Journal of Psychosomatic Research 150 (2021) 110623

Contents lists available at ScienceDirect

Journal of Psychosomatic Research

journal homepage: www.elsevier.com/locate/jpsychores

Editorial

Putting the spotlight on individual-specific psychosomatic processes: An introduction to the special issue on intensive longitudinal research methods in psychosomatic research

ARTICLE INFO

Keywords
Ecological momentary assessments
Experience sampling methods
Time series analyses

Psychosomatic research has traditionally focused on experimental and cohort studies to investigate body-mind interactions, and on case-control studies to study the importance of such interactions for disease processes. While these studies have provided important insights into psychosomatic medicine, their results have also highlighted the limitations of such methodologies. These include the questionable ecological validity of the results of such studies for daily life. In addition, the temporal resolution of their assessment schedules often does not fit the dynamic within-person processes that we aim to study. Finally classical research designs lead to results on a group level, while clinical practice has to deal with individuals.

New approaches have been developed in response to these limitations. These include Ecological Momentary Assessments (EMA) or Experience Sampling Methods (ESM), two terms that are used interchangeably. In EMA or ESM studies data are repeatedly collected once or more per day, for an extended period of time. These repeated assessments take place in the daily life of individuals and patients, allowing to study within-person dynamics and increasing ecological validity. A surge of statistical method development has followed, aiming to build insightful person-specific models of the resulting intensive longitudinal or time series data. In this editorial we will introduce the special issue on Intensive longitudinal research methods and illustrate their potential to advance the field.

1. From between-person associations to within-person processes

Many of us perform research with the aim to improve health or care, but results based on our classical designs and analytic strategies apply to the average person or patient or reveal between-person associations only. Such results cannot be easily translated to a specific individual. The paper of Frumkin et al. [1] provides an example of this problem by studying the association between emotional and physical pain. At the group or between-person level, these authors found a significant positive correlation between the pain types suggesting that emotional pain may be a component of chronic pain syndromes, but time series analyses of the data of individual patients showed that emotional and physical pain might represent different constructs in the individuals studied.

Another important issue with our classical study designs is that we often cannot distill temporal relations between symptoms, since the limited number of studies that are longitudinal often have a too low temporal resolution. This is illustrated by the papers of Romano et al. [2], studying processes with a temporal resolution of a few hours, en Metcalf et al. [3], studying day-to-day processes. The paper of Romano et al. uses time series analysis to study associations between somatic symptoms and binge eating. Their results show that, at the within- and between-person level, more severe somatic symptoms were associated with binge eating. They also showed that momentary stomachache/pain severity prospectively predicted binge eating a few hours later, illustrating how time series methods can be used to explore symptom triggers by studying the temporal order of an association [2].

Metcalf et al. studied the association between poor sleep and problem anger in veterans, an association that could theoretically be bidirectional: poor sleep induces problem anger, or vice versa [3]. Knowing the temporal order might have treatment implications, but normal longitudinal designs do not have the temporal resolution to approach this question. Their results clearly suggest a unidirectional association from poor sleep to anger problems, which points to the importance of detection of and early intervention on sleep problems in veterans.

2. Data collection

One obvious challenge when using intensive longitudinal research methods is data collection. Whereas intensive longitudinal data are ecologically more valid, they might also pose a burden on the participants since the statistical analysis methods require a high number of repeated measurements. This implies that studies either need to implement many measurements each day or continue assessments during a longer time period. The choice between these options is complicated due to the absence of temporal information on many dynamic processes. For example, it seems logical that studies on sleep use daily assessments, but

https://doi.org/10.1016/j.jpsychores.2021.110623
Received 31 August 2021; Received in revised form 14 September 2021; Accepted 15 September 2021
Available online 22 September 2021
0022-3999/© 2021 Elsevier Inc. All rights reserved.

how often do we need to assess anxiety or pain to capture meaningful variations? A previous study in experts on diary studies from different fields showed that there is no gold standard design, and provided guidelines for the specific choices that have to be made [4].

