

The use of multidimensional assessment in developmental age: How evaluation of the emotional-autonomic state can facilitate the differential diagnosis in psychopathology. Description of two case studies

BACKGROUND

Mental suffering involves cognitive, behavioral, and emotional aspects, which can manifest explicitly or remain implicit. The use of different clinical tools may allow the collection of information deriving from different channels. In the field of clinical psychopathology, there is scientific evidence regarding the use of psychophysiological parameters to identify emotional conditions characterized by hyperarousal or hypoarousal and thus favor the differential diagnosis.

PARTICIPANTS AND PROCEDURE

Our work describes two case studies demonstrating that a multidimensional assessment can comprehensively help the differential diagnosis.

RESULTS

The first case concerns a child (9 years old) brought to an assessment for behavioral disorders. The psychological tests highlighted irritability and mood alteration as prevalent concerning the behavioral manifestations (out-

bursts of anger, etc.). Additionally, a psychophysiological evaluation confirmed the depressive state characterized by a condition of psychophysical exhaustion. The second case concerns a girl (14 years old) diagnosed with major depressive disorder by a psychiatrist who treated her with psychotropic drugs. The antidepressants worsened her symptoms to the point of being the cause of suicidal attempts. The multidimensional evaluation documented the presence of hyperarousal at an emotional and autonomic level, a characteristic known in the literature to be a precursor of suicidal ideation.

CONCLUSIONS

These case studies represent clear examples of how only a multidimensional assessment can describe the entire suffering of the person and support their health through a personalized intervention.

KEY WORDS

clinical cases; psychophysiology; differential diagnosis; developmental age, multidimensional assessment

ORGANIZATION – University of Parma, Parma, Italy

AUTHORS' CONTRIBUTIONS – A: Study design · B: Data collection · C: Statistical analysis · D: Data interpretation · E: Manuscript preparation · F: Literature search · G: Funds collection

CORRESPONDING AUTHOR – Sara Guidotti, Ph.D., University of Parma, Via Università 12, 43121 Parma, Italy, e-mail: sara.guidotti@unipr.it

TO CITE THIS ARTICLE – Guidotti, S., Fiduccia, A., & Pruneti, C. (2024). The use of multidimensional assessment in developmental age: How evaluation of the emotional-autonomic state can facilitate the differential diagnosis in psychopathology. Description of two case studies. *Health Psychology Report*. <https://doi.org/>

RECEIVED 11.01.2024 · REVIEWED 23.04.2024 · ACCEPTED 06.06.2024 · ONLINE PUBLICATION 13.08.2024



BACKGROUND

Sara Guidotti,
Alice Fiduccia,
Carlo Pruneti

The multidimensional approach to clinical psychology and psychopathology consists of the collection of data from different response systems, such as cognitive-verbal, behavioral-motor, and emotional-psychophysiological (Falkenberg et al., 2012). Specific tests and questionnaires can describe the patient's suffering at a subjective level. Furthermore, the clinician can use structured or unstructured interviews as well as clinical observation settings to collect more information about the person's life history and identify signs and symptoms of psychopathology (facial expressions, posture, gestures, tone of voice, proxemics, etc.). The emotional and psychophysiological dimension is the most challenging to study, as it represents implicit aspects difficult to objectify. One of the possible types of analysis of the emotional-psychophysiological response is the "psychophysiological evaluation" or "psychophysiological profile" (which can differentiate the "stress profile" or, conversely, the "relaxation profile"), which can be part of the multidimensional diagnosis (Fuller, 1979). The psychophysiological evaluation allows the collection of information deriving from physiological indices (i.e., muscle tone, heart rate, skin conductance or electrodermal activity, peripheral temperature, respiratory rate) linked to the complex response to stress and, more generally, to the activity of the autonomic nervous system (ANS) (Öhman et al., 2000; Sarchiapone et al., 2018). More specifically, the psychophysiological evaluation detects the activity of different physiological parameters, including (1) surface electromyography of the frontalis muscle (sEMG), whose electrical potential can be detected using two active electrodes positioned 1 cm above the lining of the eyebrows with the pupils and a reference in the center of the forehead; (2) heart rate (HR) and inter-beat interval (IBI), with the detection of the electrical potential of the heart muscle with the bipolar junction. Particular analysis of the R-wave time intervals (R-R intervals) allows the definition of heart rate variability (HRV). HRV corresponds to the sympathovagal balance, which is the reflection of the dominant branch of the ANS (sympathetic or parasympathetic). In other words, if a particular HRV value (i.e., LF/HF ratio) is low, it reflects parasympathetic dominance (typical of "tend-and-befriend" behaviors). In contrast, when the ratio is high, it may indicate sympathetic dominance (typical of fight-or-flight behaviors) (Pruneti et al., 2023a; Shaffer & Meehan, 2020; Shaffer et al., 2014). Then, other physiological parameters may be: (3) peripheral temperature (PT), measured by applying a thermistor to the base of the thenar eminence of the non-dominant hand; (4) skin conductance – level and response (SCL/SCR) – which is recorded by letting a light electric current pass between two electrodes located on the last phalanx of

the fingers of the dominant hand, and, (5) respiratory frequency and amplitude (RF/RA) (Sarchiapone et al., 2018). The psychophysiological recording is divided into several phases to monitor the level of arousal at rest, under induced stress, and in the phases in which the subject is required to relax to restore baseline values (Fuller, 1979). The main purpose of the evaluation is to verify how maladaptive the psychophysiological balance appears to be, based on the following observations of one or more parameters: (1) high level of autonomic arousal in the rest phase; (2) abnormal amplitude of the stress-induced response during the stress phase; (3) slow, unstable, or absent values during the mental stress phase; (4) slow, unstable, or absent recovery of the values during the post-stress phase; (5) slow, unstable, or absent recovery of the values in the recovery phase (Pierini et al., 2013).

