MiWaves MRT Analyses Results

1. Primary Aims Analysis (Part 1) with Proximal Cannabis Use Outcome

Frequencies of Baseline Covariates

Firstly, there are two baseline records for three IDs. For these three IDs, the second baseline record is retained. The two baseline submissions are likely due to the survey timing out and participants re-submitting.

1.) *CANN_IMPORTANCE_BL*: "Right now, how important is it to you to cut back your cannabis use?" Response: 0-10 likert scale: 0=Not at all, 10=Very

Other options:

- *CANN_LIKELY_BL*: "Right now, how likely are you to cut back your use of cannabis or cannabis products?" Response: scale of 0=Not at all - 10=Very
- *CANN_CONF_BL*: "How confident are you that you could cut back your use of cannabis or cannabis products if you wanted to?" Response: scale of 0=Not at all - 10=Very

2.) *CANNHOURS_BL*: "During the past month, how many hours, on an average day, did you use cannabis?" Response: Drop down selection 0-24

3.) *CANNWAKE_BL*: "During the past month, how soon did you typically use any cannabis products after you woke up for the day?" Response: 1=Within 5 minutes, 2=6-30 minutes, 3=31 minutes to almost 1 hour, 4=1 to almost 2 hours, 5=2 to almost 4 hours, 6=4 or more hours

Other options:

- *CANNDAYS_BL*: "How many days in the past month have you used cannabis?" Response: Drop down selection 0-31
- *CANNMONTH_BL*: "In the past month, how many times per day did you use cannabis?" Response: Drop down selection 0-24

Note: If *CANNDAYS_BL*>0, then displays *CANNHOURS_BL*, *CANNWAKE_BL*, *CANNMONTH_BL*, *CANN_IMPORTANCE_BL*, *CANN_LIKELY_BL*, and *CANN_CONF_BL*.

Table 1: Frequency of baseline variable cannabis importance ($N = 120 EAs$)

cann_importance_bl	count	percent
0	4	3.3
1	5	4.2
2	13	10.8
3	11	9.2
4	18	15.0
5	24	20.0
6	13	10.8
7	17	14.2
8	11	9.2
9	1	0.8
10	3	2.5

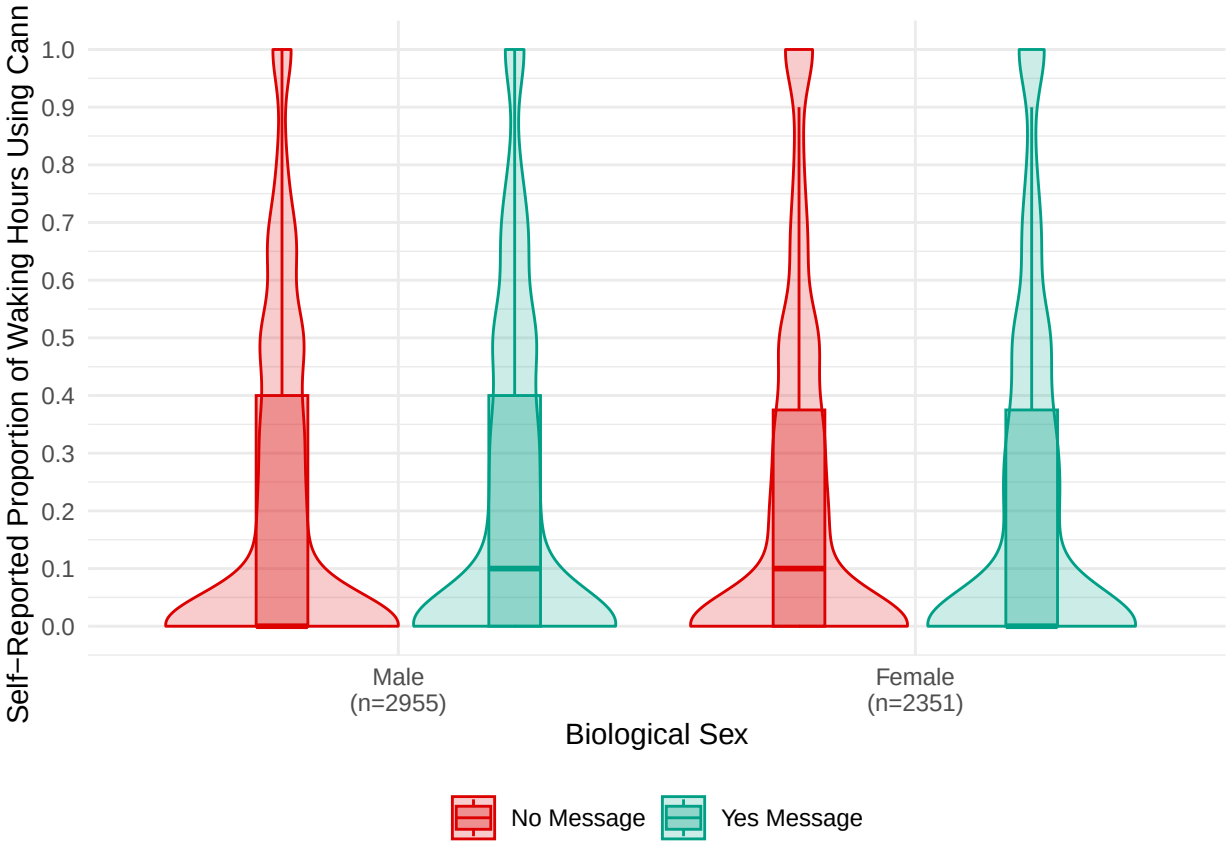
Table 2: Frequency of baseline variable cannabis hours ($N = 120 EAs$)

