```
      name:  <unnamed>
       log:  S:\Stats\7. Confidential\Trials\UK-ROX\EXAKT\Regression models output
> s.smcl
  log type:  smcl
 opened on:  19 Aug 2025, 15:31:37

.
. *** Variable definitions:
. ** Outcomes :
. * spfrac - spo2 as a fraction, used as outcome of bias model
. * SquaredDeviation - square of difference between spo2 and predicted spo2 from f
> irst model , used in RMSE model
. * SquaredError - Squared difference between sao2 and spo2 , used in ARMS model
. * sa92orless - binary variable denoting whether the observed sao2 was <= .92
. * sp92orless - binary variable denoting whether the observed spo2 was <= .92
. * sp94orless - binary variable denoting whether the observed spo2 was <= .94
.
. ** Adjustment variables :
. * t* - the derived cubic splines of ITA
. * s* - the derived cubic splines of sao2
. * h* - the derived cubic splines of haemoglobin
. * pid - individual patient identifier
. * o - categorical oximeter variable
. * o1t1 - used in rocreg models, oximeter o1 interaction with ITA spline 1
. * SiteNumber - categorical variable identifier for sites
.
.
. * SpO2/bias model: fractional regression with patient-clustered vce a
. fracreg probit spfrac t? s? c.t1#c.s1 c.t1#c.s2 c.t1#c.s3 c.t2#c.s1 c.t3#c.s1 //
> /
>         i.o i.o#c.t1 i.o#c.t2 i.o#c.t3 i.o#c.s1 i.o#c.s2 i.o#c.s3 ///
>         h?, vce(cluster pid)

Iteration 0:  Log pseudolikelihood = -3081.7217
Iteration 1:  Log pseudolikelihood = -2386.7541
Iteration 2:  Log pseudolikelihood = -2380.8657
Iteration 3:  Log pseudolikelihood = -2380.8555
Iteration 4:  Log pseudolikelihood = -2380.8555

Fractional probit regression                          Number of obs =  11,008
                                                      Wald chi2(42) = 3042.28
                                                      Prob > chi2   =  0.0000
Log pseudolikelihood = -2380.8555                     Pseudo R2     =  0.0242

                                  (Std. err. adjusted for 902 clusters in pid)
------------------------------------------------------------------------------
             |               Robust
      spfrac | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
          t1 |   .0307751   .0215542     1.43   0.153    -.0114703    .0730204
          t2 |  -.0775326   .0401449    -1.93   0.053    -.1562152    .0011501
          t3 |   .3715815   .2106659     1.76   0.078    -.0413161    .7844792
          s1 |   1.640207   1.002188     1.64   0.102    -.3240444    3.604459
          s2 |   2.771836   1.273041     2.18   0.029     .2767204    5.266951
          s3 |   -11.2667   12.28755    -0.92   0.359    -35.34985    12.81644

   c.t1#c.s1 |  -.0319503   .0228409    -1.40   0.162    -.0767177    .0128171

   c.t1#c.s2 |   -.014402   .0242061    -0.59   0.552    -.0618451    .0330411

   c.t1#c.s3 |   .0500154   .2304278     0.22   0.828    -.4016148    .5016457
```