Numerous studies have documented specific configurations of physiological indices related to psychopathological disorders (Sudol & Mann, 2017). The presence of patterns linked to anxiety and depression was described for the first time in Lader's (1975, 1983) research and then confirmed by Stegagno and Palomba (1994; cf. Stegagno, 2008) as well as by more recent studies (Bonnet & Naveteur, 2004; Falkenberg et al., 2012). For instance, while the anxious syndrome is characterized by high levels of heart rate, muscle tone, electrodermal activity, and a decrease in peripheral temperature, the depressive syndrome shows high levels of heart rate and muscle tone but a low level of electrodermal activity (Pruneti et al., 2014, 2016). However, in some cases, anxious hyperarousal can also be observed in depressive-type behavioral manifestations (Byrne, 1975; Falkenberg et al., 2012), which may represent a risk factor for suicidal ideation (Fraguas et al., 2007). Moreover, similar conditions are typical of depressed patients in whom the hyperarousal is explained by recent and highly stressful or traumatic events (Pruneti et al., 2011) or activating drugs (i.e., antidepressants) (Le Noury et al., 2015).

The use of clinical psychophysiology in psychopathology can provide valuable insights for clinical psychology. Multidimensional assessment, including a psychophysiological profile, can aid in the formulation of psychological diagnosis and differential diagnosis. Nonetheless, in recent years there has been an increasing emphasis on evidence-based practice in psychology (Bornstein, 2017). Moreover, little attention has been paid to applying the principles of evidence-based practice to the phase of psychological assessment, even though it plays a crucial role in the treatment selection and prognosis in various contexts (research, forensics, behavioral health, risk management, health settings, neuropsychological deterioration and recovery, personnel selection and placement in organizational settings, etc.) (Bornstein, 2017). Nevertheless, multidimensional assessment in developmental age is even more rarely applied in health-

care contexts (Dormal et al., 2021). To our knowledge, there have been no studies investigating the usefulness of multidimensional assessment, including the psychophysiological profile, in formulating differential diagnoses for developmental age. In this first such study, the objective is to describe two clinical cases in which the multidimensional evaluation offered fundamental clinical elements for the correct diagnostic classification. Our research proposes that it paves the way for future studies on large populations of developmental-age patients to support our goal.

CASE STUDY 1

CASE HISTORY

M. is a 9-year-old boy who lives with his mother, her new partner, and the children born from this relationship. His parents separated when he was 3 years old. The father created a new family as well. M. is described as lively but slightly hyperactive. The parents define him as a more mature child than his peers, referring to his intellectual profile, functioning, and autonomy (for example, he sometimes looks after his little brothers). Both parents complained that managing the child has been difficult since their separation, which then worsened with the attendance at primary school, in which rules, respect and impulse control are considered necessary for adequate inclusion in the classroom context. The parents describe the frequent reports from teachers, who complain about poor adherence to the rules (e.g. “He gets up”, “He speaks”), as well as irritated reactions characterized by impulsiveness towards some classmates (“He throws his class-mates to the ground”, “He throws stones”, etc.). His mood is often characterized by irritability (from which fits of anger and aggressive behavior frequently arise) but also by “boredom”, alternating with restlessness and states of “shut down”.

Considering the minor age, it was deemed appropriate to exclude, first of all, the presence of any cognitive alterations typical of certain disorders frequent in developmental age. Subsequently, the emotional and behavioral dimensions were better investigated through tests and questionnaires as well as the psychophysiological evaluation.

MEASURES

To investigate the presented symptoms and conduct an accurate diagnostic classification, the following clinical psychological assessments were administered.

The Wechsler Intelligence Scale for Children-III (WISC-III; Italian version: Orsini & Picone, 2006) evaluates the intellectual ability of subjects aged 6 to 16 years and 11 months. The WISC-III includes

thirteen subtests. Five subtests contribute to the calculation of the Verbal Intelligence Quotient (VIQ) (Information, Similarities, Arithmetic Reasoning, Vocabulary, and Comprehension), and the other five to the calculation of the Performance IQ (PIQ) (Completion of figures, Cipher, Reordering of figurative stories, Drawing with cubes, and Reconstruction of objects). There are also three additional subtests (Symbol Search, Digit Memory, and Mazes). The child’s performance is then summarized in three scores that provide an assessment of intellectual abilities: the VIQ is given by the sum of the weighted scores of 5 verbal subtests; the PIQ is given by the sum of weighted scores of 5 performance subtests; and the Total IQ (TIQ) is given by the combination of scores on the verbal and performance subtests.

The Child Behavior Checklist (CBCL/4-18; Achenbach, 2001) is a developmental assessment tool useful for assessing behavioral and emotional problems in children and young people between 4 and 18 years old. The CBCL/4-18 is made up of a series of questions designed to be completed by caregivers, as they evaluate the child’s behavior in different areas to provide a total score, one aimed at Internalizing problems and one referring to Externalizing problems. The Anxiety-Depression, Withdrawal-Depression, and Somatic Complaints sub-scales refer to Internalization, and the Rule-Breaking Behavior and Aggressive Behavior sub-scales refer to Externalization. Summing the scores of the two scales, along with supplementary sub-scales (i.e., Social Problems, Thinking Problems, Attention Problems, and Other Problems), contributes to the total (T) score. The results are evaluated based on the T scores (range: 50-100), which indicate the standard deviation compared to the reference mean (a T score above 70 indicates the presence of a significant problem in the relevant area evaluated, and a score between 65 and 70 corresponds to the pre-clinical range).

The Depression State Scale (DSS; Pruneti et al., 2001; Pruneti & Guidotti, 2021) allows the description of states of mental suffering linked to anxiety, depression, and alteration of the child’s interpersonal functioning. There are three subscales (Anxiety, Depression, and Interpersonal Relationships) and five factors (depressed mood, low self-esteem, difficulties in the school context, social withdrawal, and somatic symptoms). The cut-offs for males are as follows: anxiety = 5.88 (range: 0-24), depression = 7.94 (range: 0-30), problems in interpersonal relationships = 6.77 (range: 0-30), and total = 20.57 (range: 0-84).

The Big Five Questionnaire – Children (BFQ-C; Italian version: Barbaranelli et al., 1998) provides an assessment of personality divided into five dimensions (the Big Five; DeYoung et al., 2016) which are: conscientiousness (autonomy, order, precision, and respect for rules and commitments), extroversion/friendliness (concern and sensitivity for others and their

*Evaluation
of the emotional-
autonomic state
for the differential
diagnosis*

needs), emotional instability (feelings of anxiety, depression, discontent or anger), energy (creativity, enthusiasm, assertiveness, and self-confidence), and openness (cultural interests, creativity, and interest in other people and cultures). The questionnaire includes 65 items and includes a version for the child and one for his parents/teachers. For both versions, the raw score is converted into T points where the normal range falls between 45 and 50.

