



ELSEVIER

Review

Considerations for idiographic chronic pain treatment

Amani Lavefjord and Felicia T. A. Sundström

Psychological treatments tend to be created based on group averaged results of how variables relate to each other. This means that treatments may not be applicable to individual people where variables may relate to each other in other ways than seen in the group models. While the personalization of psychological treatments is on the rise, such attempts need to be accompanied by idiographic research methods in order to achieve a high degree of personalization. Ideally, treatments can be formed targeting individual specific psychological processes of change. If personalization is conducted on the basis of subgroups, such subgrouping needs to be done using idiographic methods rather than using categories defined in nomothetic research.

Addresses

Department of Psychology, Uppsala University, Box 1225, 751 42 Uppsala, Sweden

Corresponding author: Lavefjord, Amani (amani.lavefjord@psyk.uu.se)

Keywords

Chronic pain, SCD, Idiographic, Psychological treatment.

Introduction

Psychological treatment approaches such as cognitive behavior therapy (CBT) and acceptance and commitment therapy (ACT) are by now considered evidence-based and integral parts of specialized care for chronic pain in order to reduce disability and distress [1,2]. While these treatments are generally helpful, it does, however, seem as though we are not moving beyond small to medium effect sizes [1–3]. The question is whether any standardized psychological treatment package would be able to result in improvements for *everyone*.

The need for idiographic treatments and research methods

Two decades have passed since Molenaar [4] wrote a seminal paper described as a manifesto to move from a group-based, or nomothetic, approach to an individual, or idiographic, approach. The main point was that we often, falsely, assume so-called ergodicity; that what is true on the group level is also true on the individual level and vice versa. In other words, we assume a group to individual generalizability.

There is now plenty of research, encompassing a breadth of populations and outcomes, illustrating a lack of group to individual generalizability [5–12]. One of the implications is that group results of treatment studies do not necessarily say anything about whether a treatment was efficient for each person receiving this treatment. This goes hand in hand with the implication that the theoretical models informing generic treatment packages are not relevant for every person. Generic treatments, often designed for a particular diagnosis, rely upon group-based theoretical models derived from averaged results of how variables tend to relate to each other for people with this particular diagnosis, and interventions are built to target these relationships.

Recently, this lack of group to individual generalizability has also been demonstrated for people with chronic pain [13*,14*]. Both Sanabria-Mazo et al. [13*] and Sundström et al. [14*] assessed people with chronic pain intensively over time, showing that correlations of variables within participants were not always the same as those we see on an averaged level. This indicates that nomothetic theoretical models will not capture how variables correlate *within* each individual over time. Similarly, while measures evaluated on the group level may be said to measure certain variables grouping together related items, these items may correlate differently on the individual level. This means that there are individual specific measurement models [11,15,16].

The single case design as a method for capturing within individual variation over time

In idiographic research methods, such as when employing a single case design (SCD), each person is assessed repeatedly over time [17]. Sometimes this aligns with intensive repeated data collection

Current Opinion in Psychology 2025, 61:101946

This review comes from a themed issue on Pain (2025)

Edited by Lance McCracken and Kevin Vowles

For complete overview about the section, refer [Pain \(2025\)](#)

Available online 23 November 2024

<https://doi.org/10.1016/j.copsyc.2024.101946>

2352-250X/© 2024 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

procedures such as ecological momentary assessment (EMA) that strives to optimize validity of assessment by measuring variables in real time and in the natural context of the individual [18]. Such intense data gathering allows for statistical analyses of how variables correlate on an individual level. In a SCD, assessment is continued over the course of treatment, enabling evaluation [17]. This may lead to the treatment plan being updated in real time as the participant's responses to measurements shift during treatment, offering a method for continuous individualization over the course of treatment.

