X															
	MH provider	X	X															
	Primary WHC	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Backup WHC		X															X
.																		
.																		
.																		

PCP=primary care provider; CIH=complementary and integrative health; MH=mental health; WHC=Whole Health coach

(B) Primary Care Education Group Arm (for One Site)

Patient	Session Number										...
	Provider										
	1 PP	2 PP	3 PP	4 BP	5 PP	6 PP	7 PP	8 PP	9 PP	10 BP	
1	X	X	X	X	X						
2	X	X	X	X						X	
3	X		X		X		X		X		
4		X	X	X	X	X					
5		X	X	X	X					X	
6		X		X	X	X		X			
.											
.											
.											
n					X	X	X	X	X		

PP=primary provider; BP=backup provider

Supplemental Table S3. Power calculation for the data example (Whole Health Team vs. Usual Primary Care, Primary Care Group Education vs. Usual Primary Care, Whole Health Team vs. Primary Care Group Education) under different grouping conditions and ICCs.

ICC for WHT	ICC for PC-GE	Conditions of Mapping Matrices			
		W_1V_1	W_1V_2	W_2V_1	W_2V_2
0.00	0.00	(90.8, 90.8, 91.1)	(90.8, 90.8, 91.1)	(90.8, 90.8, 91.1)	(90.8, 90.8, 91.1)
	0.01	(90.8, 90.8, 91.1)	(90.8, 90.7, 91.0)	(90.8, 90.8, 91.1)	(90.8, 90.7, 91.0)
	0.10	(90.8, 90.6, 90.6)	(90.8, 90.3, 89.8)	(90.8, 90.6, 90.6)	(90.8, 90.3, 89.8)
	0.20	(90.8, 90.4, 90.0)	(90.8, 89.9, 88.4)	(90.8, 90.4, 90.0)	(90.8, 89.9, 88.4)
0.01	0.00	(88.6, 90.8, 84.7)	(88.6, 90.8, 84.7)	(88.8, 90.8, 85.5)	(88.8, 90.8, 85.5)
	0.01	(88.6, 90.8, 84.6)	(88.6, 90.7, 84.5)	(88.8, 90.8, 85.4)	(88.8, 90.7, 85.3)
	0.10	(88.6, 90.6, 84.1)	(88.6, 90.3, 83.3)	(88.8, 90.6, 84.9)	(88.8, 90.3, 84.0)
	0.20	(88.6, 90.4, 83.5)	(88.6, 89.9, 81.8)	(88.8, 90.4, 84.3)	(88.8, 89.9, 82.6)
0.02	0.00	(86.3, 90.8, 78.0)	(86.3, 90.8, 78.0)	(86.8, 90.8, 79.6)	(86.8, 90.8, 79.6)
	0.01	(86.3, 90.8, 78.0)	(86.3, 90.7, 77.9)	(86.8, 90.8, 79.5)	(86.8, 90.7, 79.5)
	0.10	(86.3, 90.6, 77.5)	(86.3, 90.3, 76.7)	(86.8, 90.6, 79.0)	(86.8, 90.3, 78.2)
	0.20	(86.3, 90.4, 76.9)	(86.3, 89.9, 75.3)	(86.8, 90.4, 78.4)	(86.8, 89.9, 76.8)
0.05	0.00	(79.1, 90.8, 60.8)	(79.1, 90.8, 60.8)	(80.5, 90.8, 63.8)	(80.5, 90.8, 63.8)
	0.01	(79.1, 90.8, 60.8)	(79.1, 90.7, 60.7)	(80.5, 90.8, 63.8)	(80.5, 90.7, 63.7)
	0.10	(79.1, 90.6, 60.4)	(79.1, 90.3, 59.8)	(80.5, 90.6, 63.4)	(80.5, 90.3, 62.7)
	0.20	(79.1, 90.4, 60.0)	(79.1, 89.9, 58.8)	(80.5, 90.4, 62.9)	(80.5, 89.9, 61.7)
0.10	0.00	(67.5, 90.8, 42.7)	(67.5, 90.8, 42.7)	(70.1, 90.8, 46.0)	(70.1, 90.8, 46.0)
	0.01	(67.5, 90.8, 42.6)	(67.5, 90.7, 42.6)	(70.1, 90.8, 46.0)	(70.1, 90.7, 46.0)
	0.10	(67.5, 90.6, 42.4)	(67.5, 90.3, 42.1)	(70.1, 90.6, 45.8)	(70.1, 90.3, 45.4)
	0.20	(67.5, 90.4, 42.2)	(67.5, 89.9, 41.6)	(70.1, 90.4, 45.5)	(70.1, 89.9, 44.8)

ICC for WHT: ICC for the clinicians for Whole Health Team arm.

