DATA-INFORMED CASE FORMULATION WITH THE TRIER TREATMENT NAVIGATOR

FORMULACIÓN DE CASOS BASADA EN DATOS CON EL NAVEGADOR DE TRATAMIENTO DE TRÉVERIS

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Abstract

The current article presents a way of practising case formulation using technology augmentation in the context of data-informed psychotherapy. First, we explain how case formulation guides the decision-making processes in psychotherapy and how decisions made under an intuitive clinical judgement can be biased. The use of actuarial methods is pointed out as a way of addressing these biases, mainly through clinical decision support systems based on statistical tools and machine learning algorithms. We present the Trier Treatment Navigator (TTN), a clinical decision support system developed in a University research-based clinical training programme. We show how the TTN can contribute to an initial case formulation and its dynamic adaptations during treatment with a clinical case. Finally, we discuss how case formulation and data-informed psychotherapy are aimed at the same goal: treatment personalisation. We argue that case formulation and data-informed psychotherapy enrich and feedback on each other.

Keywords: *clinical decision support systems, measurement-based care, routine outcome monitoring, feedback system, practice-based evidence*

Resumen

El artículo presenta una forma de practicar la formulación de caso a través del uso de aumentación tecnológica en el contexto de una psicoterapia informada por datos. Primero explicamos cómo la formulación de caso guía el proceso de toma de decisiones en psicoterapia y cómo las decisiones tomadas a partir de un juicio clínico intuitivo pueden estar sesgadas. El uso de métodos actuariales se muestra como una forma de abordar estos sesgos, principalmente a través de sistemas de apoyo a las decisiones clínicas basados en herramientas estadísticas y algoritmos de aprendizaje automático. Presentamos el Trier Treatmnent Navigator (TTN), un sistema de apoyo a las decisiones clínicas desarrollado en un programa universitario de formación basado en investigación. A través de un caso clínico mostramos cómo el TTN puede contribuir a una formulación de caso inicial y a sus adaptaciones dinámicas durante el tratamiento. Finalmente discutimos cómo la formulación de caso y la psicoterapia informada por datos están orientadas hacia un mismo objetivo: la personalización del tratamiento. Argumentamos que la formulación de caso y la psicoterapia informada por datos se enriquecen y retroalimentan la una a la otra.

Palabras clave: *sistemas de apoyo a las decisiones clínicas, atención basada en la medición, monitorización sistemática de resultados, sistemas de retroalimentación, evidencia basada en la práctica*

Psychotherapy case formulation (CF) constitutes a core skill taught by diverse training programmes from diverse theoretical orientations worldwide and a core competency recognised by different clinical psychology professional associations (British Psychological Society, 2011; Eells, 2022; Health & Care Professions Council, 2015; Johnstone & Dallos, 2014). CF corresponds to the process of giving sense and explaining a patient's presenting problem. From this explanation, the clinician derives the way of working with the patient (i.e., therapeutic strategies and techniques) to address the specific problem (Moggia, 2017). CF provides a psychological explanation of a patient's difficulties, constituting a process of ongoing collaborative sense-making of the patient's problems and experiences (Harper & Moss, 2003; Johnstone & Dallos, 2014). CF comprises developing hypotheses about the causes, precipitants, and maintaining influences of a patient's psychological, interpersonal and behavioural problems, as well as a plan to address these problems (Eells, 2022).

CF involves and guides the processes of clinical decision-making in psychotherapy. On the one hand, clinicians make decisions on how to formulate the case, which factors can be associated with the problem and require attention, which elements of the patient's story to consider, which variables to assess, etc. On the other hand, based on CF, clinicians make decisions to adapt the treatment according to the patient's individualised problem and characteristics. The treatment approach, modality, duration, strategy, and therapeutic techniques are some decisions clinicians must make.

Broadly speaking, clinical decision-making can be based on two general approaches: clinical judgment or actuarial methods. The first one represents an informal method based on heuristics and clinicians' intuition, which is informed by their knowledge, clinical experience and theoretical orientation. This approach presents high variability within (i.e., changes over time) and between therapists (Lutz et al., 2022b). Furthermore, research has documented the limits of clinical judgment, inference, and reasoning, showing the biases clinicians may have (e.g., overconfidence, hindsight bias, the representativeness and availability heuristics, confirmation bias, illusory correlation, neglecting base rates, "halo" and recency effects; Garb, 1998; Kahneman, 2013; Meehl, 1973; Stanovich, 2009). These biases can compromise the validity and reliability of CF (Eells, 2015).

The second approach corresponds to formal methods based on systematised decision rules or algorithms. In this regard, a technological development that has recently received considerable attention is clinical decision support systems (CDSS). CDSS are software aimed at improving healthcare delivery by enhancing clinical decisions with targeted clinical knowledge and patient information. They are designed to be direct aid to clinical decision-making, in which the characteristics of an individual patient are matched to a computerised clinical knowledge database, and patient-specific assessments or recommendations are then presented to the clinician for a decision (Sutton et al., 2020).

The current article addresses how CDSS can contribute to CF. On this

aim, we review the background under which CDSS in psychotherapy have been developed and the implications of applying these systems in clinical practice (i.e., data-informed psychotherapy; Lutz, 2022; Lutz & Schwartz, 2021; Lutz et al., 2022a). We present the Trier Treatment Navigator (TTN; Lutz et al., 2021b; Lutz et al., 2019), a CDSS developed in the context of the research-based clinical training programme of the University of Trier. A clinical case shows how the TTN can contribute to initial CF and its dynamic adaptation during treatment. Finally, we discuss the challenges of developing and implementing these systems, the issues that need to be considered and how clinicians should use the recommendations of the CDSS to inform their practice.

