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Cyclic models in ESM Research

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Background

Ecological Sampling Method (or Momentary Assessments, ESM or EMA) aims to capture dynamic processes in daily life. Mostly, only linear relations or linear trends are modelled.

Cyclic models provide a clear means to understand the dynamic patterns during a day or a week and to estimate the parameters of these patterns.

The Cyclic Model

$$Y = b_0 + b_1 \cos\left(\frac{2\pi}{P}(T - b_2)\right).$$

P is the period of the cyclic process (e.g. 10 assessment, 7 days). T is the indicator of time.

The parameter b_1 represents the maximum value (amplitude) and b_2 the time for which the process reaches its maximum. The b_0 is the intercept that represents the average value of the pattern.

After rewriting there are only two parameters necessary to test the model.

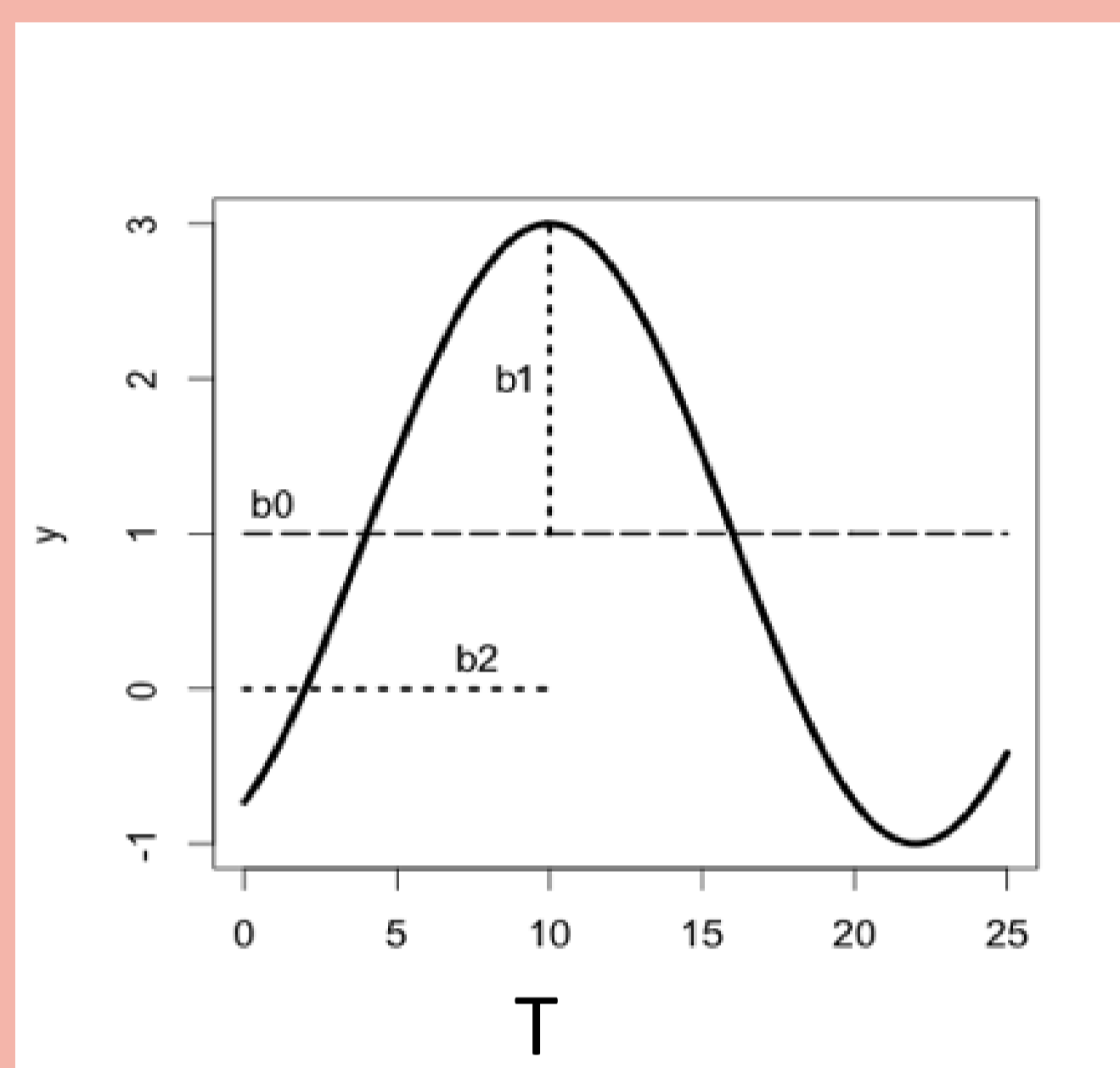
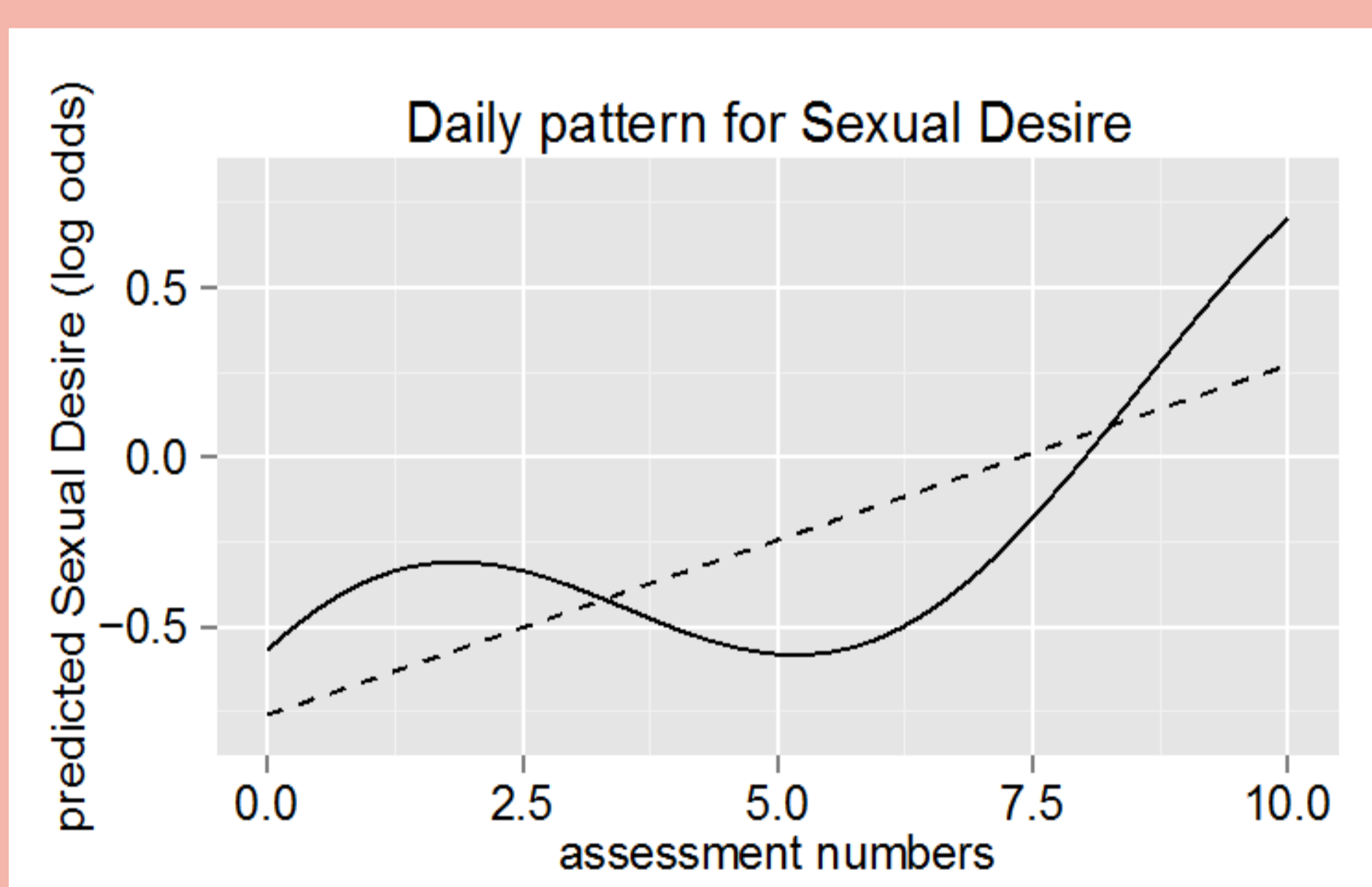


