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Psychopathology of Patients Presenting with Vertigo and Dizziness:

An Evaluation of Diagnosis and Treatment

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List of abbreviations

ANOVA	Analysis of variance
APA	American Psychiatric Association
BAI	Beck Anxiety Inventory
BDI	Beck Depression Inventory
BDS	Bodily distress syndrome
BPPV	Benign paroxysmal positional vertigo
CABAH	Cognitions about Body and Health Questionnaire
DSM	Diagnostic and Statistical Manual of Mental Disorders
HAS	Health Attitude Survey
HRQOL	Health-related quality of life
ICD	International Classification of Diseases
KLC	Body-related Locus of Control Questionnaire
MANOVA	Multivariate analysis of variance
PHQ	Patient Health Questionnaire
SAIB	Scale for the Assessment of Illness Behaviour
SCID	Structural Clinical Interview for DSM-IV
SF	Short Form Health Survey
SSD	Somatic symptom disorder
VD	Vertigo and dizziness
VHQ	Vertigo Handicap Questionnaire
VSS	Vertigo Symptom Scale
WHO	World Health Organisation
WI	Whiteley Index

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1 Summary

Vertigo and dizziness (VD) symptoms are highly prevalent and distressing complaints that can occur due to several organic dysfunctions or without an underlying organic cause. The present dissertation project dealt with two main aims in the context of VD symptoms. First, the diagnosis of a somatic symptom disorder (SSD) that was recently developed in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) was evaluated. Second, a multimodal psychosomatic inpatient therapy for patients with medically unexplained, i.e. functional VD symptoms was examined.

Patients with VD symptoms often present with affective impairment such as depressed mood and/or anxiety, cognitive factors such as catastrophising thoughts about the symptoms, and behavioural features such as avoidance behaviour or an increased use of the health care system. Criteria of the newly defined diagnosis of SSD include that patients suffer from at least one physical symptom (A-criterion) that leads to psychological impairment on the affective, cognitive, and/or behavioural level (B-criterion) and lasts for more than six months (C-criterion). Therefore, the diagnosis of SSD that has replaced former DSM-IV somatoform disorders may be highly relevant to patients with VD symptoms. Study 1 and 2 of this dissertation project aimed to evaluate the diagnosis of SSD in patients with VD symptoms on a cross-sectional (in n = 399 patients) and on a longitudinal base (in n = 239 patients). It was planned to investigate the prevalence of SSD as well as former DSM-IV somatoform disorders and their overlap. The B-criterion of SSD was examined regarding whether it is an indicator of impairment. Further, aims were to investigate the natural course of SSD over a one-year period and to examine potentially relevant predictors of persistent SSD. Results indicated high prevalence rates of SSD (Study

1: 53 %, Study 2: 36 %) as well as a high persistence (82 %) and incidence rate (50 %). Patients fulfilling all three components of the B-criterion were more impaired than those fulfilling one or two. Predictors of persistent SSD included having a self-concept of bodily weakness, an increase of depression during the study period, and a diagnosis of an anxiety and a depressive disorder at baseline. Consequently, results suggested that SSD indeed is a highly relevant diagnosis for patients with VD symptoms. The high prevalence and persistence rates point out that current treatment as usual may not be sufficient to adequately address patients' complaints. The identified predictors may serve as treatment targets.

In Study 3 of this dissertation project, a pilot trial that aimed at providing preliminary data regarding the effectiveness of multimodal psychosomatic inpatient therapy for patients with medically unexplained, i.e. functional VD symptoms was conducted. Functional VD symptoms are an important subgroup since symptoms are classified as functional for about one third of patients with chronic VD.

The study design included three times of assessment at admission (T0), discharge (T1), and six months post-discharge (T2), $n = 72$ patients were included. Treatment targets that were evaluated as outcome variables included vertigo-related handicap, somatisation, depression, anxiety, health-related quality of life, and body-related locus of control. Next to the change on these variables during and beyond inpatient therapy, predictors of improvement during therapy were evaluated. Observed effect sizes were medium for the change of vertigo-related handicap (T0-T1: $g = -0.60$, T0-T2: $g = -0.67$), and small for somatisation (T0-T1: $g = -0.29$, T0-T2: $g = -0.24$), mental health-related quality of life (T0-T1: $g = 0.43$, T0-T2: $g = 0.49$), and depression (T0-T1: $g = -0.41$, T0-T2: $g = -0.28$). Significant predictors of improvement could not be identified. Results provided first evidence that multimodal

psychosomatic inpatient therapy could be beneficial for patients with functional VD symptoms.

2 Zusammenfassung

Schwindelsymptome sind häufige Beschwerden, die mit einer deutlichen subjektiven Beeinträchtigung der Betroffenen einhergehen. Schwindel kann sowohl durch verschiedene organische Grunderkrankungen ausgelöst werden als auch ohne nachweisbare somatische Erkrankung bestehen. Die vorliegende Dissertation befasste sich mit zwei Hauptzielen im Kontext von Schwindelsymptomen. Einerseits wurde die Diagnose einer somatischen Belastungsstörung (SBS), die kürzlich in der fünften Auflage des Diagnostischen und Statistischen Manuals psychischer Störungen (DSM-5) definiert wurde, untersucht. Zum anderen wurde eine multimodale psychosomatische stationäre Therapie für Patienten mit medizinisch nicht erklärbaren, d.h. funktionellen Schwindelbeschwerden untersucht.