While the SCD is an idiographic research method, it does not however automatically follow that all treatments evaluated in a SCD are in themselves idiographic. de Vries et al. [19] used a SCD to examine the effects of using a virtual reality training program for improving pain management skills, while Borst et al. [20] evaluated the effect of eye movement desensitization in participants with fibromyalgia with post-traumatic stress symptoms. A SCD was also employed by Ritchie et al. [21], examining the effects of an intervention promoting physical activity for people with whiplash-associated disorder. For people with vulvodynia, Engman et al. [22] used a SCD to study the effect of group treatment involving clients' partners, and Chisari et al. [23] evaluated an online ACT treatment. These studies provide excellent examples of how treatment effects are *evaluated* on an idiographic level. However, the *treatments*

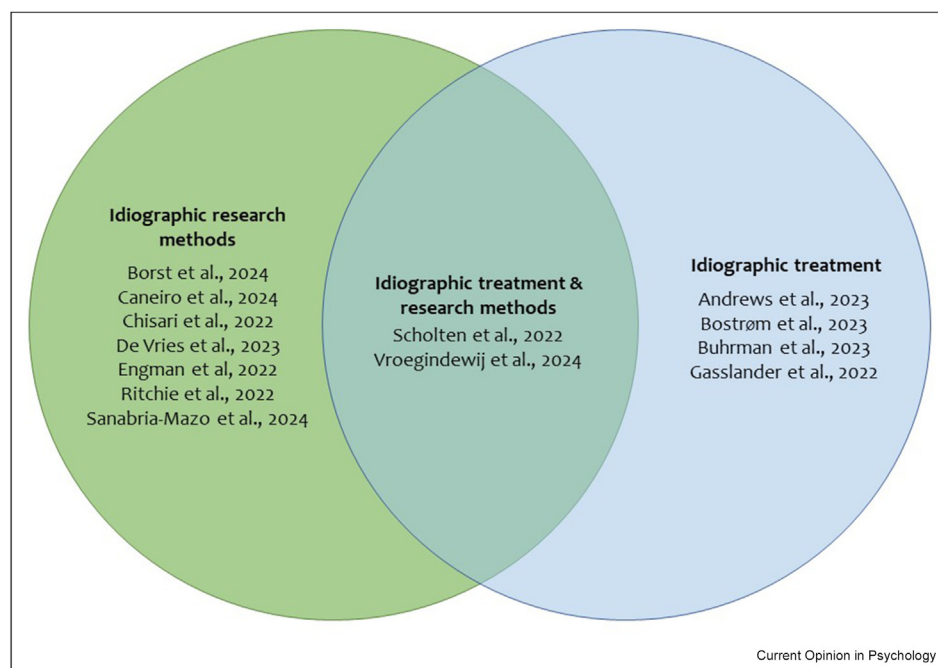
themselves were predetermined rather than individually adapted based on repeated measures.

Recent developments in optimizing treatment for the individual with chronic pain

There is no universally agreed-upon definition of when to consider an intervention to be truly idiographic. Potentially, it could be seen as a continuum. At the lower end of the spectrum - although we acknowledge that it can be argued that these treatments are not idiographic at all - treatments remain largely predetermined, but adapted to subtypes of participants, or may include minor elements of personal adaptations.

At the higher end of the idiographic spectrum, treatments might involve no exact predetermined treatment manual and instead be fully customized to the specific individual. While this is something that clinicians may strive for, treatments are often held more standardized in research settings, and thus, research evaluating idiographic treatments can ideally bridge a gap between research and practice and provide systematic methods for individualization. At the highest end of the spectrum, we should be seeing the employment of idiographic research methods in designing and evaluating the personalized treatment. See Figure 1 for a summary of which studies reviewed here strives to tailor treatment, which apply idiographic research methods, and which that do both.

Figure 1



Venn-diagram illustrating how the combination of idiographic research methods and the aim of tailoring treatment to the individual yields highly idiographic treatments or treatment plans.

