

EN SHOULD Temporal factors associated with response rates in an SMS ambulatory assessment paradigm Erin Walsh, Dr.Jay Brinker



University undergraduates...

n = 23

n = 62



...Completed a short 6 item questionnaire 20 times 10 times across two days 20 times in one day



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...Using text messaging (we send them a prompt, they reply with answers)

Bootstrapped 95% confidence intervals, 500 replicates.







- Scheduling occasion (here, 1 through 4)
- Time of day (when the prompt was sent)

Prompt 1			Promot 2	Promot 3		Prompt 4
	0.45	0.20		10.00	10.15	40.20
9:00	9:15	9:30	9:40	10:00	10:15	10:30



- Scheduling occasion (here, 1 through 4)
- Time of day (when the prompt was sent)
- Time since last prompt





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	R1			R2	R3	R4
Prompt 1			Prompt 2	Prompt 3		Prompt 4
9:00	9:15	9:30	9:45	10:00	10:15	10:30



- Scheduling occasion (here, 1 through 4)
- Time of day (when the prompt was sent)
- Time since last prompt
- Time since last response





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- Time since last prompt
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Temporal factors associated with response rates in an SMS ambulatory assessment paradigm VARIABLES OF INTEREST

DVs

- Scheduling occasion (here, 1 through 4)
- Time of day (when the prompt was sent)
- Time since last prompt

IVs

- Time since last response

- Response delay (in minutes)



VARIABLES OF INTEREST

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IVs

- Scheduling occasion (here, 1 through 4)
- Time of day (when the prompt was sent)
- Time since last prompt
- Time since last response

DVs

Temporal factors associated with response rates in an SMS ambulatory assessment paradigm

- Response delay (in minutes)
- Partial complete (at least one question attempted)
- Basic complete (all five mandatory questions attempted)
- Full complete (all six questions attempted)





Predictor or grouping variable?

- Day 1 or day 2
- One through twenty

Time of day?

- Continuous variable

Sampling Frequency

- Time between prompts
- Time since last response

DV ~ IV + (1 | participant)

Temporal factors associated with response rates in an SMS ambulatory assessment paradigm

MODEL INTERPRETATION

Logistic multilevel modelling

Scheduling occasion

Predictor or grouping variable?

- Day 1 or day 2
- One through twenty

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Full complete \sim day1 + (1 | participant)



1111

Temporal factors associated with response rates in an SMS ambulatory assessment paradigm

 R_{20}

 R_{20}

AB194L

AB201F

[...]

[...]

 R_{2}

 R_{2}

R₁

R

= -2.36, 95% CI [-4.41,-1.75] = 0.133, 95% CI [-0.587,0.767]

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Logistic multilevel modelling

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Full complete \sim day1 + (1 | participant)







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Sampling Frequency

- Time between prompts
- Time since last response

DV ~ Day + (1 | participant)



1.00

Proportion of total possible responses 0.22

0.00

Day 1



Day 2

Schedualling Occasion

STUDY 1: SCHEDULING OCCASION

Full response: SD_{part}=3.12, 95% CI [2.80, 4.74] *b*=0.13, 95% CI [-0.58, 0.76]

Basic response: SD_{part}=3.32, 95% CI [3.02,4.91] *b*=0.06, 95% CI [-0.66, 0.68]

Partial response: SD_{part}=1.53, 95% CI [1.27,2.40]) *b*=0.05, 95% CI [-0.54, 0.72].

Response delay: SD_{part}=1.53, 95% CI [1.27,2.40]) *b*=0.05, 95% CI [-0.54, 0.72].

 $DV \sim Day + (1 | participant)$





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 $DV \sim Day + (1 | participant)$







Predictor or grouping variable?

- Day 1 or day 2
- One through twenty



DV ~ occasion + IV + (1 | participant) DV ~ IV + (1 | participant) + (1 | occasion)



Predictor or grouping variable?