Figure. Model with cyclic and linear terms Data set 1.



Predicted values from model with cyclic and linear terms (solid line) and linear term only (dashed line).

Research Question

Are cyclic models an improvement in ESM research?

Method

Secondary analyses on two data sets. Variables measured during the day: positive and negative affects, intimacy and sexual desire

Data

Data set 1 (van Lankveld et al., 2016): 10 daily random assessments of sexual activity during a week

Data set 2 (Bolman et al., 2012): daily random assessments of smoking behaviour during a week

Analysis

Multilevel analyses (*lme* package in the R environment) were used to analyse the data sets, comparing the models with and without cyclic terms.

RESULTS

Model	AIC	Deviance	Dif	LR Test	p
Data set 1					
<i>Sexual desire</i>					
1. Combi	19019	18989			
1a. (S fixed)	19015	18993	4	1a vs. 1	.380
2. Cyclic	19168	19148	159	2 vs. 1	.000
3. Linear	19130	19118	129	3 vs. 1	.000
<i>Intimacy</i>					
1. Combi	17420	17390			
1a. (S fixed)	17415	17393	4	1a vs. 1	.540
2. Cyclic	17509	17489	113	2 vs. 1	.000
3. Linear	17606	17594	229	3 vs. 1	.000
Data set 2					
<i>Positive affect</i>					
1. Combination	7942	7912			
1a. (S fixed)	7937	7915	4	1a vs. 1	.540
2. Cyclic	7960	7940	28	2 vs. 1	.000
3. Linear	7946	7934	22	3 vs. 1	.008
<i>Negative affect</i>					
1. Combi	7286	7256			
1a. (S fixed)	7283	7261	5	1a vs. 1	.320
2. Cyclic	7321	7301	45	2 vs. 1	.000
3. Linear	7303	7291	35	3 vs. 1	.000

Literature

Van Lankveld, J., Jacobs, N., Thewissen, V., Dewitte, M., Verboon, P. (2016). *The Link Between Intimacy, Sexual Desire, and Sexual Activity in Daily Life. Experience Sampling Research Among Women and Men Living in Steady Relationship*. Paper presented at ICP2016, Yokohama, Japan.

Bolman, C., Jacobs, N., Thewissen, V., Boonen, V., Soons, K., & Verboon, P. (2012). *Predicting (intentional) non-smoking after a quit-attempt: an experience sampling study*. *Psychology & Health* (Vol. Suppl 1, 164).

CONCLUSIONS

Cyclic models can be useful tools to analyse ESM data.

They may improve the fit of the research model and give insight into the dynamic processes.

Cyclic models can be used in a variety of situations.

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