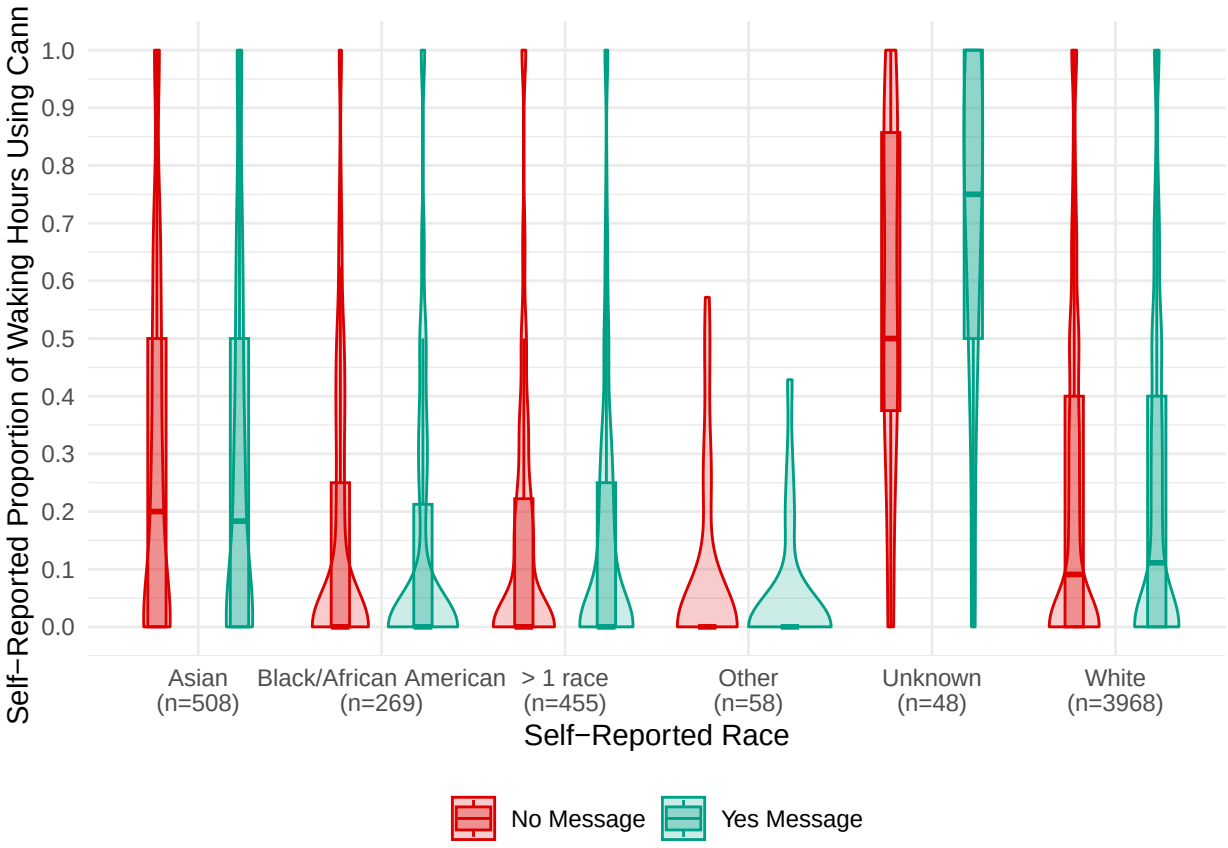
cannhours_bl	count	percent
0	2	1.7
1	16	13.3
2	34	28.3
3	28	23.3
4	13	10.8
5	8	6.7
6	8	6.7
7	1	0.8
8	2	1.7
10	2	1.7
11	1	0.8
13	1	0.8
14	1	0.8
17	1	0.8
24	2	1.7