Data-Informed Psychotherapy and Case Formulation

As previously explained, therapists can present multiple biases that may undermine their clinical practice compromising their clinical effectiveness (e.g., the tendency to underestimate patients at risk of deterioration; Lambert et al., 2003). Measurement-based and data-informed psychotherapy has become a way to overcome these issues by fostering the use of actuarial methods. It consists of using technical augmentation to improve and personalise clinical practice. Modern technologies allow a high level of personalisation by complementing routine outcome monitoring (ROM) with the feedback of psychometric information to therapists (practice- and research-based tradition also known as practice-based research, patient-focused research, practice-oriented research, and practice-based evidence; (Barkham & Lambert, 2021; Castonguay et al., 2021; Lutz et al., 2021b). Rather than intuitively making decisions to treat patients, the goal of this way of practising psychotherapy is to use empirical data to tailor the treatment to the individual patient (Lutz et al., 2021a).

In recent years, using ROM to guide adaptive decision-making during ongoing treatment has developed into the more advanced concept of personalized mental health (Müller et al., 2018). Tailoring psychological or medical treatments to patients is often named personalized medicine or precision mental health (Bickman et al., 2016). This broad paradigm focuses on improving (mental) health by treating individuals based on empirical data and statistical predictions (Lutz et al., 2020). Nowadays, such endeavours have become more sophisticated, including new statistical tools and machine learning algorithms implemented in CDSS.

CDSS can aid decision-making at different points during treatment. For instance, before treatment begins, CDSS can assist therapists in CF by providing psychometric information about the patient, such as symptom burden or personality traits. Additionally, CDSS can estimate personalised predictions about the optimal treatment, treatment strategy or dropout risk, which can significantly improve CFs (Cohen & DeRubeis, 2018). During ongoing therapy, CDSS enable a continuous adaptation of CF and treatment. CDSS can identify patients at risk for treatment failure or dropout, allowing the therapist to prevent or minimize such risks. They can

also provide support in recognizing difficult therapy situations and identifying their causes. This is particularly helpful when the therapist cannot generate hypotheses about the origin of the difficult situation from the previous CF. In a further step, the CF can be adapted or supplemented. CDSS also provide the therapist with clues to relevant issues that have not yet come up in therapy or have only come up briefly. It may then also happen that the therapist realizes that the previous CF is inappropriate and should be adjusted or discarded. CDSS can support these difficult steps.

The Outpatient Psychotherapy Clinic of the University of Trier

The Outpatient Psychotherapy Clinic of the University of Trier offers psychotherapy services to the community, training and research in southwest Germany. The clinic follows the cognitive-behavioural therapy approach (CBT; e.g., Hayes & Hofmann, 2018). Nevertheless, the clinical training is not exclusively based on CBT because it promotes a non-restrictive view of therapeutic schools (Lutz, et al., in press). Thus, therapists learn about disorder-specific CBT manuals and protocols but also about general change principles (e.g., Eubanks & Goldfried, 2019; Grawe, 1997) and transtheoretical concepts and approaches (e.g., motivational interviewing; Miller & Rollnick, 2013). The therapies provided are not strictly manualized. Therapists can integrate various components (e.g., emotion-focused therapy, interpersonal or systemic interventions; Elliott, 2004; Frank & Levenson, 2011; Friedlander et al., 2021) and change principles (e.g., motivational clarification; Caspar, 2022; Grawe, 2002) to personalize their therapies to the patient's needs.

Patients referred to the clinic are welcomed in an intake interview. Afterwards, they are assessed with a battery of instruments which include the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders (SCID; Beesdo-Baum & Zaudig, 2019), symptom and outcome measures, questionnaires to assess personality traits, interpersonal style, attitudes toward therapy, among others.

Outcome data are routinely collected during treatment at the beginning of each session. At the end of the sessions, therapists and patients report their perceptions of the therapeutic alliance and the processes through which the therapeutic work was conducted. During treatment, therapists have access to the CDSS of our clinic, the Trier Treatment Navigator (TTN; Lutz et al., 2019). The TTN offers personalized clinical recommendations, helps monitor the process and provides clinical support tools (CSTs) for patients who are not improving as expected. At the beginning of their training, therapists learn how to use and integrate the TTN into their practice.

Furthermore, all therapy sessions are videotaped for supervision and research purposes. Treatments usually consist of weekly 50-minute sessions, and therapists attend supervision both in groups and individually by at least three different supervisors throughout their clinical training. Therapists are supervised every four sessions and are encouraged to use the video recordings of the sessions and the TTN tools in supervision.

The Trier Treatment Navigator and Case Formulation

The TTN is a comprehensive CDSS developed at the Outpatient Psychotherapy Clinic of the University of Trier. Using different statistical and machine learning algorithms, the TTN combines prediction and tailoring by integrating pre-treatment recommendations and a feedback system with CSTs. First, based on the patient's initial characteristics and a dataset of already treated patients, the TTN predicts the optimal treatment strategy (i.e., problem-solving, motivation-oriented or mixed) for the individual patient. Thus, the treatment strategy with the highest probability of obtaining a good treatment outcome is recommended. Additionally, the TTN estimates the patient dropout probability and offers the results of the psychometrical initial assessment. Based on this information, the therapist can work on an initial CF (Schaffrath et al., 2022).