The *Psychophysiological Stress Profile* (PSP; Fuller, 1979) is a psychophysiological evaluation in which a continuous recording over seven phases (Baseline, Objective stress [Stroop test], Recovery, Objective stress [arithmetic calculation], Recovery, Subjective stress [completion of Sack's phrases], Recovery) of the following psychophysiological parameters is made: (1) surface electromyogram (sEMG), (2) skin conductance (SCL/SCR), (3) heart rate, inter-beat interval, heart rate variability (HR/IBI/HRV), (4) peripheral temperature (PT). Values are considered normal at rest if they fall between 1.7 and 2.5 μ V for sEMG, 2.2 and 6 μ S for SCL-SCR, 31 and 32 $^{\circ}$ C for PT, 60 and 90 bpm for HR, and values of 1.2 and 2 for HF/LF ratio of HRV (Cacioppo et al., 2010).

RESULTS

Although no elements emerged that were indicative of the possible presence of a neuro-developmental disorder affecting cognitive functioning during the interview with the parents, an intelligence test was still administered to fully exclude a possible cognitive impairment. The scores deriving from the WISC-III described an intellectual profile that fully falls within the ranges considered typical for age, with good homogeneity in the performances belonging to the VIQ (= 104) and the PIQ (= 117). Only for the scale Digit Memory was a low score (equal to 6) recorded. This aspect may indicate moderate difficulty in maintaining adequate levels of concentration or a possible overload of short-term memory and verbal work attributable to emotional alterations.

Subsequently, to better describe the emotional-behavioral problems reported by the parents at the interview, the father filled in the CBCL/4-18, which returned scores above the clinical cut-off (= 70 T points) in two of the global scales (total = 74 and Externalizing = 74), although a score at the limits of clinical significance (= 69) also emerged in the Internalizing one. In particular, the sub-dimensions linked to internalizing problems highlighted slight anxious arousal and behavioral alterations attributable to a depressed mood accompanied by somatization (Anxiety-Depression = 69; Withdrawal-Depression = 66; and Somatic Complaints = 67). The sub-dimensions linked to externalizing behavioral problems described the tendency to break the rules (= 66) and to adopt an

aggressive attitude (= 72). Furthermore, slight deviations from the norm can be observed regarding dysfunctional behaviors in the social sphere (= 67).

The involvement of emotional and behavioral aspects was confirmed by the DSS, which documented the presence of an anxious state (score = 14/24, normative value = 5.88) accompanied by a modest alteration in mood (score = 18/30, normative value = 7.94), probably oriented towards both depression and irritability, with repercussions on an interpersonal level (score = 16/30, normative value = 6.77).

The PSP made it possible to obtain more information regarding the psychophysical state of the child as it described a condition characterized by hypoarousal in resting conditions. Values above the typical ranges were only found for muscle tension, which was significantly high (6.23 μ V at rest, 12.80 μ V under stress; in this regard, the child reported frequent headache attacks, probably of the tension type). Although the skin conductance value (0.90 μ S at rest) increased significantly under stress, it only reached the value of 2 μ S, which is at the limit of normal. Furthermore, an incomplete recovery of the baseline values emerged. Significantly higher values also for heart rate were observed in conditions of subjective stress (88 bpm) (75 bpm was recorded at baseline). Lastly, the HRV spectral analysis defined the sympathovagal balance by calculating the LF/HF ratio, confirming a condition characterized by low arousal in all phases of the psychophysiological profile carried out (LF/HF ratio stably remained below the parameter of 1 when normal values fell between 1 and 2).

Lastly, M. and his father compiled the BFQ-C, which includes a version for the child and one for the caregiver. Self-administration did not reveal scores below the normal range (< 45 T points) in any of the five dimensions. Slight deviations were observed for the scores of energy (= 58), conscientiousness (= 63), and open-mindedness (= 61). M. described himself as a lively and enthusiastic child when carrying out various activities, even new ones. The moderate conscientiousness score could suggest the presence of a slightly rigid attitude in some contexts of daily life. This aspect was partially confirmed by the father, who underlined, instead, a slight decrease in his son's energy levels (= 47) and in his interpersonal and social functioning compared to peers (= 42).

To summarize, the cognitive performance evaluation highlighted an intellectual profile fully normal for age, excluding possible diagnoses of neuro-developmental disorder with involvement of intellectual functioning. The interview and the standardized questionnaire used to describe the behavioral problems highlighted the presence of a hostile attitude towards peers, which can impulsively culminate in outbursts of anger. The DSS documented the emotional alterations, underlining anxious arousal with somatizations and alterations in mood, which ap-

Sara Guidotti,
Alice Fiduccia,
Carlo Pruneti

peared to be oriented toward depression. The psychophysiological evaluation confirmed the presence of repercussions at a psychophysical level, highlighting psychophysical alterations very similar to so-called “exhaustion” conditions (Bonnet & Naveteur, 2004). Similar clinical conditions usually follow stressful events that require high levels of psychophysical energy. Additionally, some temperamental traits (linked to rigidity and a sense of responsibility associated with attempts to exercise one’s control over external events, etc.) may accentuate the emotional burden (Noble & Lader, 1971). While age may play a role in his conduct, there seems to be a discernible emotional immaturity that is not commensurate with his advanced cognitive abilities. In particular, M. displays behaviors that are often seen in children older than himself, making it difficult for his parents to manage his reactions.

In summary, the multidimensional assessment highlighted mood alterations in addition to reported behavioral disorders. Additionally, it emerged that the angry outbursts (described during the interview) were associated with a persistently irritable mood. The collection of various information deriving from the different channels made it possible to formulate the diagnosis of disruptive mood dysregulation disorder and exclude intermittent explosive disorder (APA, 2023).