The increased possibilities for using electronic diaries on smartphones decrease the burden and facilitate the inclusion of large samples. The largest sample in this issue comes from a study by Groen, van Gils and co-authors [5], who recruited 767 participants through an online crowdsourcing study, and assessed somatic and anxiety symptoms thrice daily for 30 days using smartphone diaries. One of their findings was that somatic symptoms predicted the persistence of feeling anxious, but only in a minority of people from the general population. This paper was written by two shared first authors, one from a clinical background and one from a statistical background. Their team work was awarded with the 2021 Young investigator award of the European Association of Psychosomatic Medicine (EAPM) for this paper [6].

Participant burden of the data collection can also be decreased by using sensor-based assessments, such as continuous glucose monitors in the study of Zink et al. [7]. These authors calculated mean interstitial glucose during time windows in which they also assessed affect and fatigue, and showed that individual relative increases in interstitial glucose relate to subsequent higher positive affective and lower fatigue in healthy young participants. With the increasing development of various sensors assessing biomarkers but also markers related to social interactions, the possibilities of collecting large samples of intensive longitudinal data will increase.

One remaining issue for diaries is which items are best to assess the concepts to be measured. While we are used to validated scales in epidemiological and experimental studies, such concepts are less well developed and tested in diary studies. In this regard, the ESM item repository is worth mentioning (https://osf.io/kg376/). The aim of this project is to support the further development, transparency and reproducibility of ESM research by creating an open repository of existing ESM items, and to psychometrically validate these items. We encourage all researchers with ESM data to contribute their items to this repository in order to bring the field forward.

3. Analysis

To fully focus on diverse forms of within-person dynamics and processes, statistical techniques are needed that allow their quantification and can accommodate the intricacies of intensive longitudinal data. A key question here is how to account for the inherent serial dependence, even when this dependence is not the feature or interest. To this end, a wide range of time series analysis approaches have been developed and made available through software in the last decades. This statistical development frenzy raises two important and complementary questions. The first question pertains to how applied researchers should navigate this wide methods field, which challenges they may encounter and how they can resolve them. The second question pertains to how sensitive the obtained conclusions are to the different ways in which researchers handle these statistical challenges.

In response to the first question, the paper of Ariens et al. [8] provides an overview of a very popular family of techniques, the family of vector autoregressive (VAR) methods, which also forms the backbone of many of the papers in this special issue. After introducing the basic VAR model for analyzing the data of a single individual, the paper points out that this basic model implies a number of assumptions which often do not hold for specific data sets, or do not correspond to the research questions at hand. The authors focus on five specific challenges and list proposed solutions. The five issues pertain to differences in measurement intervals, the number and nature of the variables used in the analysis, whether or not the process characteristics are stable themselves, concurrent relationships among the variables, and how to extend the model to incorporate the data of multiple individuals.

The second question is addressed by the paper of Bastiaansen et al. [9]. These authors used a crowdsourcing data analysis strategy, by inviting multiple expert teams to independently answer the same research question using the intensive longitudinal data of a single patient. They then evaluated which statistical analyses were conducted and how much the obtained answer to the question varied across these analyses. The results reveal a large diversity in both statistical choices and obtained conclusions, emphasizing the strong need for formulating and disseminating best practice recommendations.

4. Heterogeneity in within-person processes

One conclusion that recurs across the special issue is that "one size fits all' thinking about within-person processes will probably not get us very far. Many papers in the issue indeed reveal extensive and meaningful individual differences in the found processes. Such differences can be quantitative or qualitative in nature, depending on the statistical method used [8]. The paper of Mak et al. [10] for instance revealed quantitative individual differences in the concurrent relations between pain and affect, with the strength of the concurrent relations being associated to the level of depressive and anxiety symptoms. On the other hand, Kelly et al. [11] showed qualitative individual differences in whether or not momentary physical symptoms predicted momentary indicators of neuroticism, where participants scoring high on conscientiousness had a larger amount of these health-to-neuroticism relations.