Patienten mit Schwindelsymptomen weisen häufig affektive Beeinträchtigungen, z.B. in Form von gedrückter Stimmung und/oder Ängsten, kognitive Beschwerden wie katastrophisierende Gedanken hinsichtlich der Symptome und behaviorale Auffälligkeiten wie Vermeidungsverhalten und/oder eine erhöhte Inanspruchnahme des Gesundheitswesens auf. Kriterien der neu definierten Diagnose SBS verlangen, dass Patienten über mindestens ein körperliches Symptom klagen (A-Kriterium), mit dem eine Beeinträchtigung auf der affektiven, kognitiven und/oder behavioralen Ebene einhergeht (B-Kriterium) und das für mehr als sechs Monate persistiert (C-Kriterium). Demzufolge könnte die Diagnose SBS hoch relevant für Patienten mit Schwindelbeschwerden sein. Studien 1 und 2 dieses Dissertationsprojekts zielten darauf ab, die neue Diagnose bei Patienten mit Schwindelbeschwerden auf einer querschnittlichen (in n = 399 Patienten) sowie einer längsschnittlichen Ebene (in n = 239 Patienten) zu untersuchen. Es war geplant, die Prävalenz von SBS sowie früherer somatoformer Störungen nach DSM-

IV und deren Überschneidung zu untersuchen. Das B-Kriterium wurde dahingehend untersucht, ob es als Indikator der Beeinträchtigung der Patienten dienen kann. Zudem war geplant, den natürlichen Verlauf der Diagnose SBS über einen Zeitraum von einem Jahr zu untersuchen sowie relevante Prädiktoren einer Persistenz von SBS zu evaluieren. Ergebnisse zeigten hohe Prävalenzraten von SBS (Studie 1: 53 %, Studie 2: 36 %) sowie eine hohe Persistenz- (82 %) und Inzidenzrate (50 %). Patienten, die alle drei Komponenten des B-Kriteriums erfüllten, waren stärker beeinträchtigt als solche, die eine oder zwei erfüllten. Prädiktoren der Persistenz von SBS umfassten eine Selbstwahrnehmung als körperlich schwach, eine Zunahme der Depressivität über den Studienzeitraum, sowie die Diagnose einer Angst- und einer depressiven Störung. Die Ergebnisse verdeutlichen, dass SBS eine hoch relevante Diagnose für Patienten mit Schwindelsymptomen ist. Die hohen Prävalenz- und Persistenzraten zeigen, dass die momentane Standardbehandlung möglicherweise nicht ausreicht, um die Beschwerden der Patienten angemessen zu adressieren. Die identifizierten Prädiktoren könnten als therapeutische Zielvariablen gewählt werden.

In Studie 3 dieses Dissertationsprojekts wurde eine Pilotstudie durchgeführt, die darauf abzielte, vorläufige Daten hinsichtlich des Effekts multimodaler psychosomatischer stationärer Therapie für Patienten mit funktionellen Schwindelbeschwerden auszuwerten. Diese Art von Beschwerden ist eine wichtige Subgruppe, da die Beschwerden bei ca. einem Drittel der Patienten mit chronischem Schwindel als funktionell eingestuft werden.

Das Studiendesign umfasste drei Messzeitpunkte bei der stationären Aufnahme (T0), Entlassung (T1) sowie sechs Monate nach Entlassung (T2), $n = 72$ Patienten wurden eingeschlossen. Behandlungsziele, die als abhängige Variablen ausgewertet wurden, umfassten die schwindelbezogene Beeinträchtigung,

Somatisierung, Depression, Angst, gesundheitsbezogene Lebensqualität sowie körperbezogene Kontrollüberzeugungen. Neben der Veränderung dieser Variablen während und nach der stationären Behandlung wurden Prädiktoren der Verbesserung während der Therapie untersucht. Die erzielten Effektstärken waren im mittleren Bereich für die Veränderung schwindelbezogener Beeinträchtigung (T0-T1: g = -0.60, T0-T2: g = -0.67) und klein für Somatisierung (T0-T1: g = -0.29, T0-T2: g = -0.24), psychische Lebensqualität (T0-T1: g = 0.43, T0-T2: g = 0.49) und Depression (T0-T1: g = -0.41, T0-T2: g = -0.28). Signifikante Prädiktoren der Verbesserung hinsichtlich der schwindelbezogenen Beeinträchtigung konnten nicht identifiziert werden. Die Ergebnisse stellen einen ersten Nachweis dafür dar, dass multimodale psychosomatische stationäre Behandlung für Patienten mit funktionellen Schwindelbeschwerden hilfreich sein könnte.