ICC for PC-GE: the combined ICCs for both the sessions and clinicians for the Primary Care Group Education arm.

W_1 : each participant is treated by only one primary Whole Health coach (8 sessions).

W_2 : each participant is also treated by a backup coach (1 of 8 sessions) if such an arrangement is available at a specific site.

V_1 : each session has an equal number of participants.

V_2 : each session has either 1 or 10 participants.

Supplemental Table S4. Power calculation for the data example (Whole Health Team vs. Usual Primary Care, Whole Health Team vs. Primary Care Group Education) when considering all clinicians in the Whole Health Team arm under different conditions of W , V_1 and different ICCs.

ICC for WHT	ICC for PC-GE	Conditions of Mapping Matrices			
		W_3V_1	W_4V_1	W_5V_1	W_6V_1
0.00	0.00	(90.8, 91.1)	(90.8, 91.1)	(90.8, 91.1)	(90.8, 91.1)
	0.01	(90.8, 91.1)	(90.8, 91.1)	(90.8, 91.1)	(90.8, 91.1)
	0.10	(90.8, 90.6)	(90.8, 90.6)	(90.8, 90.6)	(90.8, 90.6)
	0.20	(90.8, 90.0)	(90.8, 90.0)	(90.8, 90.0)	(90.8, 90.0)
0.01	0.00	(89.2, 86.6)	(89.3, 86.8)	(89.3, 86.8)	(89.3, 86.9)
	0.01	(89.2, 86.6)	(89.3, 86.8)	(89.3, 86.7)	(89.3, 86.9)
	0.10	(89.2, 86.1)	(89.3, 86.3)	(89.3, 86.2)	(89.3, 86.4)
	0.20	(89.2, 85.5)	(89.3, 85.7)	(89.3, 85.6)	(89.3, 85.8)
0.02	0.00	(87.6, 81.9)	(87.8, 82.4)	(87.7, 82.2)	(87.9, 82.6)
	0.01	(87.6, 81.9)	(87.8, 82.3)	(87.7, 82.2)	(87.9, 82.5)
	0.10	(87.6, 81.4)	(87.8, 81.8)	(87.7, 81.6)	(87.9, 82.0)
	0.20	(87.6, 80.8)	(87.8, 81.2)	(87.7, 81.0)	(87.9, 81.4)
0.05	0.00	(82.6, 68.7)	(83.0, 69.5)	(82.9, 69.2)	(83.2, 70.0)
	0.01	(82.6, 68.6)	(83.0, 69.5)	(82.9, 69.2)	(83.2, 69.9)
	0.10	(82.6, 68.2)	(83.0, 69.0)	(82.9, 68.7)	(83.2, 69.5)
	0.20	(82.6, 67.7)	(83.0, 68.5)	(82.9, 68.2)	(83.2, 69.0)
0.10	0.00	(74.2, 52.1)	(74.9, 53.2)	(74.7, 52.8)	(75.3, 53.8)
	0.01	(74.2, 52.0)	(74.9, 53.2)	(74.7, 52.8)	(75.3, 53.8)
	0.10	(74.2, 51.7)	(74.9, 52.9)	(74.7, 52.5)	(75.3, 53.5)
	0.20	(74.2, 51.4)	(74.9, 52.5)	(74.7, 52.1)	(75.3, 53.1)

WHT: Whole Health Team; PC-GE: Primary Care Group Education; ICC: ICC.

W_3 : treatment is delivered by primary clinicians of all roles but no backup clinicians. Each participant maintains same team, with limited encounters (i.e., 4 times with primary provider, 1 time with all the other available roles including Whole Health coaches).

W_4 : treatment is delivered by primary clinicians of all roles but no backup clinicians. The encounters for all roles are maximized (i.e., 4 times with primary provider and all the other roles if available).