Such findings of quantitative and qualitative differences strengthen the call for individualized treatment (personalized medicine) focusing on individual-specific weaknesses and strengths, in order to decouple detrimental connections and enforce good ones. This case is built for instance by Worm-Smeitink et al. [12], who point out that treatment manuals are often based on results of group-level analyses and therefore ignore possible individual variation in perpetuating factors and their associations with symptoms. Identifying person-specific perpetuating components would allow for more patient-tailored treatment.

This promise of individualized treatment also holds its challenges. Looking for meaningful differences in the within-person connections between different variables requires that a sufficient amount of measurement occasions per person are gathered, to achieve a good type 1 error-power balance for detecting these differences e.g., [13]. Moreover, the more variables are included in the analyses, the more connections have to be evaluated, possibly yielding difficult to interpret individual difference patterns. These reflections are underscored by the findings of Drukker et al. [14]. While they on the one hand report significant differences between non-trauma and low-trauma groups, they also state that there were mainly non-significant connections and that a clear pattern was not visible. Relatedly, Worm-Smeitink et al. discuss the difficult balance between running individual-specific analyses and power and multiple testing issues.

5. Conclusion

Intensive longitudinal research methods provide new opportunities to better discern temporal relationships and to answer questions about within-person psychosomatic processes. Their attractiveness lies in their ecological validity, the availability of a variety of statistical techniques to unravel these processes and their potential to deal with interindividual heterogeneity. Combining these features, they hold the promise to bridge large epidemiological studies and daily clinical practice. However, various questions remain, especially related to data collection and data analysis, which currently prevent direct clinical application of these methods. The development of sensor-based assessments and valid diary items as well as knowledge of their normal dynamics is essential to construct appropriate assessment schemes with an optimal balance between the amount of data collected and the burden for participants. To make optimal use of these data, we need accessible tutorials and best practice recommendations regarding the statistical analyses of such

intensive longitudinal data. With the increasing interest in these innovative research methods, such information will most likely become available in the coming years. We hope that this special issue will contribute to a wider application of intensive longitudinal research methods in the field of psychosomatics.

References

[1] M.R. Frumkin, S. Haroutounian, T.L. Rodebaugh, Examining emotional pain among individuals with chronic physical pain: nomothetic and idiographic approaches, J. Psychosom. Res. 136 (2020) 110172, https://doi.org/10.1016/j.jpsychores.2020.110172.

[2] K.A. Romano, K.E. Heron, K.E. Smith, R.D. Crosby, S.G. Engel, S.A. Wonderlich, R. D. Pang, T.B. Mason, Somatic symptoms and binge eating in women's daily lives, J. Psychosom. Res. 135 (2020) 110161, https://doi.org/10.1016/j.jpsychores.2020.110161.

[3] O. Metcalf, J. Little, S. Cowlishaw, T. Varker, H.A. Arjmand, M.L. O'Donnell, A. J. Phelps, M. Hinton, R.A. Bryant, M. Hopwood, A.C. Mc Farlane, D. Forbes, Modelling the relationship between poor sleep and problem anger in veterans: a dynamic structural equation modelling approach, J. Psychosom. Res. 150 (2021) 110615, https://doi.org/10.1016/j.jpsychores.2021.110615.

[4] K.A.M. Janssens, E.H. Bos, J.G.M. Rosmalen, M.C. Wichers, H. Riese, A qualitative approach to guide choices for designing a diary study, BMC Med. Res. Methodol. 18 (1) (2018) 140, https://doi.org/10.1186/s12874-018-0579-6.

[5] R.N. Groen, A. van Gils, A.C. Emerencia, E.H. Bos, J.G.M. Rosmalen, Exploring temporal relationships among worrying, anxiety, and somatic symptoms, J. Psychosom. Res. 146 (2021) 110293, https://doi.org/10.1016/j.jpsychores.2020.110293.

[6] J.G. Fiedorowicz, Recognition of team science with the 2021 EAPM Elsevier young investigator award recipients, J. Psychosom. Res. 148 (2021) 110583, https://doi.org/10.1016/j.jpsychores.2021.110583.