3 Background

3.1 Vertigo and dizziness

Vertigo symptoms are defined as an unpleasant disturbance of spacial orientation or the erroneous perception of movement of the body or the environment. Patients often describe a turning (rotational vertigo) or swaying (staggering vertigo) sensation (Strupp & Brandt, 2008). Dizziness has been described as an umbrella term including vertigo, disequilibrium, presyncope, or light-headedness (Post & Dickerson, 2010). Since the terms 'vertigo' and 'dizziness' are often used together or interchangeably in the literature (e.g., Eckhardt-Henn et al., 2008; Eckhardt-Henn, Breuer, Thomalske, Hoffmann, & Hopf, 2003; Strupp & Brandt, 2008; Tschan et al., 2011; Wiltink et al., 2009), this dissertation will refer to both as 'vertigo and dizziness (VD) symptoms'.

3.1.1 Prevalence and consequences of vertigo and dizziness

Vertigo and dizziness are frequent symptoms, with prevalence rates of 20 – 40 % in the general population (Neuhauser, 2009). Almost 60 % of patients with VD seek medical consultation. The most commonly consulted medical specialties are general practice (52 %), neurology (16 %), or otorhinolaryngology (14 %), and around one quarter of patients consult more than one specialist from different disciplines (Neuhauser et al., 2008). The symptoms are associated with a high burden, both personal and to the community. Patients often describe a feeling of uncertainty in their own body, and as such are afraid of falling and/or feel restricted in their ability to move freely (Eckhardt-Henn, 2013). Consequently, they often report low health-related quality of life (HRQOL), inability to work, reduced functioning, and avoidance behaviour (Neuhauser, 2009; Neuhauser et al., 2008).

3.1.2 Causes of vertigo and dizziness

There are many possible causes of VD symptoms. Neuhauser et al. (2008, 2009) have grouped the symptoms into two categories: VD of vestibular and of nonvestibular origin. In a neurotological survey of the general population conducted in Germany in 2003 (Neuhauser et al., 2005), VD was classified as vestibular if patients reported “rotational vertigo, positional vertigo, or recurrent dizziness precipitated by changes in head position such as lying down or turning in bed” (Neuhauser et al., 2008, p. 2119). Common underlying vestibular disorders causing VD are Menière’s disease, vestibular migraine, benign paroxysmal positional vertigo (BPPV), and vestibular neuritis (Neuhauser, 2009; Neuhauser et al., 2008). Additionally, VD can be caused by several nonvestibular reasons, such as cardiological dysfunctions or diseases of the peripheral nerve system (e.g. polyneuropathy) (Schaaf, 2006). As well as potential underlying organic pathologies, VD symptoms can occur without a medically explainable reason. This is the case in about one third of complex VD disorders, that are defined as VD symptoms that persist for at least six months (Eckhardt-Henn, 2013). In addition, evidence suggests that nearly 40 % of patients with vestibular disorders continue to suffer from VD symptoms even after the organic pathology has faded (Eckhardt-Henn et al., 2003). This phenomenon of medically unexplained VD symptoms has previously been labelled ‘psychogenic’ or ‘somatoform’ VD and is now referred to as ‘functional VD’ by neurologists (Brandt, Huppert, Strupp, & Dieterich, 2015; Dieterich & Staab, 2017). If VD symptoms occur without any underlying organic pathology, they are considered primary functional symptoms; whereas if symptoms develop during the course of an organic pathology or after an organic pathology has faded, they are

referred to as secondary functional VD symptoms (Eckhardt-Henn et al., 2008; Huppert, Kunihiro, & Brandt, 1995).

3.1.3 Characteristics of functional VD symptoms

Brandt et al. (2015) listed the following features of functional VD: Patients describe chronic (i.e. occur over several months) spontaneous VD symptoms; there is divergence between objective balance tests and subjective imbalance, in that objective balance tests do not reflect the subjective VD sensation; patients describe anxiety, such as fear of falls, usually without prior falls; symptoms improve during exercise, mental distraction, or after moderate alcohol consumption; triggers of VD are often situational or social events, which can lead to avoidance of these triggers; rotational vertigo occurs without spontaneous nystagmus (i.e., eye movements); postural and gait patterns are unusual; and unsteadiness and VD often occur after movement in vehicles.

3.1.4 Development and maintenance of functional VD symptoms

Pathophysiological mechanisms of functional VD have been summarised by Dieterich & Staab (2017) in the following way. Firstly, triggers such as a vestibular crisis, a medical event, or acute anxiety, can cause normal adaptations to these events. Adaptation can include a shift in sensory integration in favour of visual or somatosensory inputs, increased attention to postural control strategies, or heightened vigilance to environmental stimuli. Due to anxiety-related personality traits, a return to normal postural and oculomotor control may be delayed. Over time and with recurrence of precipitating events, these high-risk strategies caused by anxious reactions may get consolidated by being continuously used in routine movements and situations. Consequently, perceived imbalance and VD symptoms

can become chronic conditions. This understanding of functional VD is in accordance with the cognitive-behavioural model of somatoform symptoms by Rief & Hiller (1998), which explains the emergence and maintenance of medically unexplained symptoms. The model assumes that symptoms are first caused by a particular trigger, and are then perceived and erroneously interpreted as symptoms of disease. The symptoms get enhanced by reinforced cognitive attention and physical arousal. In the long term, symptoms are maintained by illness behaviours such as protective behaviour, avoidance, body checking, doctor shopping and substance use.