- Day 1 or day 2
- One through twenty

Time of day? - Continuous variable

Sampling Frequency - Time between prompts - Time since last response

 $DV \sim$ schedule occasion + (1 | participant)





Schedualling Occasion



Full response: SD_{part}=4.55, 95% CI [3.83, 8.94] b_{eleventh}=2.12, 95% CI [0.03, 5.78]

Basic response: SD_{part}=4.27, 95% CI [3.5, 9.22] b_{fifth}=1.96, 95% CI [0.56, 4.87] b_{eleventh}=1.97, 95% CI [0.032, 5.17] **Partial response:** SD_{part}=1.85, 95% CI [1.179, 4.7] *b*=nothing x 20



Response delay: SD_{nart}=0.45, 95% CI [0.42, 0.72] b=nothing x 20

STUDY 2: SCHEDULING OCCASION

Full response: SD_{part}=3.21, 95% CI [2.84, 4.75] b= nothing x 20

Basic response: SD_{nart}=3.21, 95% CI [3.07, 4.93] $b = nothing \times 20$

Partial response: SD_{nart}=1.56, 95% CI [1.32, 2.57 b=nothing x 20

Response delay: SD_{part}=0.45, 95% CI [0.396, 0.63] b=nothing x 20



Conclusion: Scheduling occasion is best thought of as a grouping variable

Scheduling occasion

Predictor or grouping variable?

- Day 1 or day 2
- One through twenty

Time of day?

- Continuous variable

Sampling Frequency

- Time between prompts
- Time since last response



Predictor or grouping variable?

- Day 1 or day 2
- One through twenty

Time of day?

- Continuous variable

Sampling Frequency - Time between prompts - Time since last response



STUDY 1: TIME OF DAY

Full response: SD_{part}=3.09, 95% CI [2.88, 5.26] SD_{occ}=0.58, 95% CI [0.27, 0.97] *b*=-0.05, 95% CI [-0.18, 0.03]

Basic response:

SD_{part}=3.27, 95% CI [3.04, 4.98] SD_{occ}=0.53, 95% CI [0.23, 0.89] *b*=-0.05, 95% CI [-0.17, 0.05]

Partial response:

SD_{part}=1.51, 95% CI [1.29, 2.49] Sd_{occ} = 0.48, 95% CI [0.19, 0.81] *b*=-0.03, 95% CI [-0.12, 0.08]

Response delay:

SD_{part}=0.848, 95% CI [0.728, 1.07] SD_{occ}=0.402, 95% CI [0.291, 0.786] *b*=-0.111, 95% CI [-0.202, -0.007]



STUDY 1: TIME OF DAY

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Response delay:

SD_{part}=0.848, 95% CI [0.728, 1.07] SD_{occ}=0.402, 95% CI [0.291, 0.786] *b*=-0.111, 95% CI [-0.202, -0.007]

Full response: SD_{nart}=4.13, 95% CI [0.36, 2.27] SD_{occ}=7.1, 95% CI [3.62, 14.43] *b*=-0.037, 95% CI [-0.36, 0.18] **Basic response:**

Delay (in minutes

Proportion of total possible responses

SD_{nart}=3.85, 95% CI [0.43, 2.26] SD_{occ}=5.91, 95% CI [3.40, 14.8] *b*=-0.08, 95% CI [-0.42, 0.11]

Partial response:

SD_{nart}=1.70, 95% CI [0.26, 1.75] Sd_{occ} = 2.38, 95% CI [1.01, 4.12] *b*=-0.04, 95% CI [-0.24, 0.094]

Time of Day

Response delay: SD_{nart}=0.78, 95% CI [0.38, 1.57]

Temporal factors associated with response rates in an SMS ambulatory assessment paradigm

b=-0.07, 95% CI [-0.387, 0.138]

STUDY 2: TIME OF DAY

Full response: SD_{part}=3.09, 95% CI [2.88, 5.26] SD_{occ}=0.58, 95% CI [0.27, 0.97] *b*=-0.05, 95% CI [-0.18, 0.03]

Basic response:

SD_{part}=3.27, 95% CI [3.04, 4.98] SD_{occ}=0.53, 95% CI [0.23, 0.89] *b*=-0.05, 95% CI [-0.17, 0.05]

Partial response:

SD_{part}=1.51, 95% CI [1.29, 2.49] Sd_{occ} = 0.48, 95% CI [0.19, 0.81] *b*=-0.03, 95% CI [-0.12, 0.08]

Response delay:

SD_{part}=0.848, 95% CI [0.728, 1.07] SD_{occ}=0.402, 95% CI [0.291, 0.786] *b*=-0.111, 95% CI [-0.202, -0.007]

Conclusion: Time of day operationalised in a continuous sense does not clearly influence response behaviour

Scheduling occasion

Predictor or grouping variable?