Adapting treatments for subtype categories derived from nomothetic research

Starting at the lower end of the idiographic spectrum, a study by Buhrman et al. [24] focused on integrating Compassion-Focused Therapy elements in an ACT treatment delivered online to chronic pain patients also experiencing high levels of self-criticism. Similarly, although at a more complex, and arguably somewhat more idiographic, level, Gasslander et al. [25], tailored digital treatment content to patients with chronic pain based on the occurrence of comorbid psychological problems such as anxiety, depression, or trauma. Based on the results from a psychiatric diagnostic screening interview, three to nine individual-specific treatment modules per person were selected in addition to three mandatory ones. This enabled specific tailoring where the treatments offered could vary across individuals. The tailoring was conducted based on diagnostic criteria, in principle creating multiple subtypes of chronic pain participants, and patient preference also influenced the matching procedure, increasing the chances of creating personally meaningful treatments.

These studies add value to the field by identifying that treatment focused solely on the pain condition itself would fail to address one or more relevant comorbid symptoms. However, the limitation is that the subgroups used are formed based on nomothetic measurement models and that the assessment of the subgrouping variable will not capture individual variation over time. What this means is that people within these subgroups might be more heterogeneous than anticipated. Further, overall treatment evaluations were on the group comparison level in both aforementioned studies and we are faced with the potential problem of results not being generalizable to each individual receiving these treatments.

Including person specific elements

Bostrøm et al. [26] individualized their ACT and CBT focused treatment slightly by letting participants themselves decide the order of three out of eight modules focused on ‘behaviors and lifestyle’, ‘communication, relations, and social support’, and ‘coping during difficult times’ [26]. A generic treatment manual can also be made somewhat individualized by adding specific elements tailored to each person, as demonstrated in a pilot by Andrews et al. [27]. The study explored the utility of a mobile application for delivering an activity modulation intervention to people with chronic pain, with the addition of the targeted behaviors and activities being individually defined. Here, EMA was used to assess such things as pain intensity and daily activities, in order to identify which behaviors to target in the treatment.

While the treatment provided in the study by Andrews et al. [27] can be considered somewhat more idiographic

based on their employment of data collection procedures aligning with an idiographic research paradigm in terms of assessing individual specific behaviors over time, both treatment studies described here still adhered to a notion of providing basically the same, in large pre-determined, treatment for everyone. Further, overall treatment evaluations were yet again on the group comparison level.

Putting it all together: combining idiographic assessment with individualized treatment

Moving towards the higher ends of the idiographic spectrum, Vroegindewij et al. [28**] provide an excellent example of taking advantage of the vast amount of individual-based data possible to collect during a SCD, using baseline EMA data in Residual Dynamic Structural Equation Modeling to guide the intervention being delivered. Some individuals instead received a generic treatment, and the results indicated that tailored intervention may hold more promise than a generic one [28**].

Similarly, Scholten et al. [29**] illustrate how EMA data within a SCD can be used to conduct idiographic network analysis for treatment planning. Idiographic network analysis looks at how variables are associated for that particular person, and also highlights which variables that seem to influence the remaining variables in the network to the largest degree, helping to form hypotheses about relevant treatment targets [30]. Whether the use of such idiographic networks for treatment planning will yield better results than generic treatments, remains to be seen.

Future developments

Further applications of network analysis

Idiographic network analysis holds promise for facilitating highly idiographic assessments and treatments [30]. The most common approach is to employ so called discrete time vector autoregressive models (DT-VAR), although these come with a disadvantage of assuming equally spaced assessment and stationarity in data [31]. While continuous time vector autoregressive models (CT-VAR) form an alternative not bound by such requirements [31], these methods are yet less examined in psychology.

A disadvantage of network analysis is that the creation of valid idiographic models might require a higher frequency of repeated measures than what is deemed as practically doable [32]. Network researchers have recently hypothesized that the integration of EMA and clinician judgment may be a more feasible way forward compared to opting for pure data-driven networks [33]. There are also advances within clinical psychology in employing network analysis without collecting EMA data, such as using the perceived causal networks

(PECAN) approach, where participants themselves rate the degree to which they believe variables affect each other in their lives [34]. This may lessen participant burden, but risks not capturing real-time idiographic variation over time. Indeed, even in the absence of intervention, assessed variables may fluctuate greatly [14*]. PECAN could however potentially be used within an SCD in order for the intervention prompted by this network to be thoroughly assessed on the individual level.