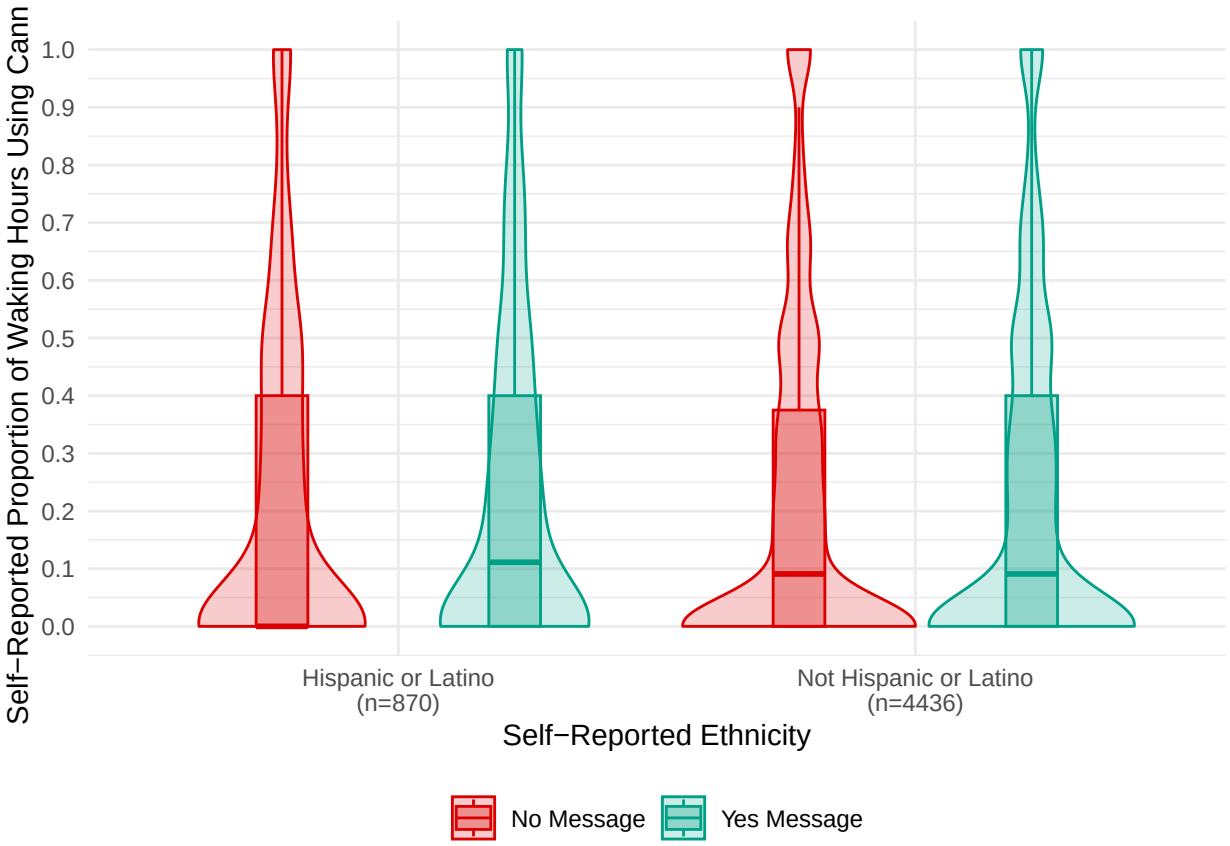
Table 3: Frequency of baseline variable cannabis after waking ($N = 120 EAs$)