CASE STUDY 2

CASE HISTORY

G. is a 14-year-old girl. She has a history of speech disorder (marked delay in the acquisition of phonemes), for which she underwent speech therapy from the second year of kindergarten to the third year of primary school. G. is described as a more mature child on a cognitive level but poorly integrated from a social point of view. Difficulties in interacting with peers are reported. She has always mainly carried out activities independently, although complex (i.e., reading fairy tales already in kindergarten, which she struggled to repeat to her peers because of the speech impairment). Even small conflicts between classmates favored reactions of closure and social withdrawal in G. There was also little involvement in extra-curricular activities, such as sports. A certain selectivity towards certain types of food also emerged.

During adolescence, G. experienced several significant life events. One such event was the death of her maternal grandmother in March 2020, which had a particular impact on her mood. She became irritable and hostile and had magical thoughts toward her mother as if she could have prevented the event. Around the same time, G. also lost a friendship due to betrayal. These events occurred during the pandemic,

already characterized by isolation and social distancing, making things more challenging for the patient. As a result, she started refusing to return to school in the post-lockdown phase. The mother reported a change in G.’s mood, which worsened in November 2020. Six months later, an episode of intense suffering occurred (not better defined and not connected to a precipitating event) culminating in an unstoppable crying crisis at school. The parents took the girl to the emergency room, where she was referred for a neuropsychiatric assessment (sertraline 100 mg was prescribed but not undertaken initially) and psychological counseling. A second neuropsychiatrist prescribed sertraline 25 mg/day and lithium carbonate 300 mg for “a patient with a mood disorder with prevalent anxious-depressive aspects and hyperthymic oscillations, in neurodevelopmental disorders”. A neuropsychological evaluation documented an intellectual profile normal for age, despite the presence of autistic traits. After a few days, G. carried out a suicidal gesture with an overdose of drugs. In April 2021, she threatened suicide by dangerously exposing herself to the classroom window at school. It seems to be a confusing episode as G. vaguely remembers the faces of the people around her. A similar episode recurred several days later. She describes these episodes as “blackouts”.

As in case 1, the cognitive dimensions were investigated, considering the minor age. Other professionals had already excluded the presence of alterations affecting intelligence and highlighted the presence of autistic traits. Our evaluation continued in this direction and explored mental suffering in terms of emotional and behavioral manifestations. In particular, a neuropsychological test investigated the fronto-executive domain (altered inhibition abilities can interfere with social-relational as well as cognitive functioning). Furthermore, standardized tests and questionnaires made it possible to describe the emotional alterations as well as the psychophysiological stress profile.

MEASURES

Based on the symptoms described by the patient, an exhaustive clinical-psychological evaluation was conducted. To this end, the tools described below were used.

The Cognitive Behavioral Assessment – 2nd Italian edition (CBA 2.0; Bertolotti et al., 1990) is a form recording the individual’s clinical history, including the collection of data relating to the subject’s recent and remote anamnesis. Standardized rating scales for the evaluation of some characteristics of the personality type (Eysenck Personality Inventory) and manifestations relating to the current state of the subject (i.e., anxiety, phobias, obsessive-compulsive tenden-

Evaluation of the emotional-autonomic state for the differential diagnosis

cies, psychophysiological disorders, mood) are also included. The scores are expressed in percentiles; values worthy of clinical attention exceed the 75th percentile.

The Symptom Checklist-90 Revised (SCL-90-R; Prunas et al., 2012) is a questionnaire that assesses a broad spectrum of psychological problems and psychopathological symptoms, investigating both internalizing and externalizing symptoms. The SCL-90-R evaluates nine primary symptom dimensions: somatization, obsessive-compulsivity, interpersonal hypersensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. The scores range from 0 to 4; the clinical cut-off is set at 1.

The Minnesota Multiphasic Personality Inventory – Adolescent version (MMPI-A; Sirigatti & Pancheri, 2001) is a test that allows an overall and exhaustive evaluation of the clinical psychopathological characteristics regarding possible deviances or even mild mental disorders. In addition to the validity scales that allow the clinician to control the subject's attitude towards the test, there are ten clinical scales that measure the following psychopathological dimensions: (1) hypochondriasis – the presence of physical problems characteristic of hypochondriacs; (2) depression – the presence of depressive-type symptoms; (3) hysteria – the tendency to somatize emotions and psychic distress; (4) psychopathic deviate – the lack of control over emotional responses and the ability to internalize social rules; (5) masculinity-femininity – the set of aspects (interests, attitudes, etc.) basically masculine or feminine; (6) paranoia – paranoid-type symptoms (e.g., delusional ideations, delusions of grandeur); (7) psychasthenia – the presence of phobic rituals and obsessive-compulsive behaviors up to delusional ideation; (8) schizophrenia – unusual experiences typical of schizophrenics; (9) hypomania – hypomanic states (e.g., ideas of grandeur, high level of activity); and (10) social introversion – the difficulties that the subject encounters in relationships with others. The raw scores are converted into T points (from 30 to 120) where normal values fall under 70.

The Wisconsin Card Sorting Test (WCST; Heaton, 1981) is a neuropsychological tool that evaluates the efficiency of frontal-executive functions in terms of complex and sustained attention, inhibition capacity, and flexibility as it evaluates how cognitive strategies adapt in response to changes in environmental circumstances.

Lastly, a Psychophysiological Stress Profile (Fuller, 1979) was conducted, as described in case study 1.

RESULTS

The CBA 2.0 did not highlight the presence of neurotic symptoms attributable to anxious arousal, mood alteration, or obsessive-compulsive type manifestations.

The only scales that were worthy of further investigation referred to the State-Trait Anxiety Inventory after the test. Compared to phobias, modest phobic anxiety emerged in response to social events (IP/2 = 89.9 p.le) and blood and wounds (IP/5 = 92.1 p.le). Lastly, at the end of the test, G. felt greater anxiety, probably because of the emotional content that the test items evoked (STAI-X1/R = 91.8 p.le).

The noteworthy clinical aspects that emerged at CBA 2.0 were explored in more depth using the SCL-90-R, which returned values above the clinical cut-off (= 1) for some internalizing symptom dimensions. In particular, the presence of anxiety (= 1.90) and interpersonal sensitivity (= 1.89) was confirmed. Furthermore, the depression scale recorded a clinically significant score (= 1.89).

