Pathway probabilities, total cost and time to treatment initiation for suspected TB patients

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Introduction

Posterior distributions are generated to provide DES model input parameters.

Model

Cost and time

Independent Bayesian linear regressions on cost and time to starting treatment with covariates of sputum smear results ('Not taken', 'Negative', 'Positive') and TB status (missing, 'E;PTB', 'PTB').

For individual i,

$$c_i \sim N(\phi_i^c, \lambda); \;\; t_i \sim N(\phi_i^t, \tau)$$

$$\phi_i^c = \mu_c + \gamma_{tb_i}^c + \beta_{ssm_i}^c; \;\; \phi_i^t = \mu_t + \gamma_{tb_i}^t + \beta_{ssm_i}^t$$

We used uninformative priors. So, the posterior distribution of the expected cost and time are

$$\hat{\phi}_{tb,ssm}^c = \hat{\mu_t} + \hat{\gamma}_{tb}^c + \hat{\beta}_{ssm}^c; \;\; \hat{\phi}_{tb,ssm}^t = \hat{\mu_t} + \hat{\gamma}_{tb}^t + \hat{\beta}_{ssm}^t.$$

Pathway probabilities

Separate multinomial models were fit to counts of sputum smear microscopy results for pulmonary only (p), and both pulmonary and extra-pulmonary (ep) cases.

$$X_{ep} \sim Multi(p_{ep}, N_{ep}); \;\; X_p \sim Multi(p_p, N_p)$$

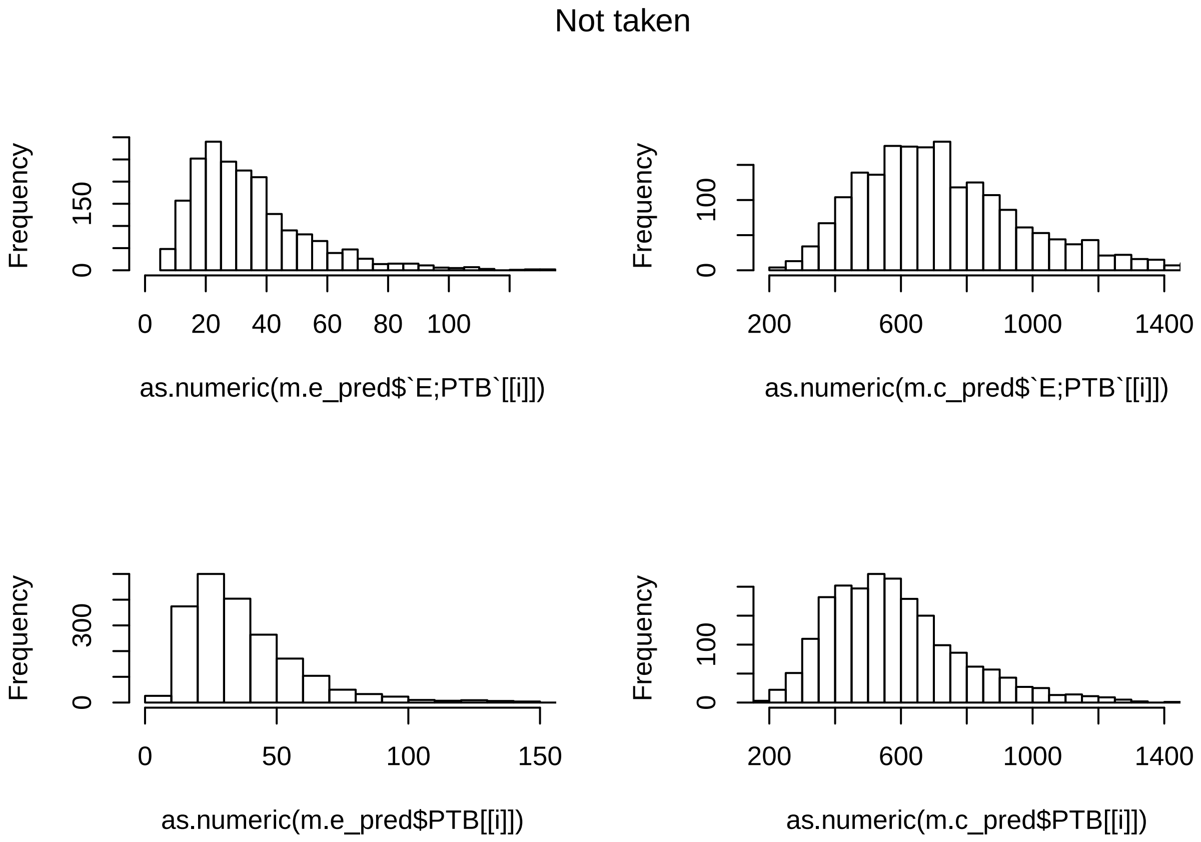
The posterior distributions for p_{ep}, p_p are reported.