c.t2#c.s1	.0794895	.0421012	1.89	0.059	-.0030274	.1620065
c.t3#c.s1	-.3788073	.2208857	-1.71	0.086	-.8117352	.0541207
o						
B	-.0460881	.7130545	-0.06	0.948	-1.443649	1.351473
C	-.786448	.7045347	-1.12	0.264	-2.167311	.5944147
D	-.4892588	.9538166	-0.51	0.608	-2.358705	1.380187
E	.2182929	.5598868	0.39	0.697	-.8790652	1.315651
o#c.t1						
B	.0002764	.0016886	0.16	0.870	-.0030333	.003586
C	-.0006862	.0012105	-0.57	0.571	-.0030586	.0016863
D	-.0015762	.0020845	-0.76	0.450	-.0056618	.0025093
E	-.0013866	.0014424	-0.96	0.336	-.0042137	.0014404
o#c.t2						
B	-.0000489	.0034586	-0.01	0.989	-.0068277	.0067299
C	.0015297	.002859	0.54	0.593	-.0040739	.0071333
D	.0044553	.004293	1.04	0.299	-.0039588	.0128695
E	.0039336	.0030919	1.27	0.203	-.0021263	.0099936
o#c.t3						
B	-.0070986	.0177107	-0.40	0.689	-.0418109	.0276138
C	-.0129919	.0158934	-0.82	0.414	-.0441425	.0181586
D	-.0311253	.0218336	-1.43	0.154	-.0739183	.0116678
E	-.0268997	.0165041	-1.63	0.103	-.059247	.0054477
o#c.s1						
B	-.0408767	.7892246	-0.05	0.959	-1.587729	1.505975
C	.8661032	.7666355	1.13	0.259	-.6364747	2.368681
D	.6683945	1.052117	0.64	0.525	-1.393718	2.730507
E	-.3585739	.6044044	-0.59	0.553	-1.543185	.826037
o#c.s2						
B	.8929108	1.735486	0.51	0.607	-2.508579	4.294401
C	1.569173	1.581633	0.99	0.321	-1.53077	4.669116
D	1.273448	2.080532	0.61	0.540	-2.80432	5.351216
E	1.950542	1.453684	1.34	0.180	-.8986258	4.799711
o#c.s3						
B	-9.215878	17.54963	-0.53	0.599	-43.61251	25.18076
C	-8.142335	15.77856	-0.52	0.606	-39.06775	22.78308
D	-12.77011	20.73559	-0.62	0.538	-53.41113	27.8709
E	-3.251787	14.36922	-0.23	0.821	-31.41493	24.91136
h1	.0028331	.0013112	2.16	0.031	.0002632	.005403
h2	-.0082485	.0051613	-1.60	0.110	-.0183644	.0018674
h3	.0208893	.0134173	1.56	0.119	-.0054082	.0471868
_cons	-.294757	.9397622	-0.31	0.754	-2.136657	1.547143

```
. estimates store fracreg

. estimates save fracreg, replace
file fracreg.ster saved

.
. * Precision model (squared deviation SpO2 - SpO2fit)
. estimates use fracreg

. predict sp_pr_overall
(option cm assumed)
(275 missing values generated)

. g SquaredDeviation = (spfrac - sp_pr_overall)^2
(806 missing values generated)

. lab var SquaredDeviation "Square of (spfrac - sp_pr)"

. fracreg probit SquaredDeviation t? s? c.t1#c.s1 c.t1#c.s2 c.t1#c.s3 c.t2#c.s1 c.
> t3#c.s1 ///
>         i.o i.o#c.t1 i.o#c.t2 i.o#c.t3 i.o#c.s1 i.o#c.s2 i.o#c.s3 ///
>         h?, vce(cluster pid)

Iteration 0:  Log pseudolikelihood = -7640.2737
Iteration 1:  Log pseudolikelihood = -112.51784
Iteration 2:  Log pseudolikelihood = -97.248269
Iteration 3:  Log pseudolikelihood = -96.475803
Iteration 4:  Log pseudolikelihood =  -96.47128
Iteration 5:  Log pseudolikelihood = -96.471277

Fractional probit regression                    Number of obs = 11,008
                                                Wald chi2(42) = 293.33
                                                Prob > chi2   = 0.0000
Log pseudolikelihood = -96.471277               Pseudo R2     = 0.0219

                                  (Std. err. adjusted for 902 clusters in pid)
```

SquaredDeviation	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
t1	-.06999	.042224	-1.66	0.097	-.1527475	.0127675
t2	.1483877	.1131776	1.31	0.190	-.0734362	.3702116
t3	-.7519726	.5914389	-1.27	0.204	-1.911171	.4072263
s1	-1.619868	2.01697	-0.80	0.422	-5.573056	2.33332
s2	6.488447	3.447129	1.88	0.060	-.2678022	13.2447
s3	-47.37497	29.20247	-1.62	0.105	-104.6108	9.86082
c.t1#c.s1	.0764331	.0444207	1.72	0.085	-.0106299	.1634961
c.t1#c.s2	-.0527885	.0997428	-0.53	0.597	-.2482807	.1427037
c.t1#c.s3	.967883	1.01546	0.95	0.341	-1.022382	2.958148
c.t2#c.s1	-.1558489	.1173056	-1.33	0.184	-.3857637	.0740658
c.t3#c.s1	.7663812	.6127273	1.25	0.211	-.4345423	1.967305
o						
B	.364872	1.724016	0.21	0.832	-3.014138	3.743882
C	.6695654	1.880799	0.36	0.722	-3.016733	4.355864
D	.0752921	1.90007	0.04	0.968	-3.648777	3.799361
E	-2.873259	3.156494	-0.91	0.363	-9.059873	3.313356