Second, during treatment, the feedback system comprises an expected treatment response (i.e., predicted trajectory of progress for the patient) and a dynamic failure boundary informed by specific patient's pre-treatment features and the experienced change progress. When a patient is not progressing as expected, the TTN generates an alert signal, and CSTs are activated according to the assessment of critical areas that might hinder the change process (i.e., suicidality risk, motivation to change and therapy goals, therapeutic alliance, social support and critical life events, emotion- and self-regulation). When the alert of one of these areas is activated, the therapist can access the CSTs that guide how to address that particular area (e.g., a clinical guideline on how to work on motivation to change). With this information, the therapist can modify their initial CF by counting on information to dynamically adapt it during the ongoing treatment (Lutz & Schwartz, 2021; Lutz et al., 2022a).

Example of Data-Informed Case Formulation

The 48-year-old patient, Ms. Lux, registered for therapy at our clinic because she suffered from depressed mood, rumination, loss of interest in activities, social withdrawal and disturbed sleep. At intake, she lived in a house with her wife (43 years old, elementary school teacher), who had been trying to talk her into therapy for a long time. The patient worked as a fund manager in a nearby city, where she had to work six days a week and always felt a lot of pressure as she was the only woman among her colleagues and had to work hard to get the same recognition as her male colleagues. Additionally, her way to work took her two hours every day, so she someday started having dinner at the office to save time.

Before the COVID-19 pandemic, she played badminton twice a week but stopped when the gyms had to close and did not start again afterwards. She reported feeling overwhelmed, tired all the time and not wanting to "waste" her energy on social activities because her profession demanded all of her energy. Her wife tried to motivate her to go out and meet with friends, but the patient always found excuses related to work. She was dissatisfied with her weight as she had gained some kilograms due to the food delivered to her office and the lack of sports.

Everything got worse when her godchild moved to another city to go to university, whom she had met at least once a week and who was very close with her. Her wife had been worried about watching her mood change and losing interest in former pleasant activities. She suggested the patient see a therapist, but the patient was initially very reluctant, not wanting to waste time and energy. Her wife insisted, however, and eventually got her enrolled in therapy at our clinic.

Ms. Lux grew up as an only child of her parents. She had always been close to her mother, an elementary school teacher who was caring and affectionate. The patient reported that she often got frustrated with her mother because she was shy, introverted, and submissive towards her husband, which the patient could not bear. Her father, an accountant in a larger company, had always been distant but very proud of his daughter's achievements in school. He liked to talk about her good grades with other relatives and friends and gave her presents for her school reports if she reached a certain average grade.

During school, she was very popular because she always helped her classmates with homework and learning for exams. However, at 17, she came out as homosexual and felt excluded by her peers after opening up. Thus, she was happy that her family accepted her and looked forward to leaving the town for her studies. At the university, in her fourth semester, she met her later wife at a party, and they soon became best friends. At that time, her wife was in a relationship with one of her classmates. During the next two years, as they grew closer, she realized that she felt attracted to Ms. Lux and ended the relationship with her boyfriend. They moved in together and stayed together from then, always supporting each other. Ms. Lux described her wife as loving and caring and reported that she was the only reason why she registered for therapy in the first place.

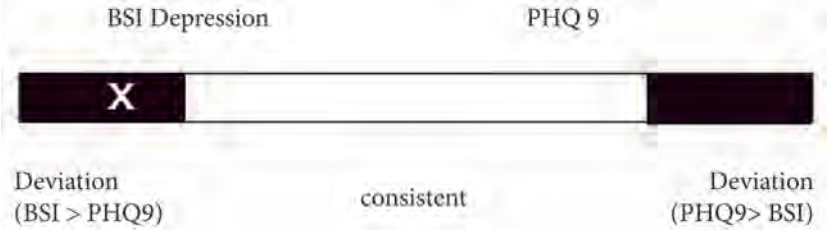
After the intake and diagnostic sessions, the TTN provided the therapist an overview of Ms. Lux's symptom severity. She reported a high overall score regarding physical and psychological symptoms in the *Brief Symptom Inventory* (BSI; Derogatis & Melisaratos, 1983; Franke, 2000)[1], with high levels of impairment in all subscales (e.g., somatization, insecurity, depression, obsession-compulsion). However, Ms. Lux reported only a low to moderate level of impairment on a depression-specific questionnaire, the *Patient Health Questionnaire* - 9 (PHQ-9; Kroenke et al., 2001; Löwe et al., 2002)[2]. Compared with all patients treated at the clinic, her symptom burden on the various scales was in the 35th (for the PHQ-9) to 85th (for the BSI) percentile. The TTN's coherency tool indicated this deviation of responses on the two questionnaires for depressive symptoms (BSI and PHQ-9; Figure 1a).

Ms. Lux's interpersonal styles were assessed with the *Inventory of Interpersonal Problems* - 32 (IIP-32; Barkham et al., 1996; Thomas et al., 2011)[3] and showed a strong tendency towards the submissive, distant side of the circumplex model, resulting in social avoidance and submissive behaviour (Figure 1b).