Processes of change

There have now been multiple calls for the assessment and treatment targeting of psychological processes of change, meaning mediating variables that might need to change in order to drive change in an outcome [3,17,35–37]. Illustrating this need, Scheidegger et al. [38] demonstrated that chronic pain participants clustered based on how they coped with their pain, had differentiated treatment outcomes. In addition, Karayannis et al. [39] showed that particular psychological profiles, such as having lower pain acceptance, or higher psychological inflexibility in general, indicated a prognosis of showing larger reductions in pain interference during treatment in routine practice. Both these studies are group-based, but they point towards the notion that differences in which skills or processes that people show, may warrant differences in treatments being offered.

A new framework hopefully inspiring further idiographic treatment studies has sprung forward as an alternative to manual-based therapy, namely process-based therapy (PBT) [40]. In PBT, the point is to select interventions that closely match the specific psychological processes that need to change for a particular person to move closer to their desired outcomes. The psychological processes that are relevant for driving change may differ between people [7,9,12], and thus, no two treatments will automatically be identical. Indeed, utilizing the potential of the SCD to understand the individual with chronic pain, Caneiro et al. [41*], did not only focus their SCD on individual treatment effects per say, but also showed that the psychological processes driving changes in treatment outcomes varied on an individual level. Similarly, Sanabria-Mazo et al. [13*] collected EMA data on process and outcome variables within a randomized controlled treatment trial, finding that individuals differ greatly from each other regarding which process of change that seems relevant to them and how strong the relationships are between outcomes and the individually associated process. A challenge in this area is to define and establish which processes to measure, and to not fall into the trap of applying the same measurement model to everyone.

Idiographic measures

Variables included in an SCD could be selected based on prior research on evidence-based processes for the

relevant area, or on clinical judgment or patient preference. Most chronic pain studies use measures derived from nomothetic research, and apply the nomothetic measurement models to the individual [42]. Although making it more difficult to pool or compare individuals, using idiographic measures, designed and validated particularly for the single individual, increases the idiographic nature of the treatment.

Moving from individual to group while maintaining an idiographic frame of thought

SCDs are sometimes critiqued for not yielding group-level results [43]. After all, it is often of interest to get a view of what principles, correlations, or intervention effects that seem to be valid on the group level or perhaps on a subgroup level. When moving from the individual to the group level in a bottom-up manner, we need methods that preserve the individual variation over time. A promising method is the Group Iterative Multiple Model Estimation (GIMME) [44] based on structural equation modeling (SEM) [45,46], estimating causal paths between variables for each person over time and then finding patterns of similarity between people. It can give us information about which relationships that seem to be the same for everyone in the group, for some people that may constitute a subgroup, and which correlations that seem to be more individual specific [47]. Specifically, when forming the group level paths, it does not rely solely on aggregating individual data, but rather takes each individual time series into account when analyzing which relations are shared by some or all [48]. Thus, paths for subgroups or groups do in fact also represent the individual level.

Another example, proposed by Arizmendi and Gates [15], is clustering individuals based on results from idiographic factor analysis. This means that items administered to the individual over time are first factor analyzed to yield a measurement model valid for that particular person. The individuals included in the study can then be cluster analyzed in order to find subgroups of people presenting similar idiographic models. Similarly, Gloster et al. [9] and Sahdra et al. [12], also used clustering in order to find subgroups derived in an idiographic manner. As with GIMME, this method of creating subgroups means relying less on categorizing people based on averaged group level models and more on finding similarities in highly idiographic data across participants, yielding subgroups more representative of the individuals encompassed.

Conclusion

Idiographic research methods can be used to create and evaluate personalized treatment. Potentially, intensive repeated measures can be used to form idiographic statistical models informing treatment targets. Future research should consider person specific processes of

change, idiographic measures, and move from individual to group in a bottom-up manner preserving the idiographic perspective.