W_5 : treatment is delivered by both primary and backup clinicians of all roles. Other than the coaching sessions, the encounters are limited and each participant only meets clinicians of all different roles once. There is a 25% chance the encounters are not with the primary clinicians.

W_6 : treatment is delivered by both primary and backup clinicians of all roles, with maximum encounters. All backup clinicians contribute to 1 out of the 4 sessions when they are available. For W_5 and W_6 , we assume that 7 out of the 8 coaching sessions are delivered by the primary Whole Health coaches.

V_1 : each session has an equal number of participants.

Supplemental Table S5. Power calculation for the data example (Whole Health Team vs. Usual Primary Care, Whole Health Team vs. Primary Care Group Education) when considering all clinicians in the Whole Health Team arm under different conditions of W , V_2 and different ICCs.

ICC for WHT	ICC for PC-GE	Conditions of Mapping Matrices			
		W_3V_2	W_4V_2	W_5V_2	W_6V_2
0.00	0.00	(90.8, 91.1)	(90.8, 91.1)	(90.8, 91.1)	(90.8, 91.1)
	0.01	(90.8, 91.0)	(90.8, 91.0)	(90.8, 91.0)	(90.8, 91.0)
	0.10	(90.8, 89.8)	(90.8, 89.8)	(90.8, 89.8)	(90.8, 89.8)
	0.20	(90.8, 88.5)	(90.8, 88.5)	(90.8, 88.5)	(90.8, 88.5)
0.01	0.00	(89.2, 86.6)	(89.3, 86.8)	(89.3, 86.8)	(89.3, 86.9)
	0.01	(89.2, 86.5)	(89.3, 86.7)	(89.3, 86.6)	(89.3, 86.8)
	0.10	(89.2, 85.2)	(89.3, 85.4)	(89.3, 85.4)	(89.3, 85.5)
	0.20	(89.2, 83.8)	(89.3, 84.0)	(89.3, 83.9)	(89.3, 84.1)
0.02	0.00	(87.6, 81.9)	(87.8, 82.4)	(87.7, 82.1)	(87.9, 82.6)
	0.01	(87.6, 81.8)	(87.8, 82.2)	(87.7, 80.8)	(87.9, 82.4)
	0.10	(87.6, 80.5)	(87.8, 80.9)	(87.7, 80.8)	(87.9, 81.1)
	0.20	(87.6, 79.1)	(87.8, 79.5)	(87.7, 79.4)	(87.9, 82.6)
0.05	0.00	(82.6, 68.7)	(83.0, 69.5)	(82.9, 69.2)	(83.2, 70.0)
	0.01	(82.6, 68.5)	(83.0, 69.4)	(82.9, 69.1)	(83.2, 69.9)
	0.10	(82.6, 67.5)	(83.0, 68.3)	(82.9, 68.0)	(83.2, 68.8)
	0.20	(82.6, 66.3)	(83.0, 67.1)	(82.9, 66.8)	(83.2, 67.5)
0.10	0.00	(74.2, 52.1)	(74.9, 53.2)	(74.7, 52.8)	(75.3, 53.8)
	0.01	(74.2, 52.0)	(74.9, 53.1)	(74.7, 52.7)	(75.3, 53.7)
	0.10	(74.2, 51.3)	(74.9, 52.4)	(74.7, 52.0)	(75.3, 53.0)
	0.20	(74.2, 50.5)	(74.9, 51.6)	(74.7, 51.2)	(75.3, 52.2)

ICC for WHT: ICC for the clinicians for Whole Health Team arm.

ICC for PC-GE: the combined ICCs for both the sessions and clinicians for the Primary Care Group Education arm.

W_3 : treatment is delivered by primary clinicians of all roles but no backup clinicians. Each participant maintains same team, with limited encounters (i.e., 4 times with primary provider, 1 time with all the other available roles including Whole Health coaches).

W_4 : treatment is delivered by primary clinicians of all roles but no backup clinicians. The encounters for all roles are maximized (i.e., 4 times with primary provider and all the other roles if available).

W_5 : treatment is delivered by both primary and backup clinicians of all roles. Other than the coaching sessions, the encounters are limited and each participant only meets clinicians of all different roles once. There is a 25% chance the encounters are not with the primary clinicians.