o#c.t1						
B	-.0039967	.0067995	-0.59	0.557	-.0173235	.0093302
C	.0000452	.0034634	0.01	0.990	-.0067429	.0068333
D	-.0012601	.0062397	-0.20	0.840	-.0134898	.0109696
E	.003503	.004832	0.72	0.468	-.0059674	.0129735
o#c.t2						
B	-.0040376	.0124661	-0.32	0.746	-.0284707	.0203955
C	-.003272	.0078635	-0.42	0.677	-.0186842	.0121401
D	-.0119334	.012027	-0.99	0.321	-.0355058	.011639
E	-.021584	.0110889	-1.95	0.052	-.043318	.0001499
o#c.t3						
B	.061031	.0591865	1.03	0.302	-.0549724	.1770344
C	.0365186	.0434817	0.84	0.401	-.0487039	.1217411
D	.1114263	.0590883	1.89	0.059	-.0043846	.2272371
E	.1362929	.0661006	2.06	0.039	.0067382	.2658477
o#c.s1						
B	-.2797333	1.978249	-0.14	0.888	-4.15703	3.597563
C	-.8153375	2.102143	-0.39	0.698	-4.935462	3.304787
D	.1682156	2.090157	0.08	0.936	-3.928417	4.264849
E	3.71006	3.580363	1.04	0.300	-3.307323	10.72744
o#c.s2						
B	.639124	5.299941	0.12	0.904	-9.74857	11.02682
C	-3.3794	4.780106	-0.71	0.480	-12.74824	5.989435
D	-2.747445	5.355134	-0.51	0.608	-13.24332	7.748425
E	-14.42595	10.63771	-1.36	0.175	-35.27547	6.423577
o#c.s3						
B	-5.30918	51.8862	-0.10	0.918	-107.0043	96.38591
C	27.84591	46.37526	0.60	0.548	-63.04792	118.7397
D	8.488827	63.54509	0.13	0.894	-116.0573	133.0349
E	125.9072	90.75503	1.39	0.165	-51.96934	303.7838
h1	.0004574	.0049294	0.09	0.926	-.009204	.0101188
h2	-.0090331	.019896	-0.45	0.650	-.0480285	.0299622
h3	.0189104	.0518174	0.36	0.715	-.0826498	.1204706
_cons	-1.632997	1.927696	-0.85	0.397	-5.411212	2.145218

```
. estimates store precision

. estimates save precision, replace
file precision.ster saved

.
. * ARMS model (squared error SpO2 - SaO2)
. g SquaredError = (spfrac-safrac)^2
(796 missing values generated)
```

```
. lab var SquaredError "squared error"

. fracreg probit SquaredError t? s? c.t1#c.s1 c.t1#c.s2 c.t1#c.s3 c.t2#c.s1 c.t3#c
> .s1 ///
>         i.o i.o#c.t1 i.o#c.t2 i.o#c.t3 i.o#c.s1 i.o#c.s2 i.o#c.s3 ///
>         h?, vce(cluster pid)

Iteration 0:  Log pseudolikelihood = -7643.5165
Iteration 1:  Log pseudolikelihood = -147.93951
Iteration 2:  Log pseudolikelihood = -124.57873
Iteration 3:  Log pseudolikelihood = -122.78224
Iteration 4:  Log pseudolikelihood =  -122.7699
Iteration 5:  Log pseudolikelihood = -122.76989

Fractional probit regression                          Number of obs = 11,008
                                                      Wald chi2(42) = 740.98
                                                      Prob > chi2   = 0.0000
Log pseudolikelihood = -122.76989                     Pseudo R2     = 0.0234

                                  (Std. err. adjusted for 902 clusters in pid)
```