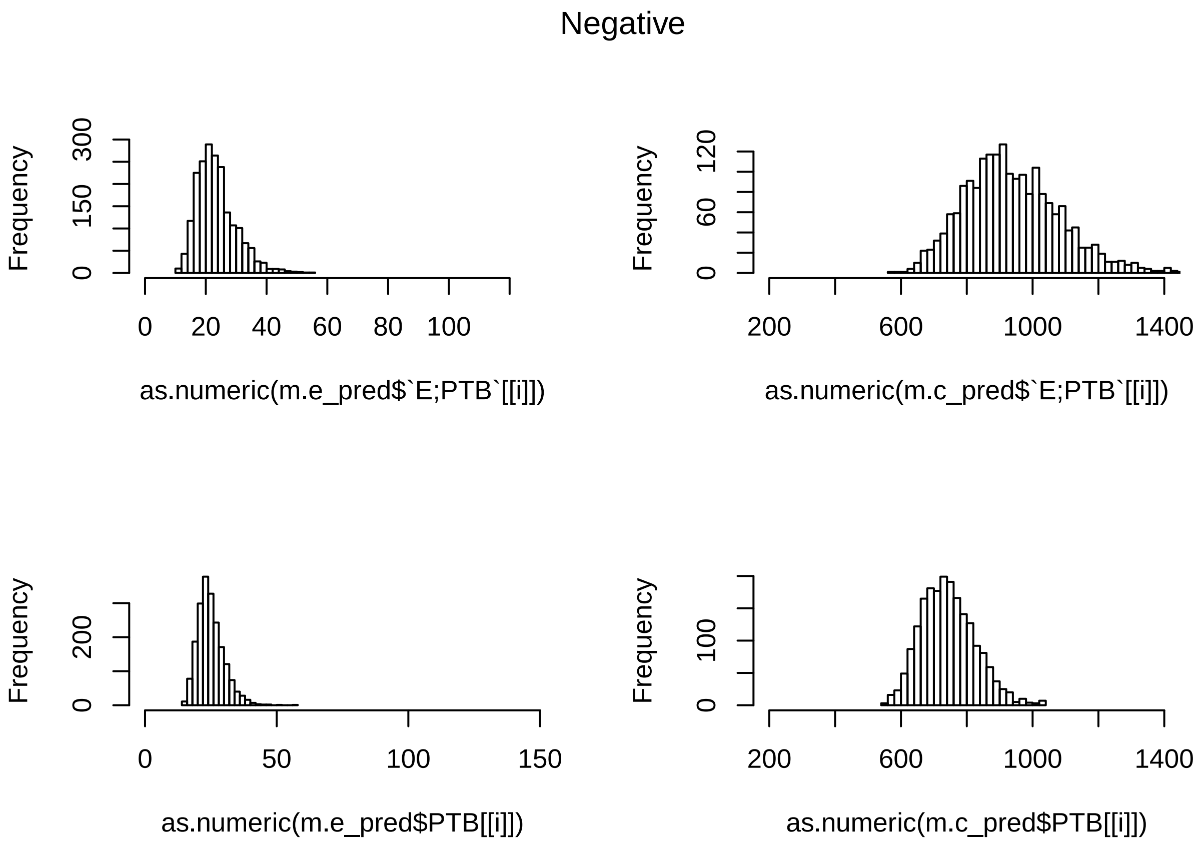
Data

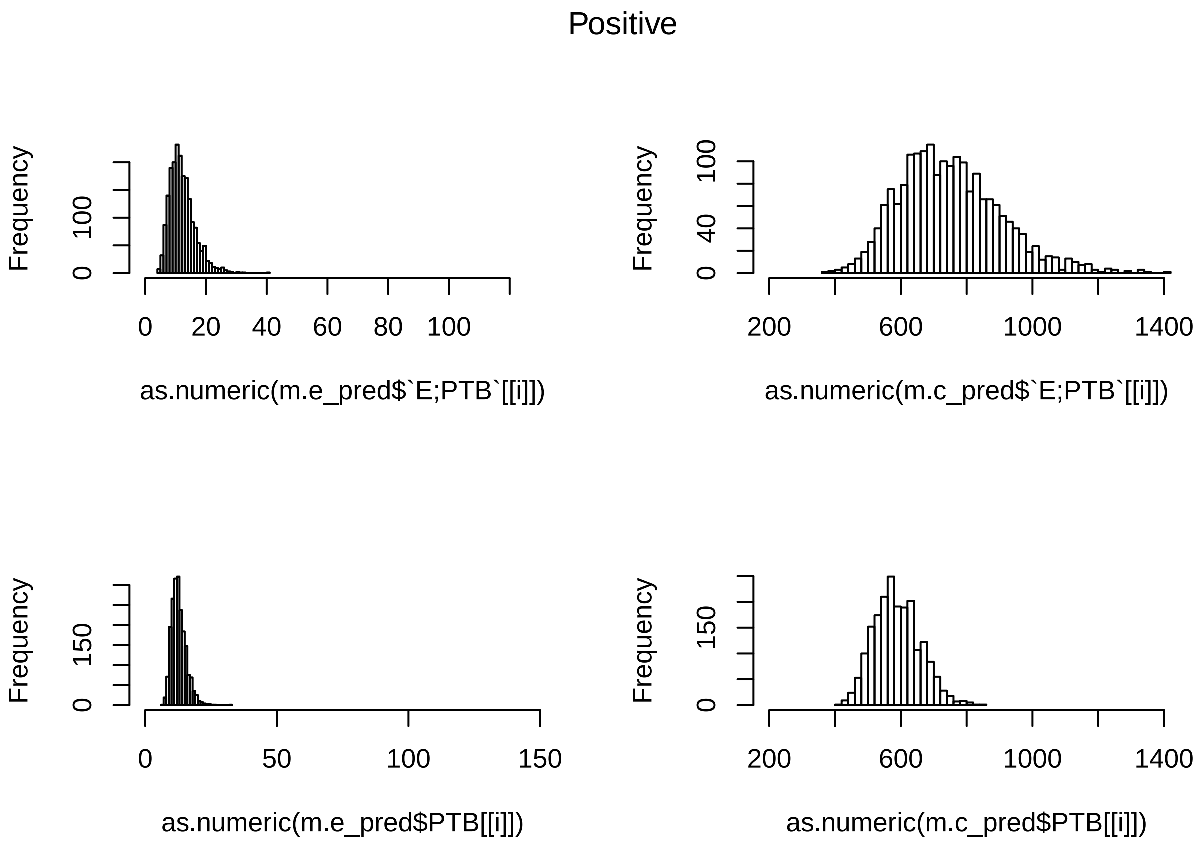
The IDEA dataset for Dosanjh category 1 and 2 patients only.

Output

Posterior distributions and summary statistics for mean cost and time to starting treatment.

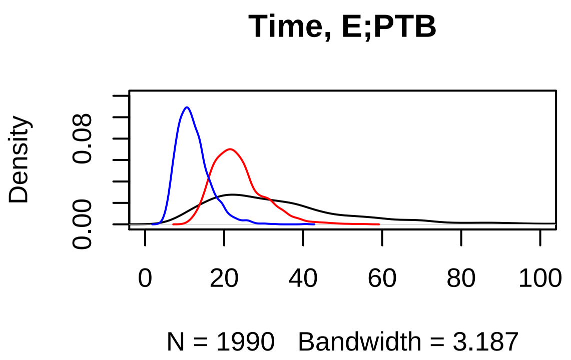


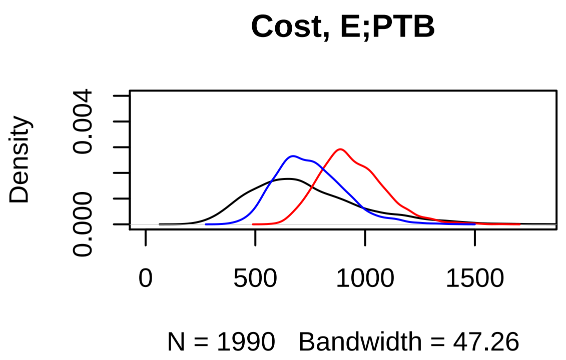

Negative
Frequency
0
150
300