W_6 : treatment is delivered by both primary and backup clinicians of all roles, with maximum encounters. All backup clinicians contribute to 1 out of the 4 sessions when they are available. For W_5 and W_6 , we assume that 7 out of the 8 coaching sessions are delivered by the primary Whole Health coaches.

V_2 : each session has either 1 or 10 participants.

Supplemental Table S6. Simulation results for the ICCs in the Primary Care Group Education arm with 2500 participants.

Session/Clinicians Mapping	Session ICC	Clinicians ICC	Session ICC Posterior				Clinicians ICC Posterior			
			Posterior Mean	Relative Bias for Posterior Mean	Posterior Median	Relative Bias for Posterior Median	Posterior Mean	Posterior Mean	Relative Bias for Posterior Mean	Relative Bias for Posterior Median
$V_a U_a$	0.010	0.010	0.019	0.009	0.012	0.002	0.018	0.008	0.013	0.003
		0.100	0.017	0.017	0.011	0.011	0.130	0.030	0.116	0.016
	0.100	0.010	0.076	-0.024	0.070	-0.030	0.019	0.009	0.013	0.003
		0.100	0.075	0.075	0.069	0.069	0.131	0.031	0.117	0.017
$V_a U_b$	0.010	0.010	0.020	0.010	0.013	0.003	0.012	0.002	0.009	-0.001
		0.100	0.018	0.018	0.011	0.011	0.117	0.017	0.104	0.004
	0.100	0.010	0.085	-0.015	0.080	-0.020	0.013	0.003	0.009	-0.001
		0.100	0.087	0.087	0.081	0.081	0.116	0.016	0.103	0.003
$V_b U_a$	0.010	0.010	0.018	0.008	0.012	0.002	0.015	0.005	0.010	0.000
		0.100	0.017	0.017	0.010	0.010	0.113	0.013	0.099	-0.001
	0.100	0.010	0.079	-0.021	0.074	-0.026	0.017	0.007	0.011	0.001
		0.100	0.079	0.079	0.073	0.073	0.117	0.017	0.101	0.001
$V_b U_b$	0.010	0.010	0.017	0.007	0.010	0.000	0.011	0.001	0.008	-0.002
		0.100	0.016	0.016	0.010	0.010	0.111	0.011	0.100	0.000
	0.100	0.010	0.079	-0.021	0.073	-0.027	0.013	0.003	0.008	-0.002
		0.100	0.085	0.085	0.078	0.078	0.109	0.009	0.097	-0.003

V_a : participants are evenly distributed across sessions; at each site, each participant is randomly allocated to 5 of 40 sessions.

V_b : participants are unevenly distributed; each participant is randomly assigned to 4 sessions in the first 15 sessions and 1 of the other 25 sessions.

U_a : primary providers deliver 90 percent of 40 sessions at each site, and the backup providers cover the rest sessions.

U_b : primary providers deliver 60 percent of 40 sessions at each site, and the backup providers cover the rest sessions.

Due to the large volume of computation, the number of simulations is 100 for all the scenarios in this table.

APPENDIX

Derivation of the Power Formulae

Power and sample size estimation are derived via the pairwise comparison approach. We estimate the contrast of each pair of treatment arms $\delta_{k,k'}$ through calculating means and variances in each arm. For simplicity, we assume the error variance, denoted σ^2 , is homogeneous across all three arms. The Usual Primary Care, Whole Health Team, and Primary Care Group Education arm each has n_1 , n_2 and n_3 participants with mean outcome \bar{Y}_1 , \bar{Y}_2 , and \bar{Y}_3 , respectively. For the Usual Primary Care arm, the mean is $\bar{Y}_1 = \mu_1 + \frac{1}{n_1} \sum_{i=1}^{n_1} \epsilon_i$ and its variance is $Var(\bar{Y}_1) = \frac{\sigma^2}{n_1}$.