- Day 1 or day 2
- One through twenty

Time of day?

- Continuous variable

Sampling Frequency - Time between prompts

- Time since last response

Predictor or grouping variable?

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Time of day? - Continuous variable

Sampling Frequency

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Predictor or grouping variable?

- Day 1 or day 2
- One through twenty

Time of day?

- Continuous variable

Sampling Frequency

- Time between prompts
- Time since last response

Temporal factors associated with response rates in an SMS ambulatory assessment paradigm

STUDY 1: TIME BETWEEN PROMPTS

Full response:

SD_{part}=3.13, 95% CI [2.95, 6.16] SD_{occ}=0.19, 95% CI [0.34, 1.05] *b*=<0.001, 95% CI [-0.005, 0.002]

Basic response:

SD_{part}=3.29, 95% CI [3.09, 5.53] SD_{occ}=0.61, 95% CI [0.28, 1.03] b=0.001, 95% CI [-0.003, 0.003]

Partial response:

SD_{part}=1.53, 95% CI [1.34, 1.55] Sd_{occ}= 0.50, 95% CI [0.20, 0.80] b=0.001, 95% CI [-0.001,0.005]

Response delay:

SD_{part}=0.683, 95% CI [0.578, 1.004] SD_{occ}=0.22, 95% CI [0.096, 0.361] *b*=0.28, 95% CI [0.195,0.384]

Temporal factors associated with response rates in an SMS ambulatory assessment paradigm

Full response: SD_{part}=3.13, 95% CI [2.95, 6.16] SD_{occ}=0.19, 95% CI [0.34, 1.05] *b*=<0.001, 95% CI [-0.005, 0.002]

Basic response:

SD_{part}=3.29, 95% CI [3.09, 5.53] SD_{occ}=0.61, 95% CI [0.28, 1.03] *b*=0.001, 95% CI [-0.003, 0.003]

Partial response:

SD_{part}=1.53, 95% CI [1.34, 1.55] Sd_{occ} = 0.50, 95% CI [0.20, 0.80] *b*=0.001, 95% CI [-0.001,0.005]

Response delay:

SD_{part}=0.683, 95% CI [0.578, 1.004] SD_{occ}=0.22, 95% CI [0.096, 0.361] b=0.28, 95% CI [0.195,0.384]

STUDY 2: TIME BETWEEN PROMPTS

Full response: SD_{part}=4.092, 95% CI [0.453, 2.301] SD_{occ}=7.301, 95% CI [3.634, 14.363] *b*=-0.005, 95% CI [-0.026, 0.016]

Temporal factors associated with response rates in an SMS ambulatory assessment paradigm

Basic response:

SD_{part}=3.835, 95% CI [0.554, 2.317] SD_{occ}=0.294, 95% CI [3.445,15.192] *b*=-0.004, 95% CI [-0.022,0.018]

Partial response:

SD_{part}=1.662, 95% CI [0.313, 1.748] Sd_{occ}= 2.364, 95% CI [1.004, 4.097] *b*=-0.004, 95% CI [-0.015, 0.022]

Response delay:

SD_{part}=0.774, 95% CI [0.171, 0.604] SD_{occ}=0.088, 95% CI [0.334, 1.324] *b*=0.007, 95% CI [0.004,0.011]

Full response: SD_{part}=3.13, 95% CI [2.95, 6.16]

SD_{occ}=0.19, 95% CI [0.34, 1.05] b=<0.001, 95% CI [-0.005, 0.002]

Basic response:

SD_{part}=3.29, 95% CI [3.09, 5.53] SD_{occ}=0.61, 95% CI [0.28, 1.03] b=0.001, 95% CI [-0.003, 0.003]

Partial response:

SD_{part}=1.53, 95% CI [1.34, 1.55] Sd_{occ}= 0.50, 95% CI [0.20, 0.80] b=0.001, 95% CI [-0.001,0.005]

Response delay:

SD_{part}=0.683, 95% CI [0.578, 1.004] SD_{occ}=0.22, 95% CI [0.096, 0.361] *b*=0.28, 95% CI [0.195,0.384]