0
20
40
60
80
100
as.numeric(m.e_pred$`E;PTB`[[i]])
Frequency
0
60
120
200
600
1000
1400
as.numeric(m.c_pred$`E;PTB`[[i]])
Frequency
0
200
0
50
100
150
as.numeric(m.e_pred$PTB[[i]])
Frequency
0
100
200
600
1000
1400
as.numeric(m.c_pred$PTB[[i]])

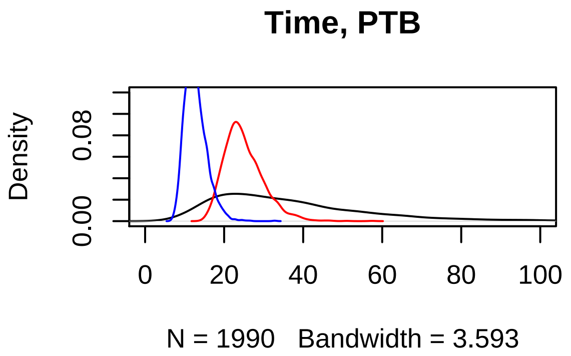


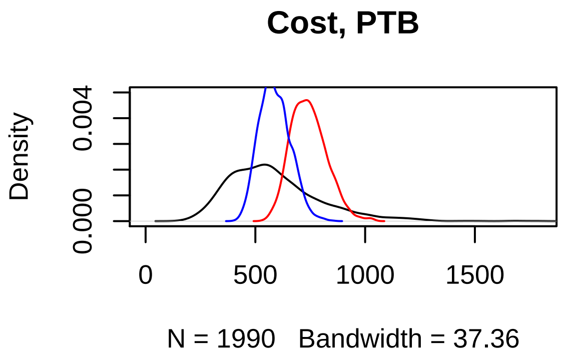
All smear results on same plot.