Author statement

Amani Lavefjord: Conceptualization, Methodology, Writing – Original Draft, Writing – Review & Editing.
Felicia Sundström: Conceptualization, Methodology, Writing – Original Draft, Writing – Review & Editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

References

References of particular interest have been highlighted as:

- * of special interest
- ** of outstanding interest

1. Lai L, Liu Y, McCracken LM, Li Y, Ren Z: **The efficacy of acceptance and commitment therapy for chronic pain: a three-level meta-analysis and a trial sequential analysis of randomized controlled trials.** *Behav Res Ther* 2023, **165**, 104308, <https://doi.org/10.1016/j.brat.2023.104308>.
2. Williams AC de C, Fisher E, Hearn L, Eccleston C: **Psychological therapies for the management of chronic pain (excluding headache) in adults.** *Cochrane Database Syst Rev* 2020, **2020**, CD007407, <https://doi.org/10.1002/14651858.CD007407.pub4>.
3. McCracken LM: **Personalized pain management: is it time for process-based therapy for particular people with chronic pain?** *Eur J Pain* 2023, **27**:1044–1055, <https://doi.org/10.1002/ejp.2091>.
4. Molenaar PCM: **A manifesto on psychology as idiographic science: bringing the person back into scientific psychology.** *This Time Forever, Measurement: Interdisciplinary Research and Perspectives* 2004, **2**:201–218, https://doi.org/10.1207/s15366359mea0204_1.
5. Brose A, Schmiedek F, Lövdén M, Molenaar PCM, Lindenberger U: **Adult age differences in covariation of motivation and working memory performance: contrasting between-person and within-person findings.** *Res Hum Dev* 2010, **7**:61–78, <https://doi.org/10.1080/15427600903578177>.
6. Brose A, Voelkle MC, Lövdén M, Lindenberger U, Schmiedek F: **Differences in the between-person and within-person structures of affect are a matter of degree: affect within and between individuals.** *Eur J Pers* 2015, **29**:55–71, <https://doi.org/10.1002/per.1961>.
7. Ciarrochi J, Sahdra B, Hayes SC, Hofmann SG, Sanford B, Stanton C, Yap K, Fraser MI, Gates K, Gloster AT: **A personalised approach to identifying important determinants of well-being.** *Cognit Ther Res* 2024, **48**:1–22, <https://doi.org/10.1007/s10608-024-10486-w>.
8. Fisher AJ, Medaglia JD, Jeronimus BF: **Lack of group-to-individual generalizability is a threat to human subjects research.** *Proc Natl Acad Sci USA* 2018, **115**:E6106–E6115, <https://doi.org/10.1073/pnas.1711978115>.
9. Gloster A, Nadler M, Block V, Haller E, Rubel J, Benoy C, Villanueva J, Bader K, Walter M, Lang U, Ciarrochi J, Hayes S: **When average isn't good enough: identifying meaningful subgroups in clinical data, cognitive therapy and research 48.** <https://doi.org/10.1007/s10608-023-10453-x>.
10. Lowie WM, Verspoor MH: **Individual differences and the ergodicity problem: individual differences and ergodicity.** *Lang Learn* 2019, **69**:184–206, <https://doi.org/10.1111/lang.12324>.
11. Molenaar PCM, Campbell CG: **The new person-specific paradigm in psychology.** *Curr Dir Psychol Sci* 2009, **18**:112–117, <https://doi.org/10.1111/j.1467-8721.2009.01619.x>.
12. Sahdra B, Ciarrochi J, Klimczak K, Krafft J, Hayes S, Levin M: **Testing the applicability of idiomatic statistics in longitudinal studies: the example of 'doing what matters.'** *Journal of Contextual Behavioral Science* 2024, **32**, 100728, <https://doi.org/10.1016/j.jcbs.2024.100728>.