Then, the MMPI-A made it possible to determine the symptomatic areas with greater specificity. In the clinical scales, high scores were obtained in the following: Depression (= 77, high): a high score on this scale is typical in patients with depressive reactions, feelings of discouragement, pessimism, and hopelessness; Social introversion (= 70, high): this scale returns the profile of an introverted, shy, submissive, and easily embarrassed person, who probably does not enjoy high levels of self-confidence. The Harris-Lingoes clinical sub-scales worthy of clinical interest concerned depression (D1, D2, D3, D4, D5): the person complained of subjective depression and unhappiness, and feels that he is unable to adequately deal with his problems, towards which he shows impotence. Sensations of immobility and withdrawal can be perceived as well as psychomotor slowing and mental inefficiency.

The WCST was administered to better investigate the deficits, albeit slight, of a cognitive-social nature, reported with the sentence “in neurodevelopmental disorder” by the neuropsychiatrist who evaluated the patient. G. completed 6 categories and made 8 perseverative errors, achieving a fully normal performance according to these parameters. Concerning the loss of criterion, especially in the first part of the administration, G. was unable to maintain the set 7 times (in the normative sample the value is below 1), demonstrating a fair amount of difficulty in inhibiting incorrect, albeit automatic, responses.

Considering the PSP, the profile was typical of a condition characterized by poor psychophysiological reactivity to environmental stimuli, as evidenced by the skin conductance value, which from 3.10 μ S reached a maximum peak of only 3.76 μ S. Even looking at the heartbeat, the values fell between 67 and 73 bpm in all the various phases, confirming poor responsiveness to the examiners' requests. The only value above the significance threshold was muscle tension, with surface electromyogram values ranging between 13 and 17 μ V. Even the spectral analysis of HRV confirmed the prevalence of the parasymp-

pathetic nervous system over the sympathetic one at rest. In contrast, the LF/HF ratio measured in the stress conditions highlighted high involvement of the ANS during the processing of emotional stimuli (the LF/HF ratio reached the value of 3.5). It is possible to hypothesize that the condition of low autonomic arousal at rest may be attributable to the ongoing pharmacological treatment (see above), although strong emotional arousal was documented in stress conditions.

To conclude, the suffering described by G. and detected through the psychological assessment tools highlighted a marked thymic deflection, which is perceived as strongly disabling for the conduction of daily activities. The mood alteration might have worsened the social functioning in the last period, although it was already characterized by reduced social interaction and preference for individual activities. The slight psychophysiological reactivity is consistent with the depressive condition described above, although it may also be related to the iatrogenic effects of the psychotropic drugs. Furthermore, it is possible that the last period of G.'s life was characterized by a marked altered emotional processing that added to the already existing difficulties present at a constitutional level. Nonetheless, the contingency between the onset of the depressive disorder and the concomitance of multiple stressful events (grandmother's bereavement, loss of a friendship, lockdown, etc.) should not be overlooked. To conclude, G.'s personality, with a substantially withdrawn temperament, may not have facilitated the management of interpersonal difficulties, especially in those moments that required adequate emotional regulation skills. It is also possible to hypothesize that the high cognitive processing of events, supported by a medium-high IQ, is not adequately sustained by interpersonal and social skills, probably related to a form of neurodevelopment disorder (i.e., a disorder of the autism spectrum). As a confirmation of this, the neuropsychological test (WCST) highlighted slight signs of frontal-executive dysfunction due to behavioral lack of control and inhibitory deficits. Such difficulties could have easily emerged within a pharmacological plan which, based on existing literature, could favor "windows of inefficiency", such as the activation phenomenon. In summary, symptoms such as disinhibition, impulsivity, insomnia, restlessness, hyperactivity, and irritability generated by stimulant drugs (i.e., sertraline) could connote events of psychophysiological hyperarousal and behavioral hyperactivity, especially among patients in developmental age.

DISCUSSION

The cases of M. and G. underlined the significance of conducting a comprehensive assessment throughout

childhood and adolescence. A multidimensional assessment should encompass all the factors that contribute to human behavior, cause emotional distress, and characterize cognitive processes (Falkenberg et al., 2012). Clinicians should employ various clinical tools to investigate cognitive, behavioral, and emotional aspects, both explicit and implicit. This process involves gathering information from multiple sources and applying various investigative methods (Fuller, 1979; Pruneti et al., 2014, 2016). First of all, the clinical interview is essential for obtaining information on family, social, and pathological history. It is also advisable to gather both qualitative and quantitative data, which can be accomplished through the use of standardized psychological assessment tools.

To illustrate, when there is a concern that symptoms may stem from a neurodevelopmental disorder, conducting a neuropsychological assessment can be beneficial. Case study 2 revealed that there were slight indications of frontal-executive dysfunction due to behavioral lack of control and inhibitory deficits, although there was normal performance on the WCST. On the other hand, case study 1 demonstrated that the assessment of intellectual functions using the WISC-III can still provide valuable information about the cognitive overload connected to emotional alterations as well as the levels of collaboration and frustration tolerance.

For both clinical cases, the so-called state tests allowed the detection of current psychopathological symptoms (e.g. anxiety, depression, somatization), taking the form of a "snapshot" of the state of the subject at a given moment. Useful assessment tools for the developmental age may be the CBCL/8-14 or the DSS, as described in the first clinical case. Furthermore, CBA2.0 and SCL-90-R, as reported in the second case report, can be administered starting from adolescence. Furthermore, CBA2.0 also investigates personality dimensions. Specifically regarding the constitutional dimensions, trait tests can reveal the stable facets of an individual's personality (Sirigatti & Stefanile, 2001). This vital component of one's character is shaped by a combination of genetic and environmental factors during childhood and remains evident through habitual patterns of behavior and internal experiences throughout the lifetime (Roberts & Lopez-Duran, 2019). A neurobiological explanation of the link between genetic and environmental factors comes from epigenetics (Caspi et al., 2010). In short, exposure to environmental factors can change the expression of genes (phenotype) without changing the DNA sequence (genotype), as if each human is born with genetically pre-wired "baggage" depending on which life events can determine different development trajectories (Arias et al., 2020). This interaction constitutes the uniqueness of each individual, which finds expression in his or her personality. For this reason, there may be greater or lesser

*Evaluation
of the emotional-
autonomic state
for the differential
diagnosis*

vulnerability to experiencing distress or the development of psychopathology (Hassan et al., 2020). For instance, anxiety traits with a greater tendency to rumination (as highlighted by the CBA2.0 in case report 2), a greater predisposition to develop depressive disorders or social introversion (as emerges from the MMPI-A within case report 2), or some rigid attitudes (as returned by the BFQ of case report 1) could represent individual factors of vulnerability to stress.