For the Whole Health Team arm, assume there are J_2 clinicians. The outcome mean is

$$\bar{Y}_2 = \frac{1}{n_2} \sum_{i=1}^{n_2} \left(\mu_2 + \sum_{j=1}^{J_2} w_{ij} b_j \right) = \mu_2 + \frac{1}{n_2} \sum_{j=1}^{J_2} (b_j \sum_{i=1}^{n_2} w_{ij}) + \frac{1}{n_2} \sum_{i=1}^{n_2} \epsilon_i$$

Let $w_j = \sum_{i=1}^{n_2} w_{ij}$, and assume the w_j and clinicians-specific random effect are independent.

Then the variance of \bar{Y}_2 is,

$$Var(\bar{Y}_2) = \frac{\tau^2 \sum_{j=1}^{J_2} w_j^2 + n_2 \sigma^2}{n_2^2}$$

To simplify this variance, if we assume the mean and variance of w_j are μ_w and σ_w^2 , then $\mu_w =$

$\frac{n_2}{J_2}$, and $\sum_{j=1}^{J_2} w_j^2 = J_2(\mu_w^2 + \sigma_w^2)$. Let the ICC across clinicians be $\rho_1 = \frac{\tau^2}{\tau^2 + \sigma^2}$, and the total

variance be $\eta_2^2 = \tau^2 + \sigma^2$, then we have,

$$Var(\bar{Y}_2) = \frac{\eta_2^2}{n_2} \left(1 + \left(\mu_w + \frac{\sigma_w^2}{\mu_w} - 1 \right) \rho_1 \right)$$

The treatment effect of the Whole Health Team arm over the Usual Primary Care is then $\hat{\delta}_{2,1} = \bar{Y}_2 - \bar{Y}_1$, and the variance is,

$$Var(\hat{\delta}_{2,1}) = Var(\bar{Y}_2) + Var(\bar{Y}_1) = \eta_2^2 \left(\frac{1-\rho_1}{n_1} + \frac{1}{n_2} \left(1 + \left(\mu_w + \frac{\sigma_w^2}{\mu_w} - 1 \right) \rho_1 \right) \right)$$

For the type I error level α , the power $(1 - \beta)$ for detecting an effect of $\Delta_{2,1}$ is given by,

$$1 - \beta = \Phi \left(\frac{\Delta_{2,1}}{\sqrt{Var(\hat{\delta}_{2,1})}} - z_{\alpha/2} \right)$$

Here, $\delta_{2,1}$ is the design effect. The corresponding sample size formula to reach the level of power $1 - \beta$ can also be easily obtained by inverting the above equation.

We now consider the outcome and variance estimation for the Primary Care Group Education arm with clustering due to sessions and clinicians. Assume there are L_3 sessions and J_3 clinicians. We can obtain the outcome mean,

$$\bar{Y}_3 = \mu_3 + \frac{1}{n_3} \sum_{\ell=1}^{L_3} \left(d_{\ell} \sum_{i=1}^{n_3} v_{i\ell} \right) + \frac{1}{n_3} \sum_{i=1}^{n_3} \epsilon_i$$

Recall that $d_{\ell} \sim N(\sum_{j=1}^{J_3} c_j \mathbb{I}_{\{j=\mathbb{Q}_{\ell}\}}, \pi^2)$ denotes the session-level random effect for relevant therapist j , where c_j is the clinician effect following $N(0, \phi^2)$; $\mathbb{Q}_{\ell} \in \{1, \dots, J\}$ is the index for the clinician delivery session ℓ . Assume the patient-to-session mapping matrix is V with elements of $v_{i\ell}$, and let the column sum of V be $v_{\ell} = \sum_{i=1}^{n_3} v_{i\ell}$. Also, assume the mapping from sessions to clinicians is represented by matrix U , and its element $u_{\ell j}$ equals to either 1 or 0 indicating whether a session is led by a clinician. Given no partial clustering at the clinician level, we then know $\sum_{j=1}^{J_3} u_{\ell j}^2 = 1$. The variance of \bar{Y}_3 is,

$$Var(\bar{Y}_3) = \frac{\sum_{\ell=1}^{L_3} (v_{\ell}^2 (\phi^2 \sum_{j=1}^{J_3} u_{\ell j}^2 + \pi^2)) + n_3 \sigma^2}{n_3^2} = \frac{(\phi^2 + \pi^2) \sum_{\ell=1}^{L_3} v_{\ell}^2 + n_3 \sigma^2}{n_3^2}.$$