13. Sanabria-Mazo JP, Giné-Vázquez I, Cristobal-Narváez P, Suso-Ribera C, García-Palacios A, McCracken LM, Hayes SC, Hofmann SG, Ciarrochi J, Luciano JV: **Relationship between outcomes and processes in patients with chronic low back pain plus depressive symptoms: idiographic analyses within a randomized controlled trial.** *Psychother Res* 2024, <https://doi.org/10.1080/10503307.2024.2382429>.
14. Sundström FTA, Lavefjord A, Buhrman M, McCracken L: **Are people with chronic pain more diverse than we think? An investigation of ergodicity.** 2024, <https://doi.org/10.31234/osf.io/5nrje> [under review].
15. Arizmendi CJ, Gates KM: **Clustering individuals based on similarity in idiographic factor loading patterns.** *Multivariate Behav Res* 2024:1–25, <https://doi.org/10.1080/00273171.2024.2374826>.
16. Gomes CMA, de Araujo J, do Nascimento E, Jelihovschi EG: **Routine psychological testing of the individual is not valid.** *Psychol Rep* 2019, **122**:1576–1593, <https://doi.org/10.1177/0033294118785636>.
17. Kravitz RL, Duan N, Vohra S, Li J: **The DEClDE methods center N-of-1 guidance panel, introduction to N-of-1 trials: indications and barriers.** 2014:1–11. in: R.L. Kravitz, N. Duan (eds), and the DEClDE Methods Center N-of-1 Guidance Panel (N. Duan, I. Eslick, N.B. Gabler, H.C. Kaplan, R.L. Kravitz, E.B. Larson, W.D. Pace, C.H. Schmid, I. Sim, S. Vohra), Design and implementation of N-of-1 trials: a user's guide, AHRQ Publication No. 13(14)-EHC122-EF. Rockville, MD: Agency for Healthcare Research and Quality.
18. Shiffman S, Stone A, Hufford M: **Ecological momentary assessment.** *Annu Rev Clin Psychol* 2008, **4**:1–32, <https://doi.org/10.1146/annurev.clinpsy.3.022806.091415>.
19. de Vries FS, van Dongen RTM, Bertens D: **Pain education and pain management skills in virtual reality in the treatment of chronic low back pain: a multiple baseline single-case experimental design.** *Behav Res Ther* 2023, **162**:1–10, <https://doi.org/10.1016/j.brat.2023.104257>.
20. Borst M, Moeyaert M, van Rood Y: **The effect of eye movement desensitization and reprocessing on fibromyalgia: a multiple-baseline experimental case study across ten participants.** *Neuropsychol Rehabil* 2024, <https://doi.org/10.1080/09602011.2024.2314883>.
21. Ritchie C, Clanchy K, Sterling M, Tate R, Smits EJ, Day M, Nikles J, Liimatainen J, Tweedy SM: **Evaluation of a physical activity promotion intervention for adults with whiplash associated disorders: a single-case experimental design study, Disability and Rehabilitation: an International.** *A Multidiscip J* 2022, **44**:7255–7268, <https://doi.org/10.1080/09638288.2021.1989062>.
22. Engman L, Ter Kuile MM, Linton SJ, Ekholm E, Tuijnman-Raasveld CC, Flink IK: **An initial proof of concept: a replicated single-case study of a CBT group treatment with partner involvement for vulvodynia.** *Cognit Ther Res* 2022, **51**: 503–519, <https://doi.org/10.1080/16506073.2022.2086907>.
23. Chisari C, McCracken LM, Cruciani F, Moss-Morris R, Scott W: **Acceptance and Commitment Therapy for women living with Vulvodynia: a single-case experimental design study of a treatment delivered online.** *Journal of Contextual Behavioral Science* 2022, **23**:15–30, <https://doi.org/10.1016/j.jcbs.2021.11.003>.