The psycho-neuro-endocrine-immunology approach (PNEI; França & Lotti, 2017) specifically describes the interconnection between the mind and body. This is evident in how stress can cause physical and psychological disorders over time. Physiological arousal is a natural reaction that evolved to protect organisms and promote fight-or-flight behavior for survival and reproduction (Pruneti et al., 2011). Therefore, physiological arousal is not always negative but can become pathological when emotional resources are exhausted (Bonnet & Naveteur, 2004). The so-called psychophysical exhaustion can result in hypoarousal, which, in turn, can become chronic, following stressful life events and absent emotional regulation skills necessary to manage them, as emerged in case report 2.

The use of the psychophysiological evaluation fits within the PNEI approach and represents a piece of the entire puzzle, that is the multidimensional assessment. For instance, there may be evidence of physiological hypoarousal (i.e., case report 1) or hyperarousal (i.e., case report 2), especially under conditions characterized by highly emotional valence. Clinical conditions characterized by marked reactivity to stimuli require particular caution in the administration of antidepressants. Selective serotonin reuptake inhibitors (SSRIs), such as sertraline, act as stimulants of the ANS and may favor the occurrence of the activation phenomenon, especially during developmental age (Le Noury et al., 2015). Activation is a dangerous side effect associated with a particular antidepressant-related adverse event, which is a hyper-arousal typically characterized by an increase in activity, impulsivity, disinhibition, restlessness, and insomnia (Riddle et al., 1990; Tulisak et al., 2017). On top of this, the U.S. Food and Drug Administration (FDA, 2004) issued an antidepressant warning for the risk of suicidal thoughts and behaviors in children and adolescents based on the results of clinical trials that demonstrated a significantly increased risk of suicidality (suicidal ideation or even attempts) for young people (Lu et al., 2014). Autonomic hyperactivation can be well described by a multidimensional assessment that includes the psychophysiological profile. By way of illustration, skin conductance can effectively highlight states of arousal within clinical conditions characterized by anxiety and depression which can accentuate suicidal ideation (Pruneti et al., 2023b). In case report 2, defining the difficulties

in emotional regulation and social interaction with some neuropsychological deficits inherent to inhibition abilities was crucial. The multidimensional assessment made it possible to understand the patient's fragility and strong vulnerability to social stressors, which facilitated the worsening of the arousal events induced by the stimulating psychotropic drug.

Although the major attention in evidence-based and multidimensional practice in psychology is placed on treatment, focusing on the assessment is imperative. For instance, the step process that characterizes the diagnostic protocols is included in the 2018 Improving Access to Psychological Therapies (IAPT) project, formalized in England by the National Collaborating Center for Mental Health. National and international research emphasizes the need for an integrated assessment on three levels (subjective, behavioral, and physiological) (Palomba, 2023). Nonetheless, evidence-based practice is an approach that fits within the recently proposed Research Domain Criteria (RDoC) for the study of mental disorders, which aim to characterize psychopathology in terms of normal and abnormal biological and behavioral processes, rather than as distinct symptom categories (Sanislow et al., 2010). To conclude, the extreme complexity that characterizes human behavior, especially in developmental age, makes clear the importance of a multidimensional assessment. As underlined through case reports 1 and 2, a multidimensional approach allows the clinician to consider numerous aspects, to structure a personalized and truly effective intervention. Finally, the importance of multidimensional evaluation does not end at the diagnosis phase because it can be useful for evaluating the effectiveness of an intervention and during follow-up.

CONCLUSIONS

The multitude of risk and co-causal factors, the extreme variability of human behavior, and the difficulty in obtaining objective data make clinical psychological diagnosis particularly complex, especially in developmental age. As emerged from the analysis of clinical cases 1 and 2, a multidimensional evaluation model requires the evaluation of cognitive, verbal, emotional, behavioral, motor, and psychophysiological aspects. All of the information comes from different channels, using different integrated investigative methods. The common thread corresponds to attention to the individual, his history, his characteristics, the nature and complexity of the problem, and the degree of motivation and compliance. This is the only way in which the extreme complexity and uniqueness of the individual can be described as well as his context and needs. Additionally, the comprehension of the individual is a predictor of a good therapeutic

relationship, which is, in turn, a positive factor for the effective intervention.

To summarize, there is an ancient Italian proverb, widespread in the tailoring sector, that states: “One hundred sizes, one cut”. Thus, the clinician’s activity can be compared to that of a good tailor, which is capable of structuring a truly personalized intervention.

INFORMED CONSENT STATEMENT

Informed consent was obtained from the patient before the publication of this article and is available for review upon request. The data were handled under the ethical standards established in the 1964 Helsinki Declaration. Subject anonymity was preserved and the data have been disguised so the patients described are not identifiable.

DISCLOSURE

This research received no external funding.
Institutional review board statement: Not applicable.
The authors declare no conflict of interest.