[7] J. Zink, M. Nicolo, K. Imm, S. Ebrahimian, Q. Yu, K. Lee, K. Zapanta, J. Huh, G. F. Dunton, M.I. Goran, K.A. Page, C.M. Dieli-Conwright, B.R. Belcher, Interstitial glucose and subsequent affective and physical feeling states: a pilot study combining continuous glucose monitoring and ecological momentary assessment in adolescents, J. Psychosom. Res. 135 (2020) 110141, https://doi.org/10.1016/j.jpsychores.2020.110141.

[8] S. Ariens, E. Ceulemans, J.K. Adolf, Time series analysis of intensive longitudinal data in psychosomatic research: a methodological overview, J. Psychosom. Res. 137 (2020) 110191, https://doi.org/10.1016/j.jpsychores.2020.110191.

[9] J.A. Bastiaansen, Y.K. Kunkels, F.J. Blaauw, S.M. Boker, E. Ceulemans, M. Chen, S. M. Chow, P. de Jonge, A.C. Emerencia, S. Epskamp, A.J. Fisher, E.L. Hamaker, P. Kuppens, W. Lutz, M.J. Meyer, R. Moulder, Z. Oravecz, H. Riese, J. Rubel, O. Ryan, M.N. Servaas, G. Sjobeck, E. Snippe, T.J. Trull, W. Tschacher, D.C. van der Veen, M. Wichers, P.K. Wood, W.C. Woods, A.G.C. Wright, C.J. Albers, L. F. Bringmann, Time to get personal? The impact of researchers choices on the selection of treatment targets using the experience sampling methodology, J. Psychosom. Res. 137 (2020) 110211, https://doi.org/10.1016/j.jpsychores.2020.110211.

[10] H.W. Mak, S. Schneider, Individual differences in momentary pain-affect coupling and their associations with mental health in patients with chronic pain, J. Psychosom. Res. 138 (2020) 110227, https://doi.org/10.1016/j.jpsychores.2020.110227.

[11] D.P. Kelly, A. Weigard, A.M. Beltz, How are you doing? The person-specificity of daily links between neuroticism and physical health, J. Psychosom. Res. 137 (2020) 110194, https://doi.org/10.1016/j.jpsychores.2020.110194.

[12] M. Worm-Smeitink, R. Monden, R.N. Groen, A. van Gils, E. Bekhuis, J.G. M. Rosmalen, J. Knoop, Towards personalized assessment of fatigue perpetuating factors in patients with chronic fatigue syndrome using ecological momentary assessment: a pilot study, J. Psychosom. Res. 140 (2021) 110296, https://doi.org/10.1016/j.jpsychores.2020.110296.

[13] G. Lafit, J.K. Adolf, E. Dejonckheere, I. Myin-Germeys, W. Viechtbauer, E. Ceulemans, Selection of the number of participants in intensive longitudinal studies: a user-friendly shiny app and tutorial for performing power analysis in multilevel regression models that account for temporal dependencies, Adv. Methods Pract. Psychol. Sci. (2021), https://doi.org/10.1177/2515245920978738.

[14] M. Drukker, J.C.H. Peters, L. Vork, Z. Mujagic, B.P.F. Rutten, J. van Os, A.A. M. Masclee, J.W. Kruimel, C. Leue, Network approach of mood and functional gastrointestinal symptom dynamics in relation to childhood trauma in patients with irritable bowel syndrome and comorbid panic disorder, J. Psychosom. Res. 139 (2020) 110261, https://doi.org/10.1016/j.jpsychores.2020.110261.

Judith G.M. Rosmalen[a,*], Eva Ceulemans[b]

[a] *University of Groningen, University Medical Center Groningen, Departments of Psychiatry and Internal Medicine, P.O. Box 30.001, 9700RB Groningen, the Netherlands*

[b] *KU Leuven, Quantitative Psychology and Individual Differences, Faculty of Psychology and Educational Sciences, Leuven 3000, Belgium*

[*] Corresponding author.
E-mail address: j.g.m.rosmalen@umcg.nl (J.G.M. Rosmalen).