SquaredError	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
t1	-.0232152	.0350267	-0.66	0.507	-.0918663	.0454358
t2	.0570168	.0937078	0.61	0.543	-.1266471	.2406807
t3	-.3874816	.4948945	-0.78	0.434	-1.357457	.5824939
s1	-4.801515	1.635993	-2.93	0.003	-8.008002	-1.595028
s2	10.62779	2.770523	3.84	0.000	5.197663	16.05791
s3	-60.27063	24.9047	-2.42	0.016	-109.0829	-11.45832
c.t1#c.s1	.0264665	.0369372	0.72	0.474	-.0459291	.0988622
c.t1#c.s2	-.014092	.0898025	-0.16	0.875	-.1901017	.1619176
c.t1#c.s3	.4101644	.907554	0.45	0.651	-1.368609	2.188938
c.t2#c.s1	-.0586768	.0971052	-0.60	0.546	-.2489996	.131646
c.t3#c.s1	.3780914	.512636	0.74	0.461	-.6266566	1.382839
o						
B	-.7350244	1.407453	-0.52	0.602	-3.493581	2.023532
C	.0730054	1.456122	0.05	0.960	-2.780941	2.926952
D	.3553578	1.243876	0.29	0.775	-2.082593	2.793309
E	-2.404742	2.781676	-0.86	0.387	-7.856727	3.047242
o#c.t1						
B	-.0047904	.0061877	-0.77	0.439	-.0169181	.0073373
C	-.0003327	.0031604	-0.11	0.916	-.006527	.0058616
D	-.0001166	.0055983	-0.02	0.983	-.0110891	.010856
E	.0033104	.0046156	0.72	0.473	-.0057359	.0123568
o#c.t2						
B	.0002812	.0113124	0.02	0.980	-.0218907	.0224531
C	-.0029636	.0072079	-0.41	0.681	-.0170908	.0111636
D	-.0136104	.0108052	-1.26	0.208	-.0347881	.0075674
E	-.019884	.0101375	-1.96	0.050	-.0397532	-.0000149
o#c.t3						
B	.0407913	.0538266	0.76	0.449	-.0647068	.1462894
C	.0403852	.0407719	0.99	0.322	-.0395263	.1202966
D	.1124884	.0532186	2.11	0.035	.0081818	.216795

E	.1345859	.0584942	2.30	0.021	.0199394	.2492323
o#c.s1						
B	.8915306	1.626495	0.55	0.584	-2.296342	4.079403
C	-.1908203	1.632707	-0.12	0.907	-3.390867	3.009226
D	.0108841	1.361484	0.01	0.994	-2.657575	2.679344
E	3.154228	3.149299	1.00	0.317	-3.018284	9.32674
o#c.s2						
B	-1.263883	4.487366	-0.28	0.778	-10.05896	7.531192
C	-5.688532	4.06181	-1.40	0.161	-13.64953	2.27247
D	-8.368114	4.389895	-1.91	0.057	-16.97215	.2359228
E	-11.93704	9.275966	-1.29	0.198	-30.1176	6.243518
o#c.s3						
B	-1.367356	44.50025	-0.03	0.975	-88.58624	85.85153
C	47.74657	41.41526	1.15	0.249	-33.42584	128.919
D	53.17491	56.59758	0.94	0.347	-57.75431	164.1041
E	88.76464	78.11708	1.14	0.256	-64.34203	241.8713
h1	.0006114	.0043033	0.14	0.887	-.0078228	.0090456
h2	-.0090986	.0169327	-0.54	0.591	-.0422861	.024089
h3	.0194867	.0438025	0.44	0.656	-.0663646	.1053381
_cons	1.327417	1.558523	0.85	0.394	-1.727232	4.382066

```
. estimates store mse

. estimates save mse, replace
file mse.ster saved

.
. * ROC regression for prediction of saO2 <= 92 (AUROC model)
. rocreg sa92orless spfrac_reverse, probit ml cluster(pid) ctrlcov(h?) ///
>          roccov(o2 o3 o4 o5 t1 t2 t3 ///
>                         o2t1 o3t1 o4t1 o5t1 ///
>                         o2t2 o3t2 o4t2 o5t2 ///
>                         o2t3 o3t3 o4t3 o5t3) //

Fractional probit regression                          Number of obs = 11,008
                                                      Wald chi2(42) = 740.98
                                                      Prob > chi2   = 0.0000
Log pseudolikelihood = -122.76989                     Pseudo R2     = 0.0234

Covariate control      : linear regression
Control variables      : h1 h2 h3
Control standardization: normal
ROC method             : parametric              Link: probit

  Status     : sa92orless
  Classifiers: spfrac_reverse

  Classifier : spfrac_reverse
  Covariate control adjustment model:
```