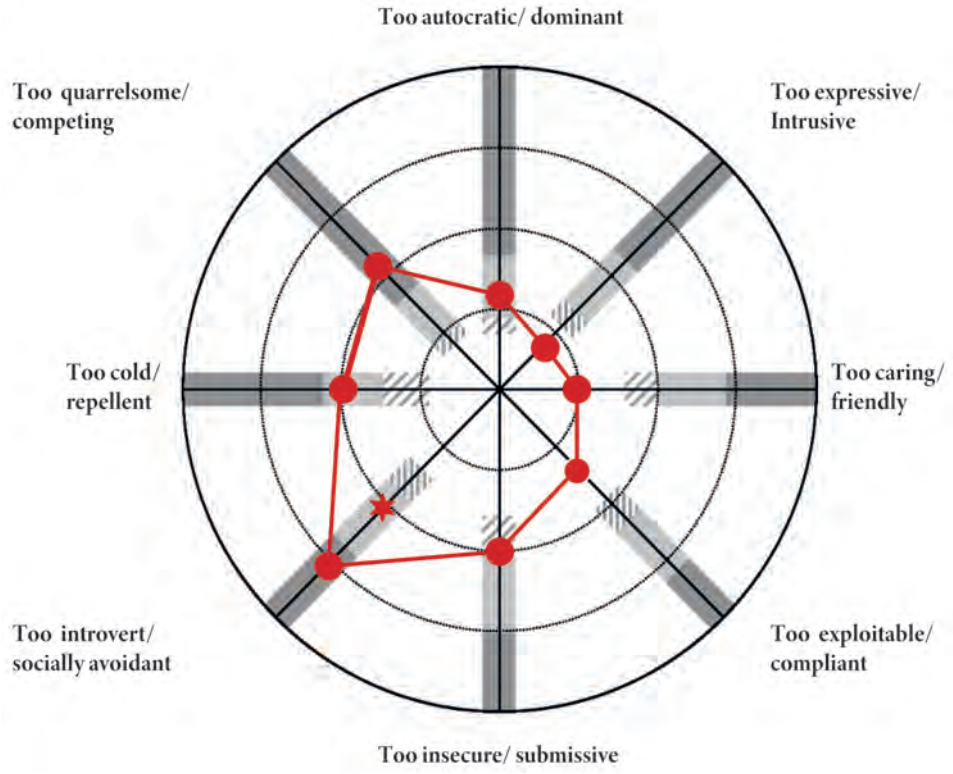
Figure 1

Coherence of Ms. Lux's Responses to Symptom Questionnaires and Interpersonal Styles (IIP-32)

a)



b)



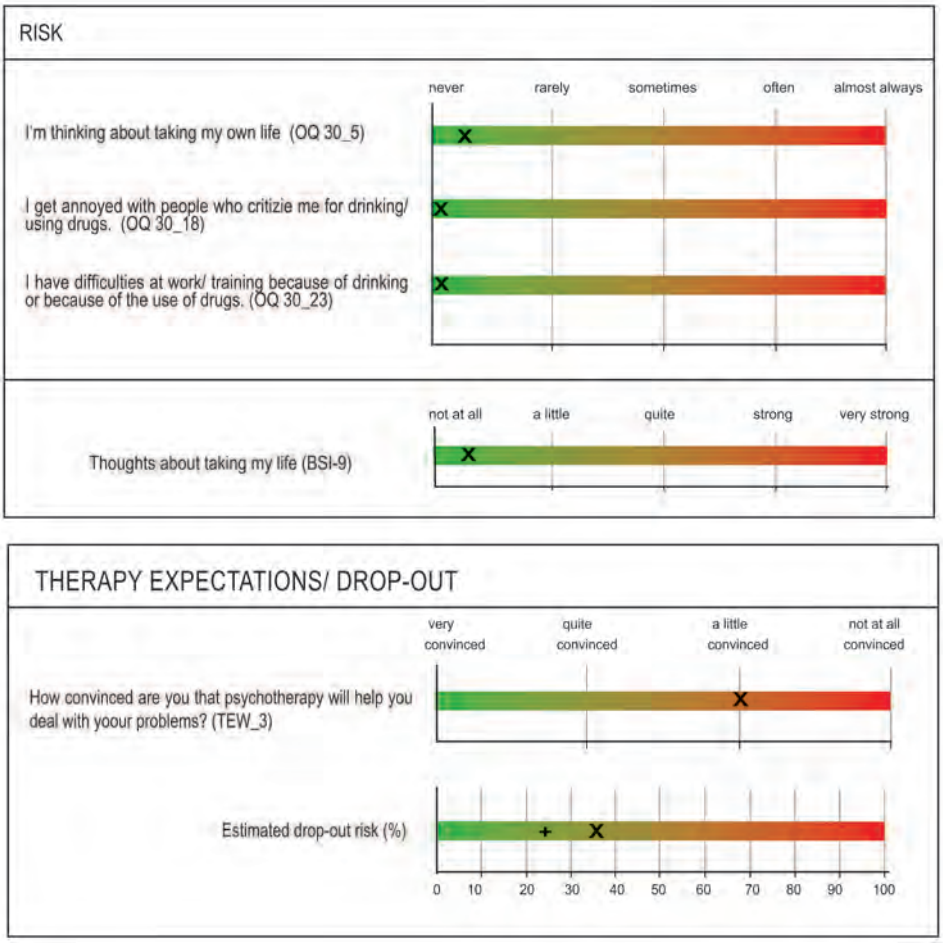
Note. Figure a) shows the extent to which the assessment is coherent on different instruments that assess the same construct (BSI and PHQ-9). In the middle area, the assessment is similar on both instruments. At the same time, a mark in the right and left marginal area indicates that one instrument was filled out significantly different than the other. Figure b) shows Ms. Lux's interpersonal styles.

Furthermore, the TTN calculated an individual dropout risk, which was higher than the average dropout rate in our clinic (Figure 2a). For the first ten sessions, the TTN recommended a motivation-oriented strategy (Figure 2b).