cannwake_bl	count	percent
0	10	8.3
1	4	3.3
3	18	15.0
4	6	5.0
5	13	10.8
6	69	57.5

Distribution of Self-Reported Proportion of Waking Hours with Cannabis Use by Baseline Candidate Moderators






Self−Reported Proportion of Waking Hours Using Cann
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Hispanic or Latino
(n=870)
Not Hispanic or Latino
(n=4436)
Self−Reported Ethnicity
No Message
Yes Message

Preliminary Causal Excursion Effect Estimates

Research Question 1: Examine whether, on average, there is a proximal effect of delivering an intervention message on proximal cannabis use

Proximal outcome ($Y_{i,t+1}$): Proportion of waking hours with self-reported cannabis use (0-1, treated as continuous)

Treatment indicator ($A_{i,t}$): Binary (1=Yes message, 0=No message)

Covariates:

- time of day – binary (AM=0, PM=1),
- day of the week – binary (weekday=1, weekend [Fri-Sun]=0),
- prior cannabis use – proportion of waking hours averaged over past 4 decision points (i.e., approximately 48 hours),
- prior intervention engagement – score that ranges from 0-3 averaged over past 6 decision points (i.e., approximately 72 hours),
- baseline motivation to change – importance of cutting back cannabis use on a scale from 0 (Not at all) to 10 (Very) at time of baseline survey,
- baseline cannabis use – self-reported average hours of cannabis use in prior day (range: 0-24), during the past month, and
- baseline time to cannabis use - self-reported time to cannabis use, since awaking (1=Within 5 minutes, 2=6-30 minutes, 3=31 minutes to almost 1 hour, 4=1 to almost 2 hours, 5=2 to almost 4 hours, 6=4 or more hours), during the past month.

Candidate Moderators: We explore whether the effect of the intervention message on proximal cannabis use varries by each of the candidate moderators listed below.

1. *timeofday*: time of day – binary (AM=1, PM=0),
2. *interact_A_message*: interaction type A message vs. no message – binary (interaction type A message=1, no message=0),

- 2.2. *interact_B_message*: interaction type B message vs. no message – binary (interaction type B message=1, no message=0),
- 2.3. *interact_C_message*: interaction type C message vs. no message – binary (interaction type C message=1, no message=0),

3. *prop_awakeuse_prior*: prior cannabis use – operationalized the same as the proximal outcome, at the prior decision point,

- 3.2. *cov_prop_awakeuse_48hrs*: prior cannabis use over the past 4 decision points,

4. *wks_since_interv_start*: time since under treatment (i.e., since intervention start) in weeks,
5. *week_day_binary1*: day of the week – binary (weekday=1, weekend [Fri-Sun]=0),
6. *prior_interv_engag*: prior intervention engagement – operationalized the same as the proximal outcome, at the prior decision point,