Note that this expression would not hold if partial clustering exists at the clinician level. Partial clustering would lead to $\sum_{j=1}^{J_3} u_{\ell j}^2 \leq 1$ and reduction in the total variance. Again, to simplify

$Var(\bar{Y}_3)$, assume the mean and variance of v_ℓ are μ_v and σ_v^2 , and $\mu_v = \frac{n_3}{L_3}$. We can then have

$\sum_{\ell}^{L_3} v_\ell^2 = L_3(\mu_v^2 + \sigma_v^2)$. Further, let the ICCs between clinicians be $\rho_2^A = \frac{\phi^2}{\phi^2 + \pi^2 + \sigma^2}$ and between

sessions be $\rho_2^B = \frac{\pi^2}{\phi^2 + \pi^2 + \sigma^2}$. Let the total sum of variance be $\eta_3^2 = \phi^2 + \pi^2 + \sigma^2$. Then,

$$Var(\bar{Y}_3) = \frac{\eta_3^2}{n_3} \left(1 + \left(\mu_v + \frac{\sigma_v^2}{\mu_v} - 1 \right) (\rho_2^A + \rho_2^B) \right)$$

We can now estimate the treatment effect of Primary Care Group Education over the Whole Health Team or the control arm. Define $\delta_{3,1} = \bar{Y}_3 - \bar{Y}_1$, and $\delta_{3,2} = \bar{Y}_3 - \bar{Y}_2$. The respective variances are then,

$$Var(\hat{\delta}_{3,1}) = \frac{\eta_3^2}{n_3} \left(1 + \left(\mu_v + \frac{\sigma_v^2}{\mu_v} - 1 \right) (\rho_2^A + \rho_2^B) \right) + \frac{\sigma^2}{n_1}$$

$$Var(\hat{\delta}_{3,2}) = \frac{\eta_3^2}{n_3} \left(1 + \left(\mu_v + \frac{\sigma_v^2}{\mu_v} - 1 \right) (\rho_2^A + \rho_2^B) \right) + \frac{\eta_2^2}{n_2} \left(1 + \left(\mu_w + \frac{\sigma_w^2}{\mu_w} - 1 \right) \rho_1 \right)$$

For the type I error rate of α , the formulae for detecting effect sizes $\Delta_{3,1}$ and $\Delta_{3,2}$ with power of $1 - \beta$ are given by,

$$1 - \beta = \Phi \left(\frac{\Delta_{3,1}}{\sqrt{Var(\hat{\delta}_{3,1})}} - z_{\alpha/2} \right)$$

$$1 - \beta = \Phi \left(\frac{\Delta_{3,2}}{\sqrt{Var(\hat{\delta}_{3,2})}} - z_{\alpha/2} \right)$$

Sample size formulae for given power can be inverted from the above equations.

Gibbs Sampler for Whole Health Team Arm

We provided the Markov Chain Monte Carlo sampler for the estimation of ICCs for the Whole Health Team. For simplicity, we re-express the outcome model for this arm in matrix form as

$$Y = X\beta + WB + E$$

Here, Y is the outcome vector, X is an n_2 by p design matrix including the intercept, and β is the vector of covariate effects. This general form of X allows for covariate adjustment such as the site effect. When there is no covariate, X is a vector of 1 and β is the overall mean. W is an n_2 by J_2 mapping matrix between participants and clinicians. B is a vector of length J_2 with b_1, \dots, b_{J_2} indicating clinician effects following a multivariate normal distribution, $N_{J_2}(0, \tau^2 I_{J_2})$. E is the residual vector following $N_{n_2}(0, \sigma^2 I_{n_2})$. Assume the prior distribution of β as $N_p(\beta_0, \sigma_0^2 I_p)$; the prior for σ^2 as inverse Gamma distribution $IG(a_0, b_0)$; the prior for τ^2 also as inverse Gamma $IG(c_0, d_0)$. The posteriors can be updated with the full conditionals as follows:

(1) Sample B from multivariate normal posterior $N_{J_2}(M, V)$, where

$$M = \sigma^{-2} V W^T (Y - X\beta), \text{ and } V = (\sigma^{-2} W^T W + \tau^{-2} I)^{-1}$$