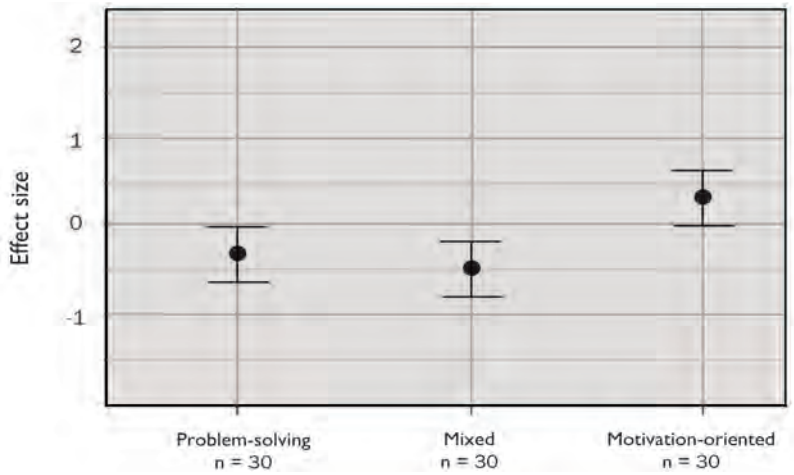
Figure 2

Ms. Lux's Pre-treatment Risk Factors and Recommendation for Treatment Strategies

a)



b)



Note. Figure a) shows Ms. Lux's risk of suicidality and her alcohol and drug consumption, as well as her therapy expectation and her individual drop-out (+ is the average dropout rate, X is Ms. Lux's dropout risk). Figure b) shows the treatment strategy recommendation for the first ten sessions, based on similar treated cases. Effect sizes are shown in Cohen's *d* of the particular treatment strategy. "*n*" indicates how many similar patients were used for calculating effect sizes in each treatment strategy.

Initial Case Formulation

Ms. Lux's therapist wrote a case formulation based on the information from the diagnostic phase and the TTN's recommendations: In her childhood, Ms. Lux was praised for her school achievements and was popular among her classmates for helping them with their homework. She learned that appreciation and social bonds could only be achieved through performance. This was reinforced by her father's striving for achievement and social prestige. As a result, her need for self-esteem was frustrated because she learned that "Others only accept me if I perform 120%." When she told her classmates that she was lesbian, she experienced exclusion by her peers, and her need for social bonds was frustrated. These hypotheses align with the socially avoidant and submissive interpersonal style depicted by the IIP-32. She also told her therapist that she was constantly struggling to keep up with her younger colleagues because she was afraid someone could realize that she did not give it 100%. This fits with the TTN's coherence tool, which shows a divergence of depressiveness in the BSI and PHQ-9. It seems that Ms. Lux is highly stressed but has difficulty recognising this due to her dysfunctional underlying assumption ("Others only accept me if I perform 120%.").

Following the initial conceptualisation and the TTN recommendations, the therapist planned to apply a motivation-oriented strategy because Ms. Lux's treatment expectancy and motivation to change seemed low. Additionally, the TTN indicated a higher than average drop-out risk, so the therapist planned on motivating

and convincing her by psycho-education about the rationale of therapy.

Concerning the submissive interpersonal style indicated by the IIP-32, the therapist planned to behave complementarily by taking a more dominant role at the beginning of therapy to establish a strong therapeutic alliance before giving back the responsibility to the patient. Because of the patient's high motive for achievement, the therapist planned to use positive reinforcement and praise her a lot, especially at the beginning of therapy.

Additionally, the therapist planned to develop a shared understanding of Ms. Lux's depressive symptoms and to decrease symptom intensity by resuming positive activities (e.g., badminton) and re-establish her social contacts. She should learn how to cope with rumination and start questioning dysfunctional beliefs about herself and her environment. In this context, Ms. Lux's high demands on herself should also be questioned. Ms. Lux should learn to listen to her body's signals (and limits) and that giving it "only 80%" is fine.

Treatment Process and Dynamic Case Formulation Adaptations

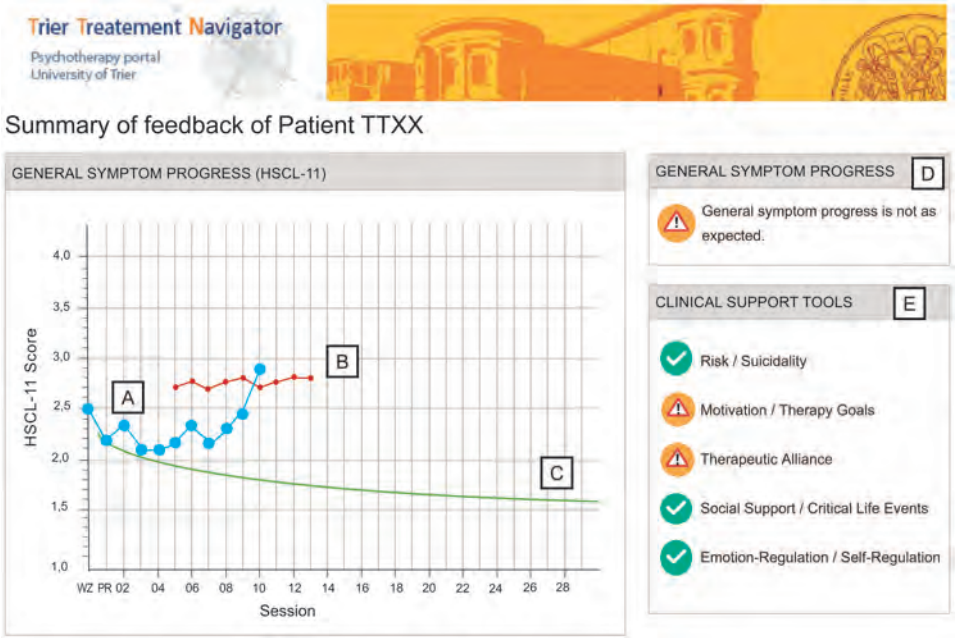
In the first few sessions, the therapist focused on strengthening Ms. Lux's treatment motivation and tried to raise her treatment expectations. He explained to her the therapy rationale and talked about the empirically proven effectiveness of psychotherapy. Together, they worked on Ms. Lux's therapy goals. She wished to learn how to relax to reduce her exhaustion and put less pressure on herself regarding work. The therapist experienced Ms. Lux as passive and submissive during this phase, with little action coming from her, which was in line with the interpersonal style indicated by the IIP-32. He decided to get her more involved in therapy by thinking about homework and planning positive activities. He wanted to give her the first sense of achievement to increase her motivation for therapy. He applied positive reinforcement strategies, but Ms. Lux often told him that she forgot to do the exercises during the week because she was too busy with work. The therapist praised her for her openness and tried working with her to understand why she prioritised her work over her well-being.