- 6.2. *cov_interv_engag_72hrs*: over past 6 decision points,

7. *prior_sent_message*: prior delivery of a message – binary (yes message=1, no message=0), at the prior decision point,

- 7.2. *prior_sent_messages_48hrs*: number of messages sent over past 4 decision points,

8. *short_message*: short message vs. no message – binary (short message=1, no message=0),

- 8.2. *long_message*: long message vs. no message - binary (long message=1, no message=0),

9. *sex*: baseline demographic of biological sex (female=1,male=0),
10. *race*: baseline demographic of race (white=1, 0=non-white),
11. *ethnicity*: baseline demographic of ethnicity (1=not hispanic or latino, 0=hispanic or latino),
12. *canndays_bl*: baseline cannabis use severity that is the number of days used cannabis in past month (range: 0-31), which reflects cannabis use frequency,

- 12.2. *dsmsc_tot_bl*: baseline cannabis use severity that is the count of number of symptoms endorsed (range: 0-11), which reflects diagnostic severity,

13. *cann_importance_bl*: baseline motivation to change that is the importance of cutting back cannabis use on a scale from 0 (Not at all) to 10 (Very) at time of baseline survey, and
14. *phq2_tot_bl*: baseline mental health, which is the sum across two item scale PHQ-2 ("Over the last two weeks, how often have you been bothered by any of the following problems? Little interest or pleasure in doing things" and "Over the last two weeks, how often have you been bothered by any of the following problems? Feeling down, depressed, or hopeless" with response values of 0=Not at all, 1= Several days, 2=More than half the days, and 3=Nearly every day).

Term	Estimate	95% LCL	95% UCL	StdErr	Wald	df1	df2	p-value
Main Effect Model (no covars)								
Intercept	0.009	-0.008	0.026	0.009	1.078	1	118	0.301
Main Effect Model (with covars)								
Intercept	0.009	-0.003	0.020	0.006	2.283	1	111	0.134
Moderation Effect Model 1								
Intercept	0.008	-0.005	0.022	0.007	1.501	1	110	0.223
timeofday	0.001	-0.021	0.022	0.011	0.007	1	110	0.934
Moderation Effect Model 2								
Intercept	0.012	-0.005	0.029	0.009	1.837	1	111	0.178
Moderation Effect Model 2.2								
Intercept	0.011	-0.006	0.027	0.008	1.554	1	111	0.215
Moderation Effect Model 2.3								
Intercept	0.001	-0.015	0.018	0.008	0.031	1	111	0.861
Moderation Effect Model 3								
Intercept	0.007	-0.013	0.027	0.010	0.478	1	110	0.491
prop_awakeuse_prior	0.023	-0.041	0.088	0.032	0.521	1	110	0.472
Moderation Effect Model 3.2								
Intercept	-0.001	-0.013	0.010	0.006	0.068	1	110	0.794
cov_prop_awakeuse_48hrs	0.046	-0.018	0.109	0.032	2.040	1	110	0.156
Moderation Effect Model 4								
Intercept	0.015	-0.015	0.045	0.015	0.991	1	109	0.322

(continued)

