Ambulatory Assessment – An innovative method for investigating the dynamics of eating and physical activity

Ulrich Ebner-Priemer

The method: Ambulatory Assessment

Definition
The use of computer-assisted methodology to assess self-reports, behaviors and physiological processes while the participant undergoes normal daily activities.

Related terms
- Ambulatory Monitoring
- Ecological Momentary Assessment
- Experience Sampling Method

Key features
real-time, real-life, within-subject processes


Agenda

I. Real-time

SLEEP QUESTIONNAIRE

Date: __________

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all of the questions.

1) During the past month, when have you usually gone to bed at night?

UNUSUAL BED TIME: ______ AM or PM (Circle One)

2) During the past month, how long (in minutes) has it taken you to fall asleep at night?

NUMBER OF MINUTES: ______

3) During the past month, when have you usually gotten up in the morning?

UNUSUAL GETTING UP TIME: ______ AM or PM (Circle One)

4) During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)

HOURS OF SLEEP PER NIGHT: ______

I. Real-time

- Gathering information retrospectively is problematic.
- Retrospective ratings are subject to multiple systematic distortions:
  - Affective valence effect (Kihlstrom, 2000)
  - Mood congruent memory effect (Kihlstrom, 2000)
  - Peak end rule & duration neglect (Kahneman et al., 1993)
  - Digit bias (Shiffman & Paty, 2005)

Added value of real time?

Rumination:
repetitively focusing on one’s symptoms of distress, and their possible causes and consequences.

- Rumination as risk factor for depression

Zamoscik, Huffziger, Ebner-Priemer, Kuehner & Kirsch, 2014, SCAN
Huffziger, Ebner-Priemer, Zamoscik, Reinhard, Kirsch & Kuehner, 2013, PNEC

DMN activity (cognitive vulnerability)

Rumination in daily life

Cortisol

Real time measures of rumination are significantly related to physiological processes (morning peak, PCC-PHG) but not trait measures of rumination.

Silvia et al., 2007; n=2113
Real-time vs. paper-pencil diary

Kraepelin (1912)

Stone et al. 2002

1.) What did you do yesterday?
2.) What did determine your behaviour most?
   - nationality
   - time
   - gender
   - others

Key features
I. real-time
II. real-life
III. repeated/within-subject perspective
   a) real-time analyses
      i. Activity triggered e-diary
      ii. GPS triggered e-diary
   b) real-time intervention
IV. Downsides
   - reactivity
   - generalizability


Agenda

Office hypertension
- 10% of the patients do show heightened blood pressure when assessed by a physician in his office or in the laboratory, but not in daily life
- Ambulatory BP predicts cardiovascular mortality, whereas office (clinic) BP has a low prognostic value (Salles, et al., 2008).

Teeth brushing
Participants brush their teeth 1 minute longer in the lab, when they are asked to brush their teeth as normal (Trabó et al., 2011).

Sloths (Bradypus variegatus) sleep in captivity 15.85h, but in tropical rainforest 9.63
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www.ambulatory-assessment.org

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Time course of physical activity and mood

- The psychological consequences and determinants of physical activity change over time
- To understand the (positive an negative) (short) term consequences/determinants of physical activity, it is necessary to assess them over time. => to have a within-subject perspective
- Life is a time-dependent process; to understand life it is necessary to assess and analyze psychological processes as time dependent

Koenemann et al., 2011

III. Repeated / within-subject perspective

Classical parameters in studying determinants of PA
- Age
- Gender
- Marital status
- General physical health
- Belief in importance of PA
- Emotional distress
- Advice of physician about getting more exercise

It’s not possible to explain within-subject processes (up and down of eating/physical activity) by between subject parameters.

Koenemann et al., 2011

III. Repeated / within-subject perspective

Ecological Momentary Assessment of Urban Adolescents’ Technology Use and Cravings for Unhealthy Snacks and Drinks: Differences by Ethnicity and Sex

Nicholas Bresciani, Ginger Lockhart, PhD, Jenny L. Gerwert, PhD, Tanya Bennett, Saul Stewart, PhD Kim D. Reynolds, PhD
It’s not possible to explain within-subject processes (up and down of eating/physical activity) by between subject parameters.

Schüz et al., 2015

EIective instability is a defining criterion for BPD

E-diary

Intensity of distress

Time-based design

every 15 minutes

every 24-hour (daytime)

Subjects

n= 50 HC and 50 BPD

Ebner-Priemer et al. (2007).