In session ten, Ms. Lux came to therapy in a very depressed mood. After filling out the assessment before the session, the TTN showed a warning signal that Ms. Lux's assessment rose above the risk value, which indicates an increased risk of deterioration. When the therapist asked her about it, she said she had gone to the medical doctor to get a sick note. At first, the therapist was very pleased that she had finally recognized and respected her boundary. However, he noticed that the patient became increasingly silent during the session and hardly answered his questions. When he tried to look at this development together with Ms. Lux from a meta-perspective, she said she was very tired and would prefer to go home and rest. The therapist told her that, on the one hand, he was happy to see her asking for her own needs, but on the other hand, he revealed to her that he felt something else might be behind her changed behaviour. However, Ms. Lux just waved it off

and repeated that she was tired. After the session, the therapist looked at the TTN and saw that her increased risk warning resulted from problematic developments in the domains of Motivation/Therapy Goals and Therapeutic Alliance (Figure 3).

Figure 3

Screenshot of Trier Treatment Navigator (TTN) Interface when the Threshold for Increased Risk of a Negative Development is Exceeded



Note. The blue line (A) indicates the actual symptom severity, the green line (B) represents the expected course of symptom severity, and the red line (C) represents the individual risk value. On the right hand side, the warning sign (D) and the domains relevant to the current problem are displayed (E). For this case, especially the domains "Motivation/ Therapy Goals" and "Therapeutic Alliance" seem to be affected. HSCL-11 = Hopkins Symptom Checklist-11; PR, pretreatment; WZ, waitlist.

At the next supervision session, the therapist brought up Ms. Lux behaviour and presented all of the information provided by the TTN. The therapist and his supervisor discussed how the first ten therapy sessions had been going and what kind of interpersonal pattern Ms. Lux had triggered in the therapist. He described that sometimes he felt like having to prove his competence to her as she was almost twice his age and that he had acted quite dominantly because of her submissive interpersonal style. However, a further inspection of the last measurement showed that Ms. Lux's alliance ratings were low. The noticeable items were "I feel that the therapist understands me" and "I feel that I, as well as the therapist, are seriously pulling together."

The Motivation/Therapy Goals CST initially provides theoretical input on therapy motivation. Additionally, the tool provides examples of therapeutic dialogues, suitable exercises and worksheets to work with in therapy. At first glance at the tool, the therapist could see that he had already implemented some of the exercises and worksheets with the patient. Furthermore, he determined that his therapeutic attitude largely corresponded to the appreciative, empathic, informative, reassuring, and equal one described in the tool. Nevertheless, the therapist realised that he may have been too dominant. He read in the CST that when there is scepticism about the usefulness or effectiveness of certain techniques or therapy as a whole, it can be helpful to present research findings. Still, it is important not to persuade the patient. The therapist realised, however, that he had fallen into a dominant and persuasive mode due to his fear of not appearing competent enough. Because of this and the low alliance ratings in the last measurement, he decided to focus on the CST for Therapeutic Alliance.

The tool for Therapeutic Alliance is structured like the tool for Motivation/Therapy Goals. First, there is general theoretical information on the therapeutic alliance, followed by subsections with therapeutic strategies, examples of therapeutic dialogues, exercises and worksheets. In the subsection on alliance ruptures, the therapist realised that they had experienced an alliance rupture in the last session with Ms. Lux, namely a 'withdrawal from the therapist' (Eubanks et al., 2022). In the tool, exploring the experience, exploring avoidance, and expressing desires are described as the next steps to resolve the alliance rupture. These explanations are supported by examples of therapeutic dialogues and videos. Based on these steps, the therapist planned the next session, in which he first wanted to address Ms. Lux's experience on a meta-therapeutic communication level (Papayianni & Cooper, 2018), and then, as described in the tool, recognise his contribution to the interaction to strengthen her self-assertion.

In the next session, the therapist mentioned to the patient again about the last session and expressed his concern that he felt she might not be able to trust him. He also mentioned that he felt like being too dominant in the first sessions, explaining that he intended to give her hope and motivate her for therapy. He could see that Ms. Lux was very tense when he spoke to her and asked her what she was thinking about this topic. Reluctantly, Ms. Lux told him that she felt like a child whenever he was praising her or explaining something to her, which reminded her of her childhood.