REFERENCES

- Achenbach, T. M. (2001). *CBCL (Child Behavior Checklist 4-18). Adattamento italiano e standardizzazione a cura di M. Molteni e A. Frigerio* [CBCL (Child Behavior Checklist 4-18). Italian adaptation and standardization by M. Molteni and A. Frigerio]. IRCCS Medea.
- American Psychiatric Association (2023). *The diagnostic and statistical manual of mental disorders, fifth edition, text revision (DSM-5-TR)*. APA Publishing.
- Arias, J. A., Williams, C., Raghvani, R., Aghajani, M., Baez, S., Belzung, C., Booij, L., Busatto, G., Chiarella, J., Fu, C. H., Ibanez, A., Liddell, B. J., Lowe, L., Penninx, B. W. J. H., Rosa, P., & Kemp, A. H. (2020). The neuroscience of sadness: a multidisciplinary synthesis and collaborative review. *Neuroscience and Biobehavioral Reviews*, *111*, 199–228. <https://doi.org/10.1016/j.neubiorev.2020.01.006>
- Barbaranelli, C., Caprara, G. V., & Rabasca, A. (1998). *Big Five Questionnaire Child (BFQ-C). Manual*. Organizzazioni Speciali.
- Bertolotti, G., Zotti, A. M., Michielin, P., Vidotto, G., Sanavio, E. (1990). A computerized approach to cognitive behavioural assessment: an introduction to CBA-2.0 primary scales. *Journal of Behavior Therapy and Experimental Psychiatry*, *21*, 21–27. [https://doi.org/10.1016/0005-7916\(90\)90045-m](https://doi.org/10.1016/0005-7916(90)90045-m)
- Bonnet, A., & Naveteur, J. (2004). Electrodermal activity in low back pain patients with and without co-morbid depression. *International Journal of Psychophysiology*, *53*, 37–44. <https://doi.org/10.1016/j.ijpsycho.2004.01.004>
- Bornstein R. F. (2017). Evidence-based psychological assessment. *Journal of Personality Assessment*, *99*, 435–445. <https://doi.org/10.1080/00223891.2016.1236343>
- Byrne D. G. (1975). A psychophysiological distinction between types of depressive states. *The Australian and New Zealand Journal of Psychiatry*, *9*, 181–185. <https://doi.org/10.3109/00048677509159846>
- Cacioppo, J. T., Tassinary, L. G., & Berntson, G. G. (2010). *Handbook of psychophysiology* (2nd ed.). Cambridge University Press.
- Caspi, A., Hariri, A. R., Holmes, A., Uher, R., & Moffitt, T. E. (2010). Genetic sensitivity to the environment: The case of the serotonin transporter gene and its implications for studying complex diseases and traits. *The American Journal of Psychiatry*, *167*, 509–527. <https://doi.org/10.1176/appi.ajp.2010.09101452>
- DeYoung, C. G., Carey, B. E., Krueger, R. F., & Ross, S. R. (2016). Ten aspects of the Big Five in the Personality Inventory for DSM-5. *Personality Disorders*, *7*, 113–123. <https://doi.org/10.1037/per0000170>
- Dormal, V., Vermeulen, N., & Mejias, S. (2021). Is heart rate variability biofeedback useful in children and adolescents? A systematic review. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *62*, 1379–1390. <https://doi.org/10.1111/jcpp.13463>
- Falkenberg, I., Kohn, N., Schoepker, R., & Habel, U. (2012). Mood induction in depressive patients: a comparative multidimensional approach. *PLoS One*, *7*, e30016. <https://doi.org/10.1371/journal.pone.0030016>
- Fraguas, R., Jr, Marci, C., Fava, M., Iosifescu, D. V., Bankier, B., Loh, R., & Dougherty, D. D. (2007). Autonomic reactivity to induced emotion as potential predictor of response to antidepressant treatment. *Psychiatry Research*, *151*, 169–172. <https://doi.org/10.1016/j.psychres.2006.08.008>
- França, K., & Lotti, T. M. (2017). Psycho-neuro-endocrine-immunology: a psychobiological concept. *Advances in Experimental Medicine and Biology*, *996*, 123–134. https://doi.org/10.1007/978-3-319-56017-5_11
- Fuller, G. D. (1979). *Biofeedback: Methods and procedures in clinical practice*. Biofeedback Press.
- Hassan, R., MacMillan, H. L., Tanaka, M., & Schmidt, L. A. (2020). Psychophysiological influences on personality trajectories in adolescent females exposed to child maltreatment. *Development and Psychopathology*, *32*, 1390–1401. <https://doi.org/10.1017/S0954579419001342>
- Heaton, R. K. (1981). *A manual for the Wisconsin Card Sorting Test*. Psychological Assessment Resources.
- Lader, M. H. (1975). The psychophysiology of anxious and depressed patients. In D. C. Fowles (Ed.), *Clin-*