EJPA

III. Repeated / within-subject perspective

III. Repeated / within-subject perspective

Research report

The time-varying association between perceived stress and hunger within and between days

Jimi Huh *, Marija Shyklo *, Stelten Keller *, Genevieve Dunton *, Susan M. Scherrande *

Huh et al., 2015

III. Repeated / within-subject perspective

III. Repeated / within-subject perspective

Research report

Stimulus control and affect in dietary behaviours. An intensive longitudinal study

Benjamin Schüz *, Jodie Bower *, Stuart G. Ferguson *

Schüz et al., 2015

III. Repeated / within-subject perspective

Dietary behaviour

Predictor

Parameter estimate

Meal

Negative affect

-.56 (.38)

Arrestal

-.61 (.39)

Availability of food

1.85 (.17)**

Having company

-.48 (.15)**

Observing others eat

1.76 (.36)**

Engaging in activity

-.99 (.14)**

Snack

Negative affect

-.24 (.10*)

Arrestal

-.26 (.11)*

Availability of food

1.49 (.23)**

Having company

-.10 (.13)**

Observing others eat

1.48 (.15)**

Engaging in activity

-.87 (.22)**

Trull et al., 2008

EBP or MD?
Affective instability

BPD  
PTSD  
ED  
HC

Santangelo et al., 2014, J. of Abnormal Psychology

III. Added value of within-subject processes

In clinical psychology within-subject processes like “stress reactivity” or “reward experience” show added value in predicting treatment success (Geschwind et al., 2011; Wichers et al., 2012), relapse (Leemput et al., 2014, Wichers et al., 2010)….

III. Added value of within-subject processes

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Physical Activity and Mood:

Time based design

Physical activity

- 1 week, sampling frequency of 32 Hz

Mood

- 1 week, sampling frequency of ???

Ebner-Priemer et al., 2013, Frontiers in Psychology
**Agenda**

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**Stress and the city**

- Negative effects of cities on mental health: risk for schizophrenia, mood and anxiety disorders is increased.
- Lederbogen et al. (2011) showed specific impacts of urbanity on neural social stress processing in humans
- Question which components of the environment account for these findings is still open: population density, noise and pollution.

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**GPS-triggered e-diaries**

- Location is tracked via GPS
- Changes in location are tracked in real-time environmental context and mapped
- Significant changes on the maps trigger the diary in real-time in participants everyday life.

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**GPS-triggered e-diaries**

- Continuous monitoring and online analyses of physical activity
- Episodes of activity or inactivity are identified online and trigger a beep which alarms participants to fill out an eDiary

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Interventions to increase awareness

102 subjects under treatment for depressive symptoms

- E-diary feedback
- TAU + e-diary + feedback
- E-diary assessment
- Control group
- TAU + e-diary

等于 Feedback on the within-subject relation between social interaction and mood

Kramer et al., 2014

Results

behavior is triggered in the moment by cues like the location (bar) or social partner (friend).

Ambulatory assessment with real-time intervention can detect high-risk situations and offer support when help is needed.

349 patients with alcohol dependency were randomized when entering residential treatment to a) treatment as usual (n = 179) or b) TAU plus smartphone APP (n = 170) as continuing care.

The APP group showed:
- fewer risky drinking days (primary outcome)
- greater abstinence than control group.

=> Real-time intervention worked.

Kramer et al., 2014, JAMA Psychiatry

interventions (in real time): the idea

Smartphone APP

- Audio-guided relaxation

Interactive features:
- If a patient was at a high-risk location (a bar she used too frequent), GPS triggered an alert asking the patient if she wanted to be there.

Gustafson et al., 2014, JAMA Psychiatry

interventions (in real time)

Results

- fewer risky drinking days (primary outcome)
- greater abstinence than control group.

=> Real-time intervention worked.

Gustafson et al., 2024, JAMA Psychiatry
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 downsides / problems ??
- timely resolution is limited
- number of items is limited
- total assessment period is limited
- battery power is limited
- …

Revisiting the Affect Regulation Model of Binge Eating: A Meta-Analysis of Studies Using Ecological Momentary Assessment
Alison A. Taxt-Mat
Paula E. Keel

.... Overall, results fail to support the affect regulation model of binge eating and challenge reductions in NA as a maintenance factor for binge eating.

Time based design:
Event based sampling: pre – post binge episode

13:07 Binge eating < 500 kcal
13:22 Binge eating 500 kcal – 1000 kcal
13:37 Binge eating > 1000 kcal
Essen / brechen
guilt

13:52 Binge eating > 1000 kcal

disgust

distress
urge to vomit

14:05 Binge eating > 1000 kcal
disgust

14:22 Self induced vomiting

disgust

14:37 Self induced vomiting

disgust

downsides / problems ??

- timely resolution is limited => The time based design must fit the process of interest
- number of items is limited
- total assessment period is limited
- battery power is limited
- ...

pre episode     post episode
Reactivity
- difficult to investigate
- no difference for 4 / 8 / 12 assessments per day (Stone, 2002)
- high compliance (> 90%)
- Work of Stacy Clemes 2008, 2009, …

Generalizability
- Studies with old participants (age > 80)
- Studies with difficult patients

Summary
Key features
I. real-time => added value
II. real-life
III. repeated/within-subject perspectives => added value
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Credits
Borderline Research Unit, CIMH:
  M. Bohus, N. Kleindienst, C. Schmahl, ……
Rumination, CIMH:
  C. Kühner, S. Huffziger, P. Kirsch
Sport Psychology:
  M. Kanning, W. Schlicht, …
Division of Biostatistics, CIMH, StatLab, University of Heidelberg:
  I. Rheinländer, N. Kleindienst, M. Limberger, G. Sawitzki, P. Kuppens, M. Houben
KIT:
  Philip Santangelo, S. Koudela