24. Buhman M, Tillfors M, Holländare F, Lekström E, Håkansson A, Boersma K: **Psychological treatment targeting acceptance and compassion in patients with chronic pain: a randomized controlled, internet-delivered, treatment trial.** *Clin J Pain* 2023, **39**:672, <https://doi.org/10.1097/AJP.0000000000001157>.
25. Gasslander N, Andersson G, Boström F, Brandelius L, Pelling L, Hamrin L, Gordh T, Buhman M: **Tailored internet-based cognitive behavioral therapy for individuals with chronic pain and comorbid psychological distress: a randomized controlled trial.** *Cognit Behav Ther* 2022, **51**:408–434, <https://doi.org/10.1080/16506073.2022.2065528>.
26. Boström K, Børøsund E, Eide H, Varsi C, Kristjansdóttir ÓB, Schreurs KMG, Waxenberg LB, Weiss KE, Morrison EJ, Støle HS, Småstuen MC, Stubhaug A, Nes LS: **Short-term findings from testing EPIO, a digital self-management program for people living with chronic pain: randomized controlled trial.** *J Med Internet Res* 2023, **25**, e47284, <https://doi.org/10.2196/47284>.
27. Andrews NE, Ireland D, Deen M, Varnfield M: **Clinical utility of a mHealth assisted intervention for activity modulation in chronic pain: the pilot implementation of pain ROADMAP.** *Eur J Pain* 2023, **27**:749–765, <https://doi.org/10.1002/ejp.2104>.
28. Vroegindeweij A, Houtveen J, Lucassen DA, Van De Putte EM, Wulffraat NM, Nijhof SL, Swart JF: **Individual outcomes after tailored versus generic self-management strategies for persistent fatigue in youth with a fatigue syndrome or rheumatic condition: a multiple single-case study.** *Br J Health Psychol* 2024, **29**:712–730, <https://doi.org/10.1111/bjhp.12722>.
29. Scholten S, Lischetzke T, Glombiewski JA: **Integrating theory-based and data-driven methods to case conceptualization: a functional analysis approach with ecological momentary assessment.** *Psychother Res* 2022, **32**:52–64, <https://doi.org/10.1080/10503307.2021.1916639>.
30. Epskamp S, van Borkulo CD, van der Veen DC, Servaas MN, Isvoranu A-M, Riese H, Cramer AOJ: **Personalized network modeling in psychopathology: the importance of contemporaneous and temporal connections.** *Clin Psychol Sci* 2018, **6**:416–427, <https://doi.org/10.1177/2167702617744325>.
31. Ryan O, Hamaker EL: **Time to intervene: a continuous-time approach to network analysis and centrality.** *Psychometrika* 2022, **87**:214–252, <https://doi.org/10.1007/s11336-021-09767-0>.
32. Mansueto AC, Wiers RW, van Weert JCM, Schouten BC, Epskamp S: **Investigating the feasibility of idiographic network models.** *Psychol Methods* 2023, **28**:1052–1068, <https://doi.org/10.1037/met0000466>.
33. Burger J, Epskamp S, van der Veen DC, Dablander F, Schoevers RA, Fried EI, Riese H: **A clinical PREMISE for personalized models: toward a formal integration of case formulations and statistical networks.** *Journal of Psychopathology and Clinical Science* 2022, **131**:906–916, <https://doi.org/10.1037/abn0000779>.
34. Klintwall L, Bellander M, Cervin M: **Perceived causal problem networks: reliability, central problems, and clinical utility for depression.** *Assessment* 2021, <https://doi.org/10.1177/10731911211039281>. 10731911211039281.
35. Hayes SC, Hofmann SG, Stanton CE, Carpenter JK, Sanford BT, Curtiss JE, Ciarrochi J: **The role of the individual in the coming era of process-based therapy.** *Behav Res Ther* 2019, **117**:40–53, <https://doi.org/10.1016/j.brat.2018.10.005>.
36. McCracken LM: **Beyond therapy types: mindful self-compassion and the future of process-based therapy for chronic pain.** *Eur J Pain* 2021, **25**:729–730, <https://doi.org/10.1002/ejp.1739>.
37. McDonald S, Quinn F, Vieira R, O'Brien N, White M, Johnston DW, Sniehotta FF: **The state of the art and future opportunities for using longitudinal n-of-1 methods in health behaviour research: a systematic literature overview.** *Health Psychol Rev* 2017, **11**:307–323, <https://doi.org/10.1080/17437199.2017.1316672>.