Iteration 0: Log pseudolikelihood = **20208.298**
Iteration 1: Log pseudolikelihood = **20255.113**
Iteration 2: Log pseudolikelihood = **20353.459**
Iteration 3: Log pseudolikelihood = **20354.883**
Iteration 4: Log pseudolikelihood = **20354.887**
Iteration 5: Log pseudolikelihood = **20354.887**

(Std. err. adjusted for **902** clusters in **pid**)

	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
casecov						
o2	.025867	.0164458	1.57	0.116	-.0063662	.0581001
o3	.0279542	.0198716	1.41	0.160	-.0109934	.0669018
o4	-.0454313	.0291088	-1.56	0.119	-.1024836	.0116209
o5	.0049804	.0208441	0.24	0.811	-.0358733	.0458342
t1	-.000242	.0003419	-0.71	0.479	-.0009121	.0004281
t2	.0006178	.0007753	0.80	0.426	-.0009018	.0021373
t3	-.0019235	.004087	-0.47	0.638	-.0099339	.0060869
o2t1	.0002925	.0004317	0.68	0.498	-.0005536	.0011386
o3t1	.0006882	.0004562	1.51	0.131	-.0002059	.0015823
o4t1	-.0006076	.0009197	-0.66	0.509	-.0024102	.0011951
o5t1	-.0001355	.0005531	-0.24	0.806	-.0012195	.0009485
o2t2	-.0001591	.0009077	-0.18	0.861	-.0019381	.0016199
o3t2	-.0014436	.0010497	-1.38	0.169	-.003501	.0006137
o4t2	.0011031	.0016575	0.67	0.506	-.0021455	.0043517
o5t2	.0003152	.0011043	0.29	0.775	-.0018492	.0024796
o2t3	-.0006736	.0047298	-0.14	0.887	-.0099439	.0085967
o3t3	.0060477	.0055576	1.09	0.277	-.0048451	.0169404
o4t3	-.0053527	.0078234	-0.68	0.494	-.0206863	.009981
o5t3	-.0019724	.0054261	-0.36	0.716	-.0126073	.0086625
_cons	.027901	.0141961	1.97	0.049	.0000772	.0557249
casesd						
_cons	.0406543	.0021487	18.92	0.000	.0364429	.0448657
ctrlcov						
h1	-.0002079	.0001794	-1.16	0.247	-.0005595	.0001437
h2	.0008196	.0007033	1.17	0.244	-.0005589	.002198
h3	-.0020864	.0018186	-1.15	0.251	-.0056507	.0014779
_cons	.0683772	.0149917	4.56	0.000	.0389941	.0977603
ctrlsd						
_cons	.0376224	.0014241	26.42	0.000	.0348312	.0404137

Status   : **sa92orless**
ROC Model :

(Std. err. adjusted for **902** clusters in **pid**)

	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
spfrac_reverse						
i_cons	.6863004	.347946	1.97	0.049	.0043389	1.368262
o2	.6362668	.4004491	1.59	0.112	-.148599	1.421133
o3	.6876087	.4908214	1.40	0.161	-.2743836	1.649601
o4	-1.117505	.6916292	-1.62	0.106	-2.473074	.238063
o5	.1225073	.5147665	0.24	0.812	-.8864166	1.131431
t1	-.0059525	.0084341	-0.71	0.480	-.0224829	.010578
t2	.0151954	.0190966	0.80	0.426	-.0222333	.0526241
t3	-.0473137	.1005149	-0.47	0.638	-.2443193	.1496918
o2t1	.0071943	.0105772	0.68	0.496	-.0135367	.0279254