(2) Sample β from normal posterior $N_p(M, V)$, where

$$M = V[\sigma^{-2} X^T (Y - WB) + \sigma_0^{-2} \beta_0] \text{ and } V = (\sigma^{-2} X^T X + \sigma_0^{-2} I)^{-1}$$

(3) Sample σ^2 from the posterior distribution,

$$IG(a_0 + \frac{n_2}{2}, b_0 + \frac{1}{2} (Y - X\beta - WB)^T (Y - X\beta - WB))$$

(4) Sample τ^2 from the posterior distribution,

$$IG(c_0 + \frac{J_2}{2}, d_0 + \frac{1}{2} B^T B)$$

With the posteriors, the ICC can be obtained by calculating $\frac{\tau^2}{\tau^2 + \sigma^2}$ for each iteration. A 95% credible interval for the ICC can also be obtained.

Gibbs Sampler for the Primary Care Group Education Arm

We provide the Markov Chain Monte Carlo sampler for the estimation of ICCs for the Primary Care Group Education arm. The model for this arm can also be expressed in the matrix form,

$$Y = X\beta + VD + E$$

Here, Y is the outcome vector, X is the 2 by p design matrix including the intercept, and β is the vector of regression coefficients. When there is no covariate, X is a vector of 1 and β is the overall mean. V is an n_3 by L_3 mapping matrix between participants and sessions. D is a vector of length L_3 with elements of d_1, \dots, d_{L_3} as session-specific effects. Here, sessions are nested within clinicians, and their mapping is denoted by U , a L_3 by J_3 matrix. Then, we have $D = UC$, where C is a vector of length J_3 for the clinician effect. C follows multivariate normal $N_{J_3}(0, \phi^2 I_{J_3})$. Then, D follows the multivariate normal distribution, $N_{L_3}(UC, \pi^2 I_{L_3})$. E is the residual vector follows $N_{n_3}(0, \sigma^2 I_{n_3})$. Assume the prior distribution of β is $N_p(\beta_0, \sigma_0^2 I_p)$; the prior for σ^2 follows an inverse Gamma distribution, $IG(a_0, b_0)$; the priors for π^2 for ϕ^2 also follow inverse Gamma, $IG(e_0, f_0)$ and $IG(g_0, h_0)$, respectively. The posteriors can be obtained with the full conditionals as follows:

(1) Sample D from multivariate normal $N_{L_3}(M^*, V^*)$, where

$$M^* = V^*[\sigma^{-2}V^T(Y - X\beta) + \pi^{-2}UC] \text{ and } V^* = (\sigma^{-2}V^TV + \pi^{-2}I)^{-1}$$

(2) Sample β from multivariate normal $N_p(M^*, V^*)$, where

$$M^* = V^*[\sigma^{-2}X^T(Y - VD) + \sigma_0^{-2}\beta_0] \text{ and } V^* = (\sigma^{-2}X^TX + \sigma_0^{-2}I)^{-1}$$

(3) Sample C from the multivariate normal $N_{J_3}(M^*, V^*)$, where

$$M^* = \pi^{-2}V^*U^TD \text{ and } V^* = (\pi^{-2}U^TU + \phi^{-2}I)^{-1}$$

(4) Sample σ^2 from the posterior distribution,

$$IG(a_0 + \frac{n_3}{2}, b_0 + \frac{1}{2}(Y - X\beta - VD)^T(Y - X\beta - VD))$$

(5) Sample π^2 from the posterior distribution,

$$IG(e_0 + \frac{L_3}{2}, f_0 + \frac{1}{2}(D - UC)^T(D - UC))$$

(6) Sample ϕ^2 from the posterior distribution,

$$IG(g_0 + \frac{J_3}{2}, h_0 + \frac{1}{2}C^T C)$$

The ICC for sessions and clinicians can be obtained by calculating $\frac{\pi^2}{\pi^2 + \phi^2 + \sigma^2}$ and $\frac{\phi^2}{\pi^2 + \phi^2 + \sigma^2}$ in each iteration of the sampler. 95% credible intervals for them can also be obtained. Note that here we express the U matrix in a general form, and this Gibbs sampler can accommodate the scenarios where mixed membership between sessions and clinicians also exists (i.e., each treatment session is delivered by multiple clinicians).