Term	Estimate	95% LCL	95% UCL	StdErr	Wald	df1	df2	p-value
wks_since_interv_start	-0.003	-0.013	0.007	0.005	0.267	1	109	0.606
Moderation Effect Model 5								
Intercept	0.009	-0.010	0.028	0.010	0.973	1	110	0.326
week_day_binary1	-0.001	-0.028	0.025	0.013	0.009	1	110	0.926
Moderation Effect Model 6								
Intercept	0.015	-0.014	0.044	0.015	1.101	1	110	0.296
prior_interv_engag	-0.003	-0.017	0.010	0.007	0.240	1	110	0.625
Moderation Effect Model 6.2								
Intercept	0.013	-0.037	0.062	0.025	0.247	1	110	0.620
cov_interv_engag_72hrs	-0.002	-0.028	0.023	0.013	0.025	1	110	0.874
Moderation Effect Model 7								
Intercept	0.006	-0.007	0.020	0.007	0.851	1	109	0.358
prior_sent_message	0.004	-0.019	0.027	0.011	0.113	1	109	0.737
Moderation Effect Model 7.2								
Intercept	0.002	-0.025	0.028	0.014	0.012	1	109	0.912
prior_sent_messages_48hrs	0.003	-0.011	0.017	0.007	0.187	1	109	0.666
Moderation Effect Model 8								
Intercept	0.009	-0.006	0.024	0.008	1.395	1	111	0.240
Moderation Effect Model 8.2								
Intercept	0.007	-0.006	0.021	0.007	1.130	1	111	0.290
Moderation Effect Model 9								
Intercept	0.014	-0.026	0.054	0.020	0.482	1	109	0.489
sex	-0.003	-0.027	0.020	0.012	0.088	1	109	0.768
Moderation Effect Model 10								
Intercept	-0.002	-0.025	0.022	0.012	0.020	1	109	0.888
white_race	0.014	-0.013	0.041	0.014	1.063	1	109	0.305
Moderation Effect Model 11								
Intercept	0.030	-0.029	0.088	0.029	1.012	1	109	0.317
ethnicity	-0.011	-0.042	0.020	0.016	0.530	1	109	0.468
Moderation Effect Model 12								
Intercept	0.003	-0.024	0.031	0.014	0.053	1	109	0.818
canndays_bl	0.000	-0.001	0.001	0.001	0.124	1	109	0.726
Moderation Effect Model 12.2								
Intercept	0.002	-0.023	0.027	0.012	0.026	1	109	0.872
dsmsc_tot_bl	0.001	-0.003	0.006	0.003	0.349	1	109	0.556
Moderation Effect Model 13								
Intercept	0.034	0.009	0.059	0.013	7.143	1	110	0.009
cann_importance_bl	-0.005	-0.010	-0.001	0.002	4.858	1	110	0.030
Moderation Effect Model 14								
Intercept	0.012	-0.006	0.030	0.009	1.681	1	109	0.197
phq2_tot_bl	-0.001	-0.006	0.004	0.003	0.266	1	109	0.607

Notes: Standard errors are not yet adjusted to account for RL uncertainty.
Moderation Effect Models include the covariates: time of day, day of week,
prior cannabis use, prior intervention engagement, baseline motivation to change,
baseline cannabis use, and baseline time to cannabis use.

2. Primary Aims Analysis (Part 2) with Proximal Intervention Engagement Outcome

Preliminary Causal Excursion Effect Estimates

Research Question 1: Investigate whether, on average, there is a proximal effect of delivering an intervention message on proximal intervention engagement.

Proximal outcome ($Y_{i,t+1}$): Intervention engagement (discrete: 0-3, treated as continuous)

Treatment indicator ($A_{i,t}$): Binary (1=Yes message, 0=No message)

Covariates:

- time of day – binary (AM=0, PM=1),
- day of the week – binary (weekday=1, weekend [Fri-Sun]=0),
- prior intervention engagement – score that ranges from 0-3 averaged over past 6 decision points (i.e., approximately 72 hours),
- prior human-touch engagement – binary (1=yes, 0=no) for any email, text, or phone call made by study staff (after 72 hours, 120 hours, and 168 hours [1 week]) over past 4 decision points (i.e., approximately 48 hours).

Term	Estimate	95% LCL	95% UCL	StdErr	Wald	df1	df2	p-value
Main Effect Model (no covars)								
Intercept	-0.008	-0.058	0.041	0.025	0.108	1	118	0.743
Main Effect Model (with covars)								
Intercept	-0.005	-0.053	0.044	0.024	0.036	1	114	0.851

Notes: Standard errors are not yet adjusted to account for RL uncertainty.
Model with covariates adjusts for the following: time of day, day of week,
prior intervention engagement, and prior human-touch engagement.