o3t1	.0169281	.011273	1.50	0.133	-.0051666	.0390227
o4t1	-.0149448	.0222463	-0.67	0.502	-.0585467	.0286571
o5t1	-.0033329	.0135369	-0.25	0.806	-.0298647	.0231989
o2t2	-.0039142	.0222876	-0.18	0.861	-.0475971	.0397687
o3t2	-.0355099	.0258526	-1.37	0.170	-.0861802	.0151603
o4t2	.0271335	.0401925	0.68	0.500	-.0516424	.1059093
o5t2	.0077537	.0270305	0.29	0.774	-.0452252	.0607326
o2t3	-.01657	.1165375	-0.14	0.887	-.2449792	.2118393
o3t3	.1487582	.1365982	1.09	0.276	-.1189693	.4164857
o4t3	-.1316635	.1901044	-0.69	0.489	-.5042613	.2409342
o5t3	-.048516	.132721	-0.37	0.715	-.3086444	.2116125
s_cons	.9254241	.0570545	16.22	0.000	.8135994	1.037249

```
. estimates store rocreg

. estimates save rocreg, replace
file rocreg.ster saved

.
. * Sensitivity and Specificity models (probabilitys of SpO2<X given case/non-case
> )
.
. melogit sp92orless t? s? c.t1#c.s1 c.t1#c.s2 c.t1#c.s3 c.t2#c.s1 c.t3#c.s1 ///
>         i.o i.o#c.t1 i.o#c.t2 i.o#c.t3 i.o#c.s1 i.o#c.s2 i.o#c.s3 ///
>         h?      ///
>         || SiteNumber: || pid: // sample too small to include RepeatNumber?

Fitting fixed-effects model:

Iteration 0:  Log likelihood = -4575.9795
Iteration 1:  Log likelihood = -4471.5179
Iteration 2:  Log likelihood =  -4469.079
Iteration 3:  Log likelihood =  -4469.063
Iteration 4:  Log likelihood =  -4469.063

Refining starting values:

Grid node 0:  Log likelihood = -4081.0426

Fitting full model:

Iteration 0:  Log likelihood = -4081.0426  (not concave)
Iteration 1:  Log likelihood =  -4075.126
Iteration 2:  Log likelihood = -4067.5446
Iteration 3:  Log likelihood = -4033.1666
Iteration 4:  Log likelihood = -4030.5994
Iteration 5:  Log likelihood = -4030.5357
Iteration 6:  Log likelihood =  -4030.535
Iteration 7:  Log likelihood =  -4030.535

Mixed-effects logistic regression               Number of obs     =     11,008
```

Grouping information

Group variable	No. of groups	Observations per group Minimum	Average	Maximum
SiteNumber	24	52	458.7	2,213
pid	902	1	12.2	28

Integration method: **mvaghermite** Integration pts. = **7**

Log likelihood = **-4030.535** Wald chi2(**42**) = **1496.82**
Prob > chi2 = **0.0000**

sp92orless	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
t1	-.1057397	.1762231	-0.60	0.548	-.4511306	.2396511
t2	.4775985	.3716308	1.29	0.199	-.2507845	1.205982
t3	-1.386967	2.075029	-0.67	0.504	-5.45395	2.680016
s1	-19.63356	9.188903	-2.14	0.033	-37.64348	-1.623638
s2	-37.30123	12.51476	-2.98	0.003	-61.82972	-12.77275
s3	298.1451	123.3091	2.42	0.016	56.46366	539.8266
c.t1#c.s1	.1141253	.1863273	0.61	0.540	-.2510695	.4793202
c.t1#c.s2	.1608242	.207731	0.77	0.439	-.246321	.5679694
c.t1#c.s3	-.1660934	2.086199	-0.08	0.937	-4.254969	3.922782
c.t2#c.s1	-.4917771	.3904573	-1.26	0.208	-1.257059	.2735052
c.t3#c.s1	1.365394	2.180425	0.63	0.531	-2.908161	5.63895
o						
B	13.79919	9.483379	1.46	0.146	-4.787895	32.38627
C	15.90954	9.660172	1.65	0.100	-3.02405	34.84313
D	-6.503452	7.509089	-0.87	0.386	-21.221	8.214092
E	6.079773	8.601095	0.71	0.480	-10.77806	22.93761
o#c.t1						
B	-.0161591	.013419	-1.20	0.229	-.0424599	.0101417
C	.0142754	.014923	0.96	0.339	-.0149732	.0435239
D	-.011533	.016317	-0.71	0.480	-.0435137	.0204477
E	.0097329	.0149565	0.65	0.515	-.0195814	.0390472
o#c.t2						
B	.0363987	.0277328	1.31	0.189	-.0179566	.0907541
C	-.0276328	.0323363	-0.85	0.393	-.0910107	.0357451
D	.0042665	.0337955	0.13	0.900	-.0619715	.0705044
E	-.0216532	.0296978	-0.73	0.466	-.0798599	.0365534
o#c.t3						
B	-.119185	.1495303	-0.80	0.425	-.412259	.1738891
C	.223103	.1788982	1.25	0.212	-.127531	.5737371
D	.0912337	.1833477	0.50	0.619	-.2681212	.4505886
E	.1993423	.1583635	1.26	0.208	-.1110445	.5097291
o#c.s1						
B	-14.75699	10.31847	-1.43	0.153	-34.98081	5.466831
C	-17.44949	10.52868	-1.66	0.097	-38.08533	3.186344
D	4.220199	8.170897	0.52	0.606	-11.79447	20.23486
E	-6.184528	9.35361	-0.66	0.508	-24.51727	12.14821
o#c.s2						
B	12.11973	18.25363	0.66	0.507	-23.65673	47.89619
C	-11.55992	21.15867	-0.55	0.585	-53.03014	29.91031
D	.964567	18.49332	0.05	0.958	-35.28168	37.21082
E	-9.76297	17.88832	-0.55	0.585	-44.82343	25.29749
o#c.s3						
B	45.58428	168.5012	0.27	0.787	-284.672	375.8405
C	277.5542	216.8108	1.28	0.200	-147.3872	702.4955