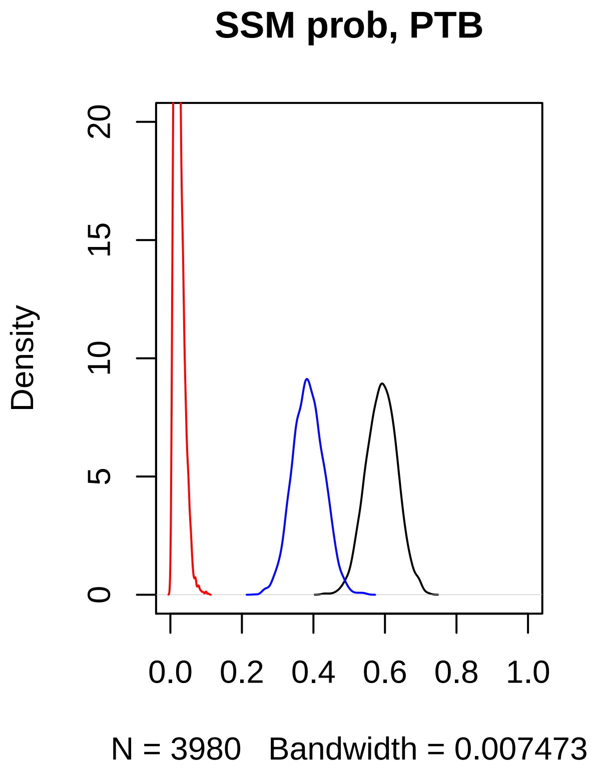
Black - Not taken, Red - Negative, Blue - Positive.

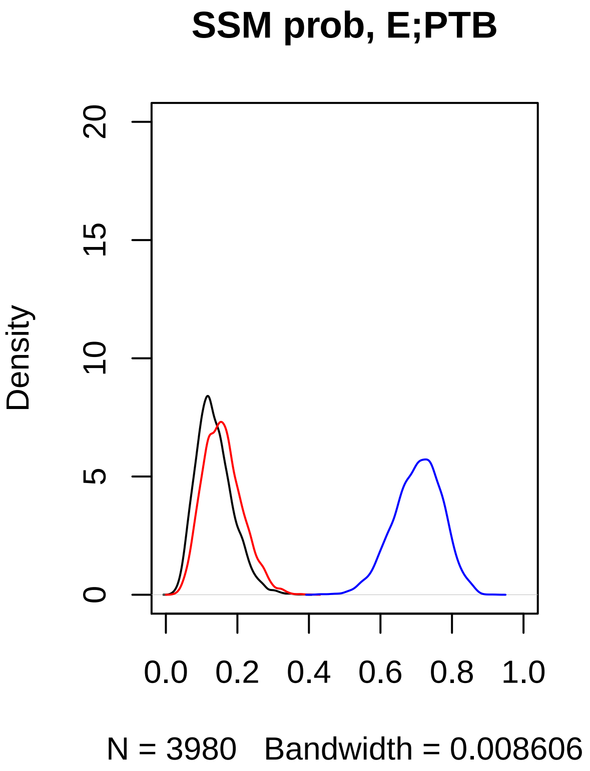

Time, E;PTB
Density
0.00
0.08
0
20
40
60
80
100
N = 1990 Bandwidth = 3.187


Cost, E;PTB
Density
0.000
0.004
0
500
1000
1500
N = 1990 Bandwidth = 47.26


Time, PTB
Density
0.00
0.08
0
20
40
60
80
100
N = 1990 Bandwidth = 3.593


Cost, PTB
Density
0.000
0.004
0
500
1000
1500
N = 1990 Bandwidth = 37.36





ssm	tb status	mean prob	sd prob	mean cost	sd cost	mean time	sd time
Not taken	E;PTB	0.14	0.05	731.76	261.20	34.61	20.29
Not taken	PTB	0.59	0.04	581.95	206.12	37.59	23.00
Negative	E;PTB	0.16	0.05	939.68	147.53	23.48	6.47
Negative	PTB	0.02	0.01	743.43	81.75	24.97	4.95
Positive	E;PTB	0.70	0.04	749.46	153.40	12.18	4.15
Positive	PTB	0.39	0.04	588.51	69.60	12.76	2.76