3.1.5 Psychiatric comorbidities of VD symptoms

Regardless of whether VD symptoms occur due to structural dysfunction and/or primary or secondary functional origin, they are frequently comorbid with psychiatric disorders. Depending on the cause of vertigo, prevalence rates of psychiatric comorbidities range from 15 to 65 %, the most frequent comorbidities are depressive, anxiety, and somatoform disorders (Eckhardt-Henn et al., 2008; Lahmann, Henningsen, Brandt, et al., 2015). Depressive symptoms can emerge as a consequence of VD symptoms and the accompanying impairment (Eckhardt-Henn, 2013) while VD symptoms can also develop during a depressive disorder (Schaaf, 2008). This is also the case for anxiety disorders. For example, VD can be a symptom of an anxiety disorder and as such only occur during a panic attack or while the phobic stimulus is present; or it can emerge as a physical component of rumination and worry in a patient with generalised anxiety disorder (Schaaf, 2008). Moreover, there is evidence that the vestibular system and systems involved in anxiety conditioning share neural pathways (Furman, Balaban, Jacob, & Marcus, 2005) and anxiety could enhance the risk of developing BPPV, a form of vestibular

VD (Chen et al., 2016). Further, as stated above, anxious personality traits have been described as enhancing the risk of developing persistent functional VD (Dieterich & Staab, 2017; Staab, Rohe, Eggers, & Shepard, 2014). The third group of psychiatric disorders that are frequently diagnosed in patients with VD symptoms are somatoform disorders (Lahmann, Henningsen, Brandt, et al., 2015). The Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV; American Psychiatric Association [APA], 1994) described several somatoform disorders that were all characterised by physical symptoms that occur without an underlying organic psychopathology and cause severe distress. With the introduction of DSM-5 (APA, 2013a), the category of somatoform disorders has undergone extensive changes. Several somatoform disorders were subsumed under one category, somatic symptom disorder (SSD). This diagnosis no longer requires physical symptoms to be medically unexplained, it can also be considered for patients that present with structural dysfunctions. Due to the high prevalence of somatoform disorders in patients with VD symptoms, the changes from DSM-IV to DSM-5 are likely very relevant to this patient group. Therefore, this was considered in the present dissertation. In the following sections, the historical development of classifications of symptoms and disorders, predominantly the DSM, is summarised. Additionally, major changes from DSM-IV to DSM-5 are outlined.

3.2 Classification of disorders

3.2.1 Historical aspects of psychiatric classification

Despite criticism of his system, one of the pioneers of psychiatric classification was Emil Kraepelin (1856-1926). As a psychiatrist, he used clinical observations to group common symptoms of psychotic conditions together as syndromes. This resulted in three main groups, namely dementia praecox, manic-depressive illness,

and paranoia (Decker, 2007). Over time, classification developed and was faced with criticism. For example, in the 1960s, it was argued that psychiatry's view of illness implied that non-conforming and/or threatening behaviour was declared as abnormal; therefore, it was stated that mental illness was a myth (Decker, 2007; Kirk & Kutchins, 1994). In this regard, the Rosenhan experiment, in which pseudopatients were sent into a psychiatric hospital and – due to misclassification by staff as being mentally ill – treated with antipsychotic drugs, was conducted in order to investigate the validity of psychiatric diagnostic decisions (Rosenhan, 1973). Following this and other points of criticism, the so-called neo-Kraepelinians established a 'credo' for psychiatry as a medical discipline. The nine points of this credo served to define psychiatry as being based on scientific knowledge and as such, the discipline's aim is to treat people who need treatment for a specific mental illness. In particular, the credo emphasised that mental illnesses are discrete entities that can be described by diagnostic criteria that need to be coded, constantly validated through research, and taught in medical schools (Decker, 2007; Klerman, 1978). At this time, the DSM already existed; its first edition (DSM-I) came out in 1952 (American Psychiatric Association & Committee on Nomenclature Statistics, 1960; Grob, 1991), followed by its revision (DSM-II) in 1968 (APA, 1968).

3.2.2 Diagnostic classification systems

The DSM is published and developed by the American Psychiatric Association (APA) and "provides the standard language by which clinicians, researchers, and public health officials in the United States communicate about mental disorders" (Regier, Kuhl, & Kupfer, 2013, p. 92). In research, the system is used internationally (Maser, Kaelber, & Weise, 1991) and the APA claims that it "provides a common language for researchers to study the criteria for potential future revisions and to aid

in the development of medications and other interventions" (APA, 2018, para. 1). While DSM-I and –II described the criteria of a variety of psychiatric conditions or syndromes in terms of their mental pathology and personality aspects only, DSM-III brought a major change with the introduction of a multiaxial system. On axis I, clinical disorders were coded, axis II was used for personality disorders, axis III allowed the clinician to code physical disorders, axis IV was intended to capture psychosocial stressors, and axis V required assessment of patient functioning at a global level. This change occurred due to criticism of the former system, and was intended to demonstrate that DSM-III is useful within a broader biopsychosocial model (Spitzer, 2001). The multiaxial system was retained in DSM-IV (APA, 1994). The latter, DSM-IV, has been in use until recently and has just been replaced by the next edition, the DSM-5 (APA, 2013a). In this version, the multiaxial classification has been dropped in order to conform to the categorisation of diseases of the World Health Organization (WHO), the International Classification of Diseases (ICD) (Trestman, 2014). The latter, the ICD, is the other classification system that is used world-wide, currently in its tenth version (ICD-10; Word Health Organization [WHO], 1992). It contains criteria for all diseases from all medical disciplines, with criteria of psychiatric disorders listed in chapter V (WHO, 2013). Compared to the DSM-IV, criteria in the ICD-10 are only slightly different. Nevertheless, investigations of prevalence rates of disorders in accordance with each of the two systems resulted in quite different numbers (Andrews, Slade, & Peters, 1999). Subsequently, current efforts aim to increase compatibility between DSM-5 and the upcoming ICD-11 which is currently being developed (First & Pincus, 1999; Regier et al., 2013). During the course of the development of DSM-5, joint efforts between APA and WHO were made in order to proceed with a common "'metastructure' or organisational