D	**137.0276**	**201.0334**	**0.68**	**0.495**	**-256.9906**	**531.0459**
E	**107.3039**	**176.1871**	**0.61**	**0.543**	**-238.0164**	**452.6242**
h1	**-.0071599**	**.0111604**	**-0.64**	**0.521**	**-.0290339**	**.0147141**
h2	**.0007052**	**.0463152**	**0.02**	**0.988**	**-.090071**	**.0914814**
h3	**-.0062886**	**.1216782**	**-0.05**	**0.959**	**-.2447735**	**.2321963**
_cons	**18.86135**	**8.63071**	**2.19**	**0.029**	**1.94547**	**35.77723**
SiteNumber						
var(_cons)	**.2320752**	**.1077362**			**.0934277**	**.5764768**
SiteNumber>pid						
var(_cons)	**1.990176**	**.1845819**			**1.659379**	**2.386918**

LR test vs. logistic model: chi2(**2**) = **877.06** Prob > chi2 = **0.0000**

Note: LR test is conservative and provided only for reference.

```
. estimates store sp92orless

. estimates save sp92orless, replace
file sp92orless.ster saved

.
. melogit sp94orless t? s? c.t1#c.s1 c.t1#c.s2 c.t1#c.s3 c.t2#c.s1 c.t3#c.s1 ///
>         i.o i.o#c.t1 i.o#c.t2 i.o#c.t3 i.o#c.s1 i.o#c.s2 i.o#c.s3 ///
>         h?      ///
>         || SiteNumber: || pid: // sample too small to include RepeatNumber?

Fitting fixed-effects model:

Iteration 0:  Log likelihood = -5353.7402
Iteration 1:  Log likelihood = -5300.8352
Iteration 2:  Log likelihood = -5299.1089
Iteration 3:  Log likelihood = -5299.0964
Iteration 4:  Log likelihood = -5299.0964

Refining starting values:

Grid node 0:  Log likelihood = -4855.1747

Fitting full model:

Iteration 0:  Log likelihood = -4855.1747  (not concave)
Iteration 1:  Log likelihood = -4847.7625  (not concave)
Iteration 2:  Log likelihood = -4844.9829
Iteration 3:  Log likelihood = -4811.9495
Iteration 4:  Log likelihood = -4810.0606
Iteration 5:  Log likelihood = -4810.0453
Iteration 6:  Log likelihood = -4810.0453

Mixed-effects logistic regression               Number of obs     =     11,008
```

Grouping information

Group variable	No. of groups	Observations per group Minimum	Average	Maximum
SiteNumber	**24**	**52**	**458.7**	**2,213**
pid	**902**	**1**	**12.2**	**28**