When the therapist listened to her, she gained more confidence and told him that her male colleague, who was younger than her and had far less experience, had gotten a promotion that she had been working hard for and hoping to receive. She said she felt like "men always outperform me" and had no chance of advancing further if younger men outcompete her. This was the first time the therapist experienced Ms. Lux emotionally engaged; he paraphrased and emphasized her feelings to validate them. Furthermore, he asked her if she had felt the same in their

therapeutic relationship. Ms. Lux admitted that she hadn't trusted him to care about her problems because "Usually, men are only interested in their own business." She mentioned feeling "inferior," which was difficult for her to bear.

The therapist wanted to validate her and interjected that he would like to say that he is happy that she is showing her vulnerable side, but at the same time, wonders whether this might not also trigger a feeling of inferiority. Encouraged by the therapist's more reserved approach, Ms. Lux could take a moment to think and listen to herself before answering that their conversation now felt very different from interactions with her father. In the next sessions, the therapist took a more restrained approach and used a patient-centred interviewing style to give Ms. Lux space for her thoughts and feelings. In addition, he constantly applied meta-therapeutic communication to reflect on what was happening in the therapy and the associated feelings.

During therapy, there were some other episodes of alliance ruptures during which Ms. Lux withdrew from the conversation. Nevertheless, the therapist was always able to resolve them in the same session due to his increased sensitivity to alliance ruptures. Finally, Ms. Lux could verbalize when she felt she was not being taken seriously and no more alliance ruptures occurred. She also reduced her working hours, which made it possible for her to go to badminton again.

Discussion

We presented a novel way of practising CF using technology augmentation in the context of data-informed psychotherapy. Data-informed psychotherapy emerged as a way of practising psychotherapy with the aid of CDSS. CDSS use big data, statistical tools and machine algorithms to make clinical recommendations. These recommendations help the clinician personalise treatment according to the patient's characteristics and the progress they obtain during the ongoing therapy. In this sense, the term "informed" is prefered over "based" (i.e., data-based psychotherapy) because is about informing and supporting clinical decision-making with empirical data, not about replacing clinicians' knowledge.

The aims of data-informed psychotherapy (i.e., personalising treatment at the individual level to ensure the highest probability of treatment success) are analogue to the aims of CF (i.e., personalise treatment based on a psychological understanding of the patient's problems). In this sense, both practices generate mutual synergies, with data-informed psychotherapy providing empirical quantitative support and CF providing a qualitative sense-making framework of the patient's issues and therapy rationale. Both practices inform and feedback to each other. The information provided by the CDSS can inform the clinician's initial CF after the initial assessment. During the ongoing therapy, the different tools provided to monitor treatment can continue informing CF in an ongoing dynamic process. At the same time, CF can provide an interpretative framework to understand the patient responses and the information provided by the CDSS.

As shown in Ms. Lux case, based on the clinical history, the psychometric information and the treatment recommendations provided by the TTN, the therapist was able to state a case formulation to understand Ms. Lux situation and guide the therapeutic process. At the same time, with the CF, the therapist could understand and give sense to some of the information revealed by the TTN (e.g., discrepancy between PHQ-9 and BSI depression subscale scores). Nevertheless, the initial relational style chosen by the therapist was counterproductive. The TTN reflected this situation with the feedback system and alert signals of critical areas. With the help of CSTs and the previous CF, the therapist was able to understand the situation, conceptualise it as an alliance rupture and repair it at the correct timing. By addressing the alliance rupture with meta-therapeutic communication, the therapist could understand Ms. Lux's experience more in-depth and enrich his CF. With these new understandings, the therapist could enact a different relational style and redirect the therapy to a good resolution.

Ms. Lux case showed how CF and the practice of data-informed psychotherapy can complement and enrich each other. Nevertheless, despite the current development of data-informed psychotherapy, little is known about the incremental benefit of psychometric psychological assessment on CF (Eells, 2022; Nelson-Gray, 2003). Research on the reliability of CF has shown mixed results (Flinn et al., 2015), being considered "modest at best" (Bieling & Kuyken, 2003, p. 52). The expert consensus is that CF reliability is compromised as clinicians move from descriptive to inferential levels (British Psychological Society, 2011). It is unclear whether problems in reliability are due to difficulties in the process, such as the use of heuristics or biases that affect clinical judgement (Dumont, 1993), or to methodological issues, such as the absence of information available to clinicians in routine practice (including the possibility of developing the formulation in collaboration with the patient). It is also unclear if a reliable and valid CF contributes to better treatment outcomes (Aston, 2009). Studies comparing outcomes of patients randomly assigned to manualised treatments or tailored therapy based on CF have not found significant differences between them (Emmelkamp et al., 1994; Jacobson et al., 1989; Schulte et al., 1992). However, there is some evidence that factors often included in CF act as moderators or mediators of the change process and treatment outcome (Persons & Hong, 2016). It is expectable that the practice of data-informed psychotherapy with CDSS contributes to addressing part of the issues on the reliability, validity and effectiveness of CF.

Beyond CF, it has been shown that practising data-informed psychotherapy with technological augmentation tools (i.e., CDSS, ROM and feedback systems, CSTs) contributes to better treatment outcomes (Cohen et al., 2021; de Jong et al., 2021; Delgadillo et al., 2018). For instance, in a prospective evaluation of the TTN, Lutz et al. (2021b) found that therapists who followed the recommended treatment strategies in the first 10 sessions obtained a differential effect size of Cohen's d = .30 compared to therapists that did not follow them. Nevertheless, more prospec-

tive studies are needed to evaluate the effectiveness of treatment recommendation algorithms and the practice of data-informed psychotherapy.