Evaluation of the emotional-autonomic state for the differential diagnosis

- ical applications of psychophysiology* (pp. 12–41). Columbia University Press.
- Lader, M. H. (1983). Anxiety and depression. In A. Gale & J. A. Edwards (Eds.), *Physiological correlates of human behavior* (pp. 155–167). Academic Press.
- Le Noury, J., Nardo, J. M., Healy, D., Jureidini, J., Raven, M., Tufanaru, C., & Abi-Jaoude, E. (2015). Restoring Study 329: Efficacy and harms of paroxetine and imipramine in treatment of major depression in adolescence. *BMJ*, *351*, h4320. <https://doi.org/10.1136/bmj.h4320>
- Lu, C. Y., Zhang, F., Lakoma, M. D., Madden, J. M., Rusinak, D., Penfold, R. B., Simon, G., Ahmedani, B. K., Clarke, G., Hunkeler, E. M., Waitzfelder, B., Owen-Smith, A., Raebel, M. A., Rossom, R., Coleman, K. J., Copeland, L. A., & Soumerai, S. B. (2014). Changes in antidepressant use by young people and suicidal behavior after FDA warnings and media coverage: quasi-experimental study. *BMJ*, *348*, g3596. <https://doi.org/10.1136/bmj.g3596>
- Noble, P., & Lader, M. (1971). The symptomatic correlates of the skin conductance changes in depression. *Journal of Psychiatric Research*, *9*, 61–69. [https://doi.org/10.1016/0022-3956\(71\)90008-2](https://doi.org/10.1016/0022-3956(71)90008-2)
- Öhman, A., Hamm, A., & Hugdahl, K. (2000). Cognition and the autonomic nervous system: Orienting, anticipation, and conditioning. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.), *Handbook of psychophysiology* (2nd ed., pp. 533–575). Cambridge University Press.
- Orsini, A., & Picone, L. (2006). *WISC-III: Contributo alla taratura italiana* [WISC-III: Italian version of Wechsler Intelligence Scale for Children]. Organizzazioni Speciali.
- Palomba, D. (2023). *Prospettive della psicofisiologia clinica* [Perspectives on clinical psychophysiology]. Carocci.
- Pierini, D., Rolandi, S., & Bertolotti, G. (2013). L'assessment psicofisiologico nel contesto clinico [Psychophysiological assessment in clinical settings]. *Psicoterapia Cognitiva e Comportamentale*, *19*, 355–380.
- Prunas, A., Sarno, I., Preti, E., Madeddu, F., & Perugini, M. (2012). Psychometric properties of the Italian version of the SCL-90-R: a study on a large community sample. *European Psychiatry*, *27*, 591–597. <https://doi.org/10.1016/j.eurpsy.2010.12.006>
- Pruneti, C., Donalizio, M., Calugi, S., & Baracchini-Muratorio, G. (2001). Scala di valutazione degli Stati Depressivi: Valutazione fattoriale su un campione di 2300 adolescenti [Depressive states rating scale: Factorial evaluation on a sample of 2300 adolescents]. *Giornale di Neuropsichiatria dell'Età Evolutiva*, *21*, 357–364.
- Pruneti, C., Fontana, F., Carrozzo, E., & Fante, C. (2011). Autonomic reactivity emotions and stress response in psychopathology. *Applied Psychophysiology and Biofeedback*, *36*, 217–229.
- Pruneti, C., Cosentino, C., Sgromo, D., & Innocenti, A. (2014). Skin conductance response as a decisive variable in individuals with a DSM-IV TR axis I diagnosis. *JMED Research*, *2014*, 565009.
- Pruneti, C., Saccò, M., Cosentino, C., & Sgromo, D. (2016). Relevance of autonomic arousal in the stress response in psychopathology. *Journal of Basic & Applied Sciences*, *12*, 176–184. <https://doi.org/10.6000/1927-5129.2016.12.26>
- Pruneti, C., & Guidotti, S. (2021). Depression states, behavioral, and cognitive components in developmental age: Factorial analysis of a short assessment tool. *Mediterranean Journal of Clinical Psychology*, *9*, 1–26. <https://doi.org/10.6092/2282-1619/mjcp-2842>
- Pruneti, C., Ferrari, S., & Guidotti, S. (2023a). A narrative review of heart rate variability as a good index of psychophysical health in athletes and in biofeedback training. *Journal of Clinical Sport Psychology*. <https://doi.org/10.1123/jcsp.2022-0016>
- Pruneti, C., Fiduccia A., & Guidotti, S. (2023b). Electrodermal activity moderates the relationship between depression and suicidal ideation in a group of patients with anxiety and depressive symptoms. *Journal of Affective Disorders Reports*, *14*, 100673, <https://doi.org/10.1016/j.jadr.2023.100673>
- Riddle, M. A., King, R. A., Hardin, M. T., Scahill, L., Ort, S. I., Chappell, P., Rasmusson, A., & Leckman, J. F. (1990). Behavioral side effects of fluoxetine in children and adolescents. *Journal of Child and Adolescent Psychopharmacology*, *1*, 193–198. <https://doi.org/10.1089/cap.1990.1.193>
- Roberts, A. G., & Lopez-Duran, N. L. (2019). Developmental influences on stress response systems: Implications for psychopathology vulnerability in adolescence. *Comprehensive Psychiatry*, *88*, 9–21. <https://doi.org/10.1016/j.comppsy.2018.10.008>
- Sanislow, C. A., Pine, D. S., Quinn, K. J., Kozak, M. J., Garvey, M. A., Heinssen, R. K., Wang, P. S., & Cuthbert, B. N. (2010). Developing constructs for psychopathology research: Research domain criteria. *Journal of Abnormal Psychology*, *119*, 631–639. <https://doi.org/10.1037/a0020909>
- Sarchiapone, M., Gramaglia, C., Iosue, M., Carli, V., Mandelli, L., Serretti, A., Marangon, D., & Zeppegno, P. (2018). The association between electrodermal activity (EDA), depression and suicidal behaviour: a systematic review and narrative synthesis. *BMC Psychiatry*, *18*, 22. <https://doi.org/10.1186/s12888-017-1551-4>
- Shaffer, F., McCraty, R., & Zerr, C. L. (2014). A healthy heart is not a metronome: an integrative review of the heart's anatomy and heart rate variability. *Frontiers in Psychology*, *5*, 1040. <https://doi.org/10.3389/fpsyg.2014.01040>
- Shaffer, F., & Meehan, Z. M. (2020). A practical guide to resonance frequency assessment for heart rate variability biofeedback. *Frontiers in Neuroscience*, *14*, 570400. <https://doi.org/10.3389/fnins.2020.570400>

- Sirigatti, S., & Pancheri, P. (2001). *Minnesota Multiphasic Personality Inventory-Adolescent. Italian adaptation*. Giunti Psychometrics.
- Sirigatti, S., & Stefanile, C. (2001). *Il 16PF-5: Adattamento italiano* [The 16PF-5: Italian adaptation]. Organizzazioni Speciali.
- Stegagno, L. (2008). *Psicofisiologia. Dalla genetica comportamentale alle attività cognitive* [Psychophysiology. From behavioral genetics to cognitive activities]. Zanichelli.
- Sudol, K., & Mann, J. J. (2017). Biomarkers of suicide attempt behavior: Towards a biological model of risk. *Current Psychiatry Reports, 19*, 31. <https://doi.org/10.1007/s11920-017-0781-y>
- Tulisiak, A. K., Klein, J. A., Harris, E., Luft, M. J., Schroeder, H. K., Mossman, S. A., Varney, S. T., Keeshin, B. R., Cotton, S., & Strawn, J. R. (2017). Antidepressant prescribing by pediatricians: a mixed-methods analysis. *Current Problems in Pediatric and Adolescent Health Care, 47*, 15–24. <https://doi.org/10.1016/j.cppeds.2016.11.009>
- US Food and Drug Administration (2004). *Suicidality in children and adolescents being treated with antidepressant medications*. Retrieved from <https://www.fda.gov/drugs/postmarket-drug-safety-information-patients-and-providers/suicidality-children-and-adolescents-being-treated-antidepressant-medications>

*Evaluation
of the emotional-
autonomic state
for the differential
diagnosis*