framework by which disorders are grouped into similar clusters based on shared pathophysiology, genetics, disease risk, and other findings from neuroscience and clinical experience" (Regier et al., 2013, p. 93). This aim is valuable as it may help to reduce the above-mentioned differences in prevalence rates of disorders that primarily result from varying diagnostic criteria between the systems, rather than truly different conceptualisations of disorders. It may also assist in further developing international research collaborations and, most of all, may help to simplify translating research findings into clinical practice. For example, in Germany, disorders are clinically categorised based on ICD-10 criteria, but research is conducted based on DSM conceptualisations. It would be easier to derive clinical implications if the same nomenclature was used.

3.2.3 Changes regarding somatoform disorders from DSM-IV to DSM-5

As this dissertation discusses the changes regarding somatoform disorders in DSM-IV and the development of a new diagnosis in DSM-5 (somatic symptom disorder, SSD), the following sections will outline these major changes. The most obvious change occurred in terms of the number of diagnoses. DSM-IV listed six specified disorders under the category of somatoform disorders, namely somatisation disorder, undifferentiated somatoform disorder, conversion disorder, pain disorder, hypochondriasis, and body dysmorphic disorder (APA, 1994). In DSM-5, somatisation disorder, undifferentiated somatoform disorder, and pain disorder were removed; instead, the new diagnosis of SSD was introduced. Further, hypochondriasis was removed, too whilst it has been stated that the majority of patients with hypochondriasis would fulfil the criteria of illness anxiety disorder, another new diagnosis in DSM-5 (Regier et al., 2013). The criteria of body dysmorphic disorder were updated and the diagnosis was moved to another

category (obsessive compulsive and related disorders). Additionally, the diagnosis of conversion disorder was retained, yet its definition was updated (APA, 2013a). The reduction in the number of diagnoses was mentioned as an advantage in DSM-5 (APA, 2013b), since the variety of different categories of somatoform disorders in previous editions of the DSM was said to lead to confusion and it was seen as cumbersome to assess the different disorders. In turn, this may have led clinicians to use inaccurate diagnostic labels in favour of a specific somatoform disorder (Dimsdale et al., 2013). SSD consists of three main criteria. The A-criterion requires that the patient reports at least one distressing physical symptom (regardless of whether it is medically explained or not). The B-criterion consists of three components (an affective, cognitive, and a behavioural one) and requires that the patient reports impairment on at least one of these components. Criterion C specifies that symptoms must be present over a period of at least six months. Additionally, there is an option to specify the severity of the condition based on how many components of the B-criterion are fulfilled. One component indicates mild severity, two components indicate medium severity, and all three components indicate high severity (APA, 2013a). The change from somatoform disorders to SSD was discussed controversially in the literature. Supporters emphasise that the new diagnosis helps to overcome mind-body dualism and to promote holistic care (APA, 2013b) by moving the focus away from the centrality of medically unexplained symptoms (Sharpe, 2013). Further, it has been considered problematic that somatoform disorders were diagnosed based on the absence of criteria instead of positively described diagnostic features which made the diagnosis hard to use (Dimsdale et al., 2013). Opponents of SSD argue that the new diagnosis “risks mislabelling people as mentally ill” (Frances, 2013b, p. 1) because patients with

medical conditions can now be considered for the diagnosis. Further, the definition of the diagnosis has been criticised as too loose and therefore too easy to fulfil the criteria (Frances, 2013a). For example, one physical complaint is sufficient to fulfil criterion A of SSD, this leads to concerns of very low clinical utility (Voigt et al., 2010). Similar points of criticism have occurred regarding other DSM-5 diagnoses and consequently, Gornall (2013) concluded that DSM-5 carries the risk of raising prevalence rates of psychiatric disorders in general.