Temporal factors associated with response rates in an SMS ambulatory assessment paradigm

STUDY 1: TIME SINCE LAST RESPONSE

Full response:

SD_{part}=3.76, 95% CI [3.67, 11.87] SD_{occ}=0.87, 95% CI [0.31, 1.63] *b*=-0.002, 95% CI [-0.008, 0.004]

Basic response:

SD_{part}=4.41, 95% CI [4.32, 15.11] SD_{occ}=SD=0.93, 95% CI [0.27, 1.77] *b*=-0.002, 95% CI [-0.01, 0.004]

Response delay:

SD_{part}=0.68, 95% CI [0.578,1.004] SD_{occ}=SD=0.22, 95% CI [0.096, 0.36] *b*=0.289, 95% CI [0.195, 0.384]

Temporal factors associated with response rates in an SMS ambulatory assessment paradigm

STUDY 1: TIME SINCE LAST RESPONSE

Full response:

SD_{part}=3.76, 95% CI [3.67, 11.87] SD_{occ}=0.87, 95% CI [0.31, 1.63] *b*=-0.002, 95% CI [-0.008, 0.004]

Basic response:

SD_{part}=4.41, 95% CI [4.32, 15.11] SD_{occ}=SD=0.93, 95% CI [0.27, 1.77] *b*=-0.002, 95% CI [-0.01, 0.004]

Response delay:

SD_{part}=0.68, 95% CI [0.578,1.004] SD_{occ}=0.22, 95% CI [0.096, 0.36] *b*=0.289, 95% CI [0.195, 0.384]

STUDY 2: TIME SINCE LAST RESPONSE

Full response: SD_{part}=6.746, 95% CI [<0.001,53.551] SD_{occ}=<0.001, 95% CI [<0.001, 6.113] *b*=-0.007, 95% CI [-0.560, 0.021]

Temporal factors associated with response rates in an SMS ambulatory assessment paradigm

Basic response:

SD_{part}=6.156 , 95% CI [0.401, 24.254] SD_{occ}=<0.001, 95% CI [<0.001, 5.799] *b*=-0.004, 95% CI [-0.251, 0.029]

Response delay:

SD_{part}=0.793, 95% CI [0.160, 0.606] SD_{occ}=0.117, 95% CI [0.365, 1.330] *b*=0.291, 95% CI [0.116, 0.510] Full response: SD_{part}=3.76, 95% CI [3.67, 11.87] SD_{occ}=0.87, 95% CI [0.31, 1.63] b=-0.002, 95% CI [-0.008, 0.004]

Basic response:

SD_{part}=4.41, 95% CI [4.32, 15.11] SD_{occ}=SD=0.93, 95% CI [0.27, 1.77] *b*=-0.002, 95% CI [-0.01, 0.004]

Response delay:

SD_{part}=0.68, 95% CI [0.578,1.004] SD_{occ}=0.22, 95% CI [0.096, 0.36] *b*=0.289, 95% CI [0.195, 0.384]

Conclusion: more frequent sampling was not associated with a lower response rate, but with a significantly (but slightly) longer response delay.

Scheduling occasion

Predictor or grouping variable?

- Day 1 or day 2
- One through twenty

Time of day?

- Continuous variable

Sampling Frequency

- Time between prompts
- Time since last response

- Expect slightly longer response delays later in the day, and if sampling more frequently

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- Think about scheduling occasion as a grouping variable for analysis

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- Think about scheduling occasion as a grouping variable for analysis

DV ~ IV + (1 | participant) + (1 | occasion)

Keep in mind...

- This only applies to a university student sample

(very likely the time of day is related to being at work in non-student sample)

- The highest sampling frequency was every 15 minutes (there may well be an exhaustion effect at higher sampling frequencies)

- Expect slightly longer response delays later in the day, and if sampling more frequently

- Think about scheduling occasion as a grouping variable when analysing repeated measures data

DV ~ IV + (1 | participant) + (1 | occasion)

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- This only applies to a university student sample

(very likely the time of day is related to being at work in non-student sample)

- The highest sampling frequency was every 15 minutes (there may well be an exhaustion effect at higher sampling frequencies)

Acknowledgement: Heartfelt thanks to Dr. Busby Grant for providing the resources and support needed for this project