Integration method: **mvaghermite** Integration pts. = **7**

Log likelihood = **-4810.0453** Wald chi2(**42**) = **1765.74**
Prob > chi2 = **0.0000**

sp94orless	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
t1	-.0844519	.1722697	-0.49	0.624	-.4220944	.2531906
t2	.3889543	.3653677	1.06	0.287	-.3271533	1.105062
t3	-.6732196	2.062575	-0.33	0.744	-4.715793	3.369354
s1	-28.07596	11.06004	-2.54	0.011	-49.75324	-6.398691
s2	-20.75212	14.28374	-1.45	0.146	-48.74774	7.243497
s3	128.5705	115.9675	1.11	0.268	-98.72172	355.8627
c.t1#c.s1	.0916269	.1810719	0.51	0.613	-.2632674	.4465212
c.t1#c.s2	.2687394	.197963	1.36	0.175	-.119261	.6567398
c.t1#c.s3	-1.701248	1.79738	-0.95	0.344	-5.224048	1.821552
c.t2#c.s1	-.3999497	.38074	-1.05	0.294	-1.146186	.3462869
c.t3#c.s1	.642711	2.149228	0.30	0.765	-3.569699	4.855121
o						
B	-1.387787	12.34566	-0.11	0.910	-25.58484	22.80927
C	-8.379601	11.97582	-0.70	0.484	-31.85178	15.09258
D	-14.02047	9.86516	-1.42	0.155	-33.35582	5.314893
E	-29.58732	10.46066	-2.83	0.005	-50.08985	-9.084801
o#c.t1						
B	-.0127184	.0123463	-1.03	0.303	-.0369168	.01148
C	.0063146	.0123277	0.51	0.608	-.0178472	.0304764
D	.0173941	.0141353	1.23	0.218	-.0103106	.0450988
E	.001447	.0132671	0.11	0.913	-.024556	.02745
o#c.t2						
B	.0285962	.0258041	1.11	0.268	-.021979	.0791714
C	-.0039078	.0270868	-0.14	0.885	-.0569969	.0491813
D	-.0294177	.0286336	-1.03	0.304	-.0855384	.0267031
E	-.0208141	.0267903	-0.78	0.437	-.0733221	.0316939
o#c.t3						
B	-.1043352	.1410227	-0.74	0.459	-.3807347	.1720642
C	.0737683	.1527135	0.48	0.629	-.2255447	.3730813
D	.1291923	.1553688	0.83	0.406	-.175325	.4337096
E	.2318788	.1454958	1.59	0.111	-.0532878	.5170453
o#c.s1						
B	1.678223	13.37753	0.13	0.900	-24.54125	27.8977
C	8.885133	12.98626	0.68	0.494	-16.56746	34.33773
D	13.57761	10.69997	1.27	0.204	-7.393947	34.54917
E	33.38603	11.33876	2.94	0.003	11.16246	55.6096
o#c.s2						
B	-1.676523	20.35504	-0.08	0.934	-41.57167	38.21863
C	-54.3099	20.80651	-2.61	0.009	-95.08991	-13.52989
D	-26.274	18.20276	-1.44	0.149	-61.95076	9.402756
E	-83.96162	18.39109	-4.57	0.000	-120.0075	-47.91575
o#c.s3						
B	52.49066	163.2856	0.32	0.748	-267.5432	372.5245
C	533.7389	179.0305	2.98	0.003	182.8456	884.6321

D	**300.7558**	**167.3246**	**1.80**	**0.072**	**-27.1943**	**628.706**
E	**608.8025**	**156.2037**	**3.90**	**0.000**	**302.6488**	**914.9562**
h1	**-.0153697**	**.0101005**	**-1.52**	**0.128**	**-.0351663**	**.0044269**
h2	**.0436233**	**.0417021**	**1.05**	**0.296**	**-.0381113**	**.125358**
h3	**-.1144713**	**.1092075**	**-1.05**	**0.295**	**-.3285142**	**.0995715**
_cons	**28.70342**	**10.36044**	**2.77**	**0.006**	**8.39734**	**49.0095**
SiteNumber						
var(_cons)	**.1678519**	**.0791173**			**.0666363**	**.4228066**
SiteNumber>pid						
var(_cons)	**1.674943**	**.1445833**			**1.41424**	**1.983704**

LR test vs. logistic model: chi2(**2**) = **978.10** Prob > chi2 = **0.0000**

Note: LR test is conservative and provided only for reference.

```
. estimates store sp94orless

. estimates save sp94orless, replace
file sp94orless.ster saved

.
.
. log close
      name:  <unnamed>
       log:  S:\Stats\7. Confidential\Trials\UK-ROX\EXAKT\Regression models output
> s.smcl
  log type:  smcl
 closed on:  19 Aug 2025, 15:33:51
```