38. Scheidegger A, Jäger J, Blättler LT, Aybek S, Bischoff N, grosse Holtforth M: **Identification and characterization of pain processing patterns among patients with chronic primary pain: a replication.** *Clin J Pain* 2023, **39**:414, <https://doi.org/10.1097/AJP.0000000000001130>.
39. Karayannis NV, Sturgeon JA, Kemani MK, Mackey SC, Greco CM, Wicksell RK, McCracken LM: **Pain acceptance and psychological inflexibility predict pain interference outcomes for persons with chronic pain receiving pain psychology.** *Scandinavian Journal of Pain* 2023, **23**:464–475, <https://doi.org/10.1515/sjpain-2022-0107>.
40. Hofmann SG, Hayes SC: **The future of intervention science: process-based therapy.** *Clin Psychol Sci* 2019, **7**:37–50, <https://doi.org/10.1177/2167702618772296>.
41. Caneiro JP, O'Sullivan P, Tan J-S, Klem N-R, de Oliveira BIR, Choong PF, Dowsey M, Bunzli S, Smith A: **Process of change for people with knee osteoarthritis undergoing cognitive functional therapy: a replicated single-case experimental design study.** *Disabil Rehabil* 2024, **46**:2348–2364, <https://doi.org/10.1080/09638288.2023.2221459>.
42. Lavefjord A, Sundström FTA, Buhman M, McCracken LM: **Assessment methods in single case design studies of psychological treatments for chronic pain: a scoping review.** *Journal of Contextual Behavioral Science* 2021, **21**:121–135, <https://doi.org/10.1016/j.jcbs.2021.05.005>.
43. Spencer JP, Schöner G: **Bridging the representational gap in the dynamic systems approach to development.** *Dev Sci* 2003, **6**:392–412, <https://doi.org/10.1111/1467-7687.00295>.
44. Gates KM, Molenaar PCM: **Group search algorithm recovers effective connectivity maps for individuals in homogeneous and heterogeneous samples.** *Neuroimage* 2012, **63**:310–319, <https://doi.org/10.1016/j.neuroimage.2012.06.026>.
45. Gates KM, Molenaar PCM, Hillary FG, Ram N, Rovine MJ: **Automatic search for fMRI connectivity mapping: an alternative to Granger causality testing using formal equivalences among SEM path modeling, VAR, and unified SEM.** *Neuroimage* 2010, **50**:1118–1125, <https://doi.org/10.1016/j.neuroimage.2009.12.117>.
46. Gates KM, Chow S-M, Molenaar PCM: *Intensive longitudinal analysis of human processes.* Routledge; 2023.
47. Lane ST, Gates KM, Pike HK, Beltz AM, Wright AGC: **Uncovering general, shared, and unique temporal patterns in ambulatory assessment data.** *Psychol Methods* 2019, **24**:54–69, <https://doi.org/10.1037/met0000192>.
48. Beltz AM, Wright AGC, Sprague BN, Molenaar PCM: **Bridging the nomothetic and idiographic approaches to the analysis of clinical data.** *Assessment* 2016, **23**:447–458, <https://doi.org/10.1177/1073191116648209>.

Further information on references of particular interest

13. Intensive measuring of people with chronic pain demonstrated that correlations of variables within participants were not always the same as those on a group level. The data also demonstrated individual differences regarding which processes of change that seem relevant for driving changes in outcomes.
14. A study specifically aiming to investigate group to individual generalizability in people with chronic pain, illustrating vast individual differences in how variables are correlated over time. The results further showed that individuals may even vary from themselves over a fairly short period of time, even in the absence of intervention.
28. This study uses baseline single case data to form statistical individual models for adapting treatment content, showing that tailored intervention may hold more promise than a generic one.
29. This study uses baseline data to illustrate how idiographic network analysis can be conducted and potentially used for treatment planning.
41. A study showing that the psychological processes of change driving treatment outcomes seem to be individual specific.