Integrating CDSS in clinical practice requires overcoming several challenges. First, big datasets with information on previously treated patients are required. In this sense, ROM in the context of a measurement-based practice needs to be implemented in psychotherapy services to collect routine data. Outcome measurement can be seen as an important and integral part of clinical practice, comparable to other areas in the health care system, where continuous monitoring of health indicators is common in routine practice (e.g., body temperature, blood pressure). In this sense, ROM forms the basis of modern data-informed psychotherapy (Lutz et al., 2022b). These data collection procedures are not passive tasks. ROM must be an integral part of clinical competence, practice, and training. In this way, clinicians can use the information provided by these tools with their patients to inform their CFs and decisions on empirical data from their practice.

Second, developing clinical recommendations based on statistical and machine learning algorithms requires the involvement of researchers (e.g., quantitative psychologists, data analysts) and clinicians. Clinicians know what kind of recommendations are useful for them based on the treatments they provide. In this sense, it is necessary to incorporate therapeutic processes and change mechanism measures into routine practice (e.g., Lutz et al., 2019; McAleavey et al., 2021; Miller et al., 2005; Moggia et al., 2021). With these kinds of measures, studying what processes and mechanisms are optimal for specific patients is possible. These measures allow knowing what therapists better provide certain change processes or mechanisms, contributing to developing algorithms recommending therapist-patient matches (Constantino et al., 2021).

Finally, therapists' training in using CDSS and creating a "feedback culture" at the service level are necessary elements for appropriately implementing these systems. Clinicians' behaviour and attitudes, perceived usefulness, and commitment to outcome measurement mediate the impact on the effectiveness of such tools in clinical practice (de Jong et al., 2021; Lutz et al., 2021b). Traditionally, psychotherapists have been reluctant about or even critical of implementing measures on a routine basis (Boswell et al., 2015; de Jong, 2016; Douglas et al., 2016). This contrasts with the patient perspective, from which outcome assessment is usually well-received (Lutz et al., 2021a). Several factors contribute to the hesitant reception of measurement in clinical practice. For instance, reluctancy on the use of technical equipment, financial support, time disposal, apprehension about the ecological validity of measures (e.g., thinking that empirical findings do not reflect their everyday practice; Boswell et al., 2015; Gilbody et al., 2002), perceiving measurement as a way of control, or concerns about data security (de Jong & de Goede, 2015; Mütze et al., 2022). In this regard, appropriate training and institutional support (involving all stakeholders) are necessary for a correct implementation.

More recent developments in data-informed psychotherapy deal with tools

from e-mental health apps and intensive longitudinal assessments, which can also be used to create, improve and customize CF (Hehlmann et al., 2021). For instance, data from high-frequency measurements can be obtained via ecological momentary assessment (EMA). Technological devices such as smartphones and smartwatches allow the collection of real-time psychological, physiological, and behavioural variables in patients' daily lives. In this way, EMA represents an ecologically valid assessment procedure that can provide a reliable representation of intrapersonal processes that can be used for CF (Scholten et al., 2022).

To conclude, incorporating information technologies and developments from the "big data era" has come to psychotherapy to stay. As we have shown in this article, CF and data-informed psychotherapy are targeted to the same aim: personalising treatment according to individualised patient characteristics and needs. In this sense, the practice of data-informed psychotherapy and CF complement and enrich each other. It should be borne in mind that data-informed psychotherapy is not only counting on data but also knowing what to do with them and how to obtain insights from data. In this regard, CF is crucial because it establishes the framework under which the information provided by the technological augmentation tools makes sense. At the same time, data helps clinicians empirically inform CF. Thus, it is not about blindly trusting the data but using it to inform clinical practice and make empirically-based decisions to achieve the best treatment possible for each patient.

Notes:

1 The Brief Symptom Inventory (BSI; Franke, 2000; German translation of Derogatis & Melisaratos, 1983) is the brief form of the Symptom Checklist-90-R (SCL 90-R; Derogatis, 1994). It is a 53-item self-report symptom inventory for the evaluation of physical and psychological symptoms within the last week. The instrument covers nine dimensions: somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism. The items are scored on a five-point Likert scale ranging from 0 ("not at all") to 4 ("extremely"). The internal consistency of the German BSI has been reported on Cronbach's α = .92 and retest-reliability of r = .90 (Franke 2000).

2 The Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) is a self-report questionnaire measuring depressive symptoms according to the diagnostic criteria of major depressive disorder of the Diagnostic and Statistical Manual of Mental Disorders - IV (DSM-IV; American Psychiatric Association, 2000). It comprises nine items which are answered on a 4-point Likert Scale ranging from 0 ("not at all") to 4 ("almost every day"). The German version shows good internal consistency with Cronbach's α = .88 (Löwe et al., 2004).

3 The Inventory of Interpersonal Problems - 32 (IIP-32; Barkham et al., 1996) is the short version of the Inventory of Interpersonal Problems (IIP; Horowitz et al., 1988) aimed at assessing difficulties people experienced in their interpersonal relationships. The IIP-32 comprises 32 items which are answered on a five-point Likert scale ranging from 0 ("not at all") to 4 ("extremely") in response to the stem: "How much have you been distressed by this problem?" The IIP-32 covers eight interpersonal maladaptive styles according to Leary's circumplex interpersonal model (Leary, 1957): Too autocratic/dominant, too expressive/intrusive, too caring/friendly, too exploitable/compliant, too insecure/submissive, too introvert/socially avoidant, too cold/repellent, and too quarrelsome/competing. The German version was adapted by Thomas et al. (2011), showing solid psychometric properties.

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