3.2.4 Existing findings on SSD

Previous studies have investigated the predictive validity and clinical utility of SSD in psychosomatic patients with various psychological disorders (Voigt et al., 2012, 2013) and in patients with fibromyalgia syndrome, a diagnosis currently located in the somatic diseases section of the ICD classification system (Häuser, Bialas, Welsch, & Wolfe, 2015). Voigt et al. (2012) found that the SSD diagnosis helps to identify more psychologically impaired patients than former DSM-IV somatoform disorders. A later study by Voigt et al. (2013) demonstrated that DSM-5 SSD is better than DSM-IV diagnoses at predicting mental functioning at a 12-month follow-up after inpatient therapy. In contrast, Häuser et al. (2015) found limited construct validity and clinical utility of SSD criteria in patients with fibromyalgia syndrome. The authors state that the vast majority of their patients with fibromyalgia and the SSD diagnosis were also diagnosed with a depressive or anxiety disorder, thus bringing the need for the new diagnostic category into question. In addition and in accordance with previous authors, they argued that the diagnostic criteria of SSD are over-inclusive and not well-defined (Häuser et al., 2015). Another study conducted by van Geelen and colleagues (2015) looked at the criteria of SSD in a general adolescent population and found that symptoms should be captured based

on the assessment of multiple somatic items as well as psychological distress. Further, they stated that a tool to assess functional impairment should be included in the diagnosis. This combination of tools may help to improve diagnostic accuracy and reduce over-diagnosis. This finding is also likely relevant to an adult population. The suggestion to assess multiple somatic symptoms is in line with findings of a high somatic symptom count being associated with a higher risk of subsequent functional somatic syndromes, lower quality of life, and psychopathology (Creed et al., 2013; Fischer, Gaab, Ehlert, & Nater, 2013; Tomenson et al., 2013). To date, due to the novelty of SSD there are not enough studies to make conclusions about the clinical utility and predictive validity of SSD (Dimsdale et al., 2013). In terms of reliability, there are promising findings (Freedman et al., 2013; Kraemer, Kupfer, Clarke, Narrow, & Regier, 2012) that need to be reassessed continuously while SSD is in use.

Up to now, most investigations of SSD have been conducted in populations of patients with functional, i.e. medically unexplained symptoms (e.g., Claassen-van Dessel, van der Wouden, Dekker, & van der Horst, 2016; Häuser et al., 2015; Voigt et al., 2012, 2013). It has been found that the prevalence of SSD may vary depending on the population that has been investigated (patients with medically unexplained symptoms vs. patients with both structural and functional reasons); this issue has been discussed by Claassen-van Dessel et al. (2016) and Huang, Chen, Chen, et al. (2016). Claassen-van Dessel et al. (2016) investigated SSD in a population of patients with medically unexplained symptoms and found that only half of the patients who fulfilled a DSM-IV diagnosis of a somatoform disorder also fulfilled DSM-5 SSD criteria. They concluded that SSD is less inclusive compared to DSM-IV somatoform disorders. In contrast, Huang, Chen, Chen, et al. (2016)

investigated a psychiatric population of patients with both functional and structural origins of their complaints and found that all patients diagnosed with a somatoform disorder according to DSM-IV also fulfilled SSD criteria. In two letters to the editor of the Journal of Psychosomatic Research, both groups concluded that the sampling situation (patients with only functional vs. those with both types of complaints) has an important influence on prevalence rates of SSD (Claassen-van Dessel & Van der Wouden, 2016; Huang, Chen, Chang, & Liao, 2016). As the diagnosis of SSD is intended to be used in patients with both medically unexplained and medically explained symptoms and, ultimately, to reduce mind-body dualism, it is important to conduct investigations in patient populations with both types of symptoms. In regard to patients with VD symptoms, which can also occur due to structural and/or functional reasons, investigating SSD in a population of patients with VD would offer the opportunity to evaluate patients with symptoms of both aetiologies simultaneously. It is likely that SSD would be relevant to this group because patients with VD often present with a particular pattern of thoughts, feelings, and behaviours regarding the VD symptoms. Many report specific affective characteristics such as higher scores on anxiety or depression rating scales (Meli, Zimatore, Badaracco, De Angelis, & Tufarelli, 2007), cognitive patterns such as negative beliefs about the consequences of VD symptoms (Yardley, Beech, & Weinman, 2001), and/or behaviours such as avoidance behaviour (Schaaf & Hesse, 2015) and increased health care utilisation (Wiltink et al., 2009). Further, VD symptoms often have a chronic course (Dieterich & Staab, 2017). Therefore, the first part of this dissertation examines the prevalence and course of SSD and its criteria in patients with VD symptoms. This is outlined in further detail below (see Objectives section and corresponding parts of the respective study papers, Appendix A and B).

3.3 Treatment of functional VD

As well as sound diagnosis, it is vital to develop and provide suitable treatment options for patients with VD symptoms. In terms of SSD, it is expected that patients would benefit from access to treatment for symptoms such as excessive thoughts or worries about the bodily complaints or illness, regardless of whether the VD symptoms are medically explained or not (APA, 2013b). Although patients with functional VD symptoms may often fulfil SSD criteria, based on the impairment caused by the physical vertigo sensations one can expect that it may be insufficient to purely treat the SSD symptoms. Instead, interventions that are specific to the physical complaints, i.e. VD symptoms, may be necessary. Moreover, as SSD is a very recent diagnosis, psychotherapeutic treatment approaches until now have been investigated in populations with purely functional symptoms. Evidence suggests that psychotherapy may be an effective treatment for functional VD symptoms or the impairment caused by these symptoms; however, there is a need for RCTs and long-term follow-up studies with large and representative samples (Schmid, Henningsen, Dieterich, Sattel, & Lahmann, 2011). Additionally, a recent review found that cognitive behavioural therapy (CBT) is effective for specific somatoform disorders and functional complaints including irritable bowel syndrome, fibromyalgia, and chronic fatigue syndrome (Henningsen, Zipfel, Sattel, & Creed, 2018). Further, some evidence suggests that psychodynamic interpersonal therapy can be beneficial in reducing somatisation and enhancing physical quality of life (Sattel et al., 2012). These findings have emerged in outpatient treatment. As well as outpatient psychotherapy, in the German health care system it is possible to admit patients to inpatient treatment, namely psychosomatic inpatient therapy. This form of therapy applies a biopsychosocial approach to health and illness (Linden, 2014) and as such

is usually multimodal and multidisciplinary, with a focus on psychotherapeutic interventions. There are different types of psychotherapeutic treatments that vary considerably between different hospitals, such as psychodynamic, cognitive-behavioural, specialised, or integrative concepts. Very common is a psychodynamic treatment model, where psychodynamic principles of structural psychopathology are often applied (Cierpka, Grande, Rudolf, von der Tann, & Stasch, 2007; Westen, Gabbard, & Blagov, 2006). This means that patients are treated according to their level of personality structure with the aim of reducing their psychopathological symptomatology. Evidence suggests that psychosomatic inpatient therapy can be effective in patients with chronic VD symptoms (Schaaf & Hesse, 2015). However, the effectiveness of multimodal psychosomatic inpatient therapy has rarely been evaluated in controlled studies. This is surprising, especially given this form of treatment is recommended by the current clinical practice guidelines for patients with severely impairing and chronic functional symptoms (Schaefert et al., 2012). Therefore, the second part of this dissertation examines potential effects of multimodal psychosomatic inpatient therapy for patients with functional VD symptoms. This is outlined in further detail below (see Objectives section and corresponding parts of the respective study paper, Appendix C).

3.4 Objectives

The present dissertation project studied two main areas in the context of VD symptoms. Study 1 and 2 investigated diagnostic aspects, specifically regarding SSD. Study 3 examined therapeutic aspects by evaluating potential effects of multimodal psychosomatic inpatient treatment for patients with VD.

3.4.1 Objectives of Study 1 and 2

Study 1 and 2 aimed to investigate relevant diagnostic criteria of the new DSM-5 SSD in terms of their clinical utility in patients presenting with VD symptoms. It was planned to evaluate the prevalence of the new diagnosis amongst patients with functional and structural types of VD and to compare this with the prevalence of former DSM-IV diagnoses of somatoform disorders. Further, it was intended to compare patients with SSD and those with somatoform disorders in regard to their impairment to evaluate whether the diagnoses capture conditions of similar or different severities. As the criterion B of SSD includes excessive thoughts, feelings, and behaviours regarding the reported symptoms, another central aim was to test the prevalence and overlap of these components of the B-criterion and to investigate whether they are useful as indices of impairment or classification of severity of the condition as suggested by the diagnostic criteria of SSD (APA, 2013a). In addition, it was intended to test the value of these psychological factors in predicting the long-term outcome. Häuser et al. (2015) claimed the need for a better definition of research criteria for the criterion B of SSD (excessive thoughts, feelings, and behaviours regarding the reported symptoms). Currently, criterion B is usually assessed by the Whiteley Index (WI; Pilowsky, 1967), an instrument for measuring illness worries. By investigating the SSD criteria in patients with VD it is hoped that this research can promote the development of more precise diagnostic criteria, which was also recommended by Voigt et al. (2013).

Further, as patients presenting with organic and somatoform VD have been shown to suffer from various psychiatric comorbidities such as anxiety/phobic or affective disorders (Lahmann, Henningsen, Brandt, et al., 2015), it was planned to investigate the overlap of DSM-5 SSD and other psychiatric disorders. This aimed to

examine the necessity of the new diagnosis in addition to already existing categories, such as anxiety or depressive disorders as suggested by Häuser et al. (2015). Ultimately, the aim was to derive clinical implications for diagnosis and treatment.

Study 1 included a cross-sectional analysis and looked at both DSM-5 SSD and DSM-IV somatoform disorders in patients with VD symptoms. Study 2 was conducted longitudinally and focussed solely on the DSM-5 diagnosis of SSD.

More specifically, the aims and hypotheses of Study 1 were as follows:

- Aim 1: To evaluate the prevalence of DSM-5 SSD, DSM-IV somatoform disorders, and their overlap.

  Hypothesis: DSM-5 SSD will be more prevalent than DSM-IV somatoform disorders and the overlap will be relatively small due to the change in the main diagnostic criterion (medical explicability).
- Aim 2: To investigate SSD criterion B by estimating the prevalence of its three components (affective, cognitive, behavioural).
- Aim 3: To test different patterns of criterion B (i.e., single vs. multiple components fulfilled) by comparing them in regard to impairment and various psychopathological aspects.

  Hypothesis: Patients that fulfil all three components of the B-criterion will be more impaired than those who fulfil one or two.
- Aim 4: To compare patients with DSM-5 SSD and DSM-IV somatoform disorders regarding impairment and various psychopathological aspects.

  Hypothesis: Patients with both diagnoses will be more impaired than those with one of the two diagnoses.

Study 2 aimed to answer the following research questions:

- Aim 1: To evaluate the prevalence, persistence, incidence, and remission of SSD over a one-year period.
- Aim 2: To compare groups of patients who persistently or never had SSD during the study period as well as those with remission or incidence of SSD in regard to relevant psychopathological variables.
- Aim 3: To investigate potential predictor variables of persistent SSD during the study period.

Hypothesis: A greater number of symptoms at baseline, the three components of the B-criterion (affective, cognitive, and behavioural aspects) at baseline, the number of depression and anxiety symptoms at baseline, the change in these variables between baseline and follow-up, and comorbid psychiatric disorders will serve as predictors of persistent SSD.

3.4.2 Objectives of Study 3

The second main aim of this project was to conduct a preliminary investigation on potential effects of multimodal psychosomatic inpatient therapy for patients with functional VD symptoms in reducing vertigo-related handicap and related psychopathology. As stated above, research in this area is limited, although this form of treatment is recommended in current clinical practice guidelines for functional symptoms and despite the high burden to the health care system. Study 3 therefore aimed to provide data that may allow further discussion on this form of treatment. As well as evaluating potential effects of psychosomatic inpatient treatment at reducing aspects of psychopathology, Study 3 aimed to investigate predictors of symptom improvement. If relevant predictors can be identified, this may assist in improving

therapeutic strategies by focussing on particularly relevant factors. Variables that are evaluated as predictors of treatment effects are introduced and discussed in Study 3.

Specifically, the aims and hypotheses of Study 3 were as follows:

- Aim 1: To provide preliminary data on potential effects of a multimodal psychosomatic inpatient treatment programme for patients suffering from functional VD symptoms and comorbid psychiatric and somatic pathologies.

  Hypothesis: Self-reported vertigo-related handicap, vertigo symptom severity, and comorbid psychopathology will reduce from baseline to post-treatment; and self-reported health-related quality of life (HRQOL) will increase from baseline to post-treatment.

- Aim 2: To evaluate predictors of improvement of vertigo-related handicap during treatment.

  Hypothesis: Somatic and psychopathological symptom burden and body-related locus of control will predict improvement of vertigo-related handicap.

4 Methods

4.1 Methods of Study 1 and 2

Study 1 and 2 of this dissertation project were carried out as part of the Munich Diagnostic and Predictor Study of Dizziness (Lahmann et al., 2012). This project was conducted as a cooperation between the German Centre for Vertigo and Balance Disorders, a specialised tertiary care centre at the Department of Neurology at the University Hospital Großhadern of the Ludwig-Maximilians-University (LMU) Munich, and the Department of Psychosomatic Medicine and Psychotherapy at the University Hospital “Klinikum rechts der Isar” of the Technical University of Munich. It was approved by the ethical committee of the medical faculty of the LMU Munich, and principles of the Declaration of Helsinki were followed. The overall project had a

prospective design with three times of measurements and aimed to investigate "diagnostic subgroups, correlates, and predictors of dizziness that is not sufficiently explained medically but clearly related to a psychiatric disorder" (Lahmann et al., 2012, p. 702). Therefore, the overall aim of the project was to increase understanding of these aspects via several individual studies. Study 1 and 2 were two of these studies.

4.1.1 Study participants

All patients presenting at the German Centre for Vertigo and Balance Disorders were eligible to take part in the study. Exclusion criteria were being younger than 18 years, insufficient ability to understand and speak German, and the presence of a neurodegenerative disorder such as dementia. Patients were informed about the study by their treating neurologist. Written informed consent to participate in the study was obtained. In total, during the study period of May 2010 to June 2012, *n* = 860 were considered eligible and *n* = 687 gave their written informed consent to take part in the study. Based on the individual inclusion and exclusion criteria of Study 1 and 2, Study 1 included n = 399 (58 % of the initial 687 patients), and Study 2 included n = 239 (35 %). Dropout mainly occurred due to incomplete return of relevant questionnaires and loss to follow-up (discussed in further detail in the studies, see Appendix A and B).

4.1.2 Procedures, material and methods

Upon presentation at the German Centre for Vertigo and Balance Disorders, all patients first underwent an extensive medical examination. This examination is coordinated by the treating assistant physician the patient is assigned to. Physicians at the centre are usually in their specialist medical education in neurology, and some

are specialising in otorhinolaryngology. During the study period, there were five assistant physician positions at the centre, individual doctors changed over time due to job rotation. All assistant physicians were closely supervised by a senior physician from the department of neurology or otorhinolaryngology. Supervision included discussing all patients with a senior physician after the clinical routine had been finished. Following the discussion between senior and assistant physician, all patients were seen by both doctors in order to explain the diagnostic decision and discuss further procedures. In addition, senior physicians were available for questions and in case of emergency during the examinations. Clinical routine started by detailed history taking and neurological tests. After this, there were neuro-otological and neuro-ophthalmological examinations. The following specific tests were conducted. For one, visual dependency was measured via the Rod and Disk Test (Dichgans, Held, Young, & Brandt, 1972). This required that the patient was seated in front of a viewing cone that blocked external visual cues. Through this cone, a computer screen that showed a rotating 6 cm white rod on a black background was seen. Around this central screen image, there were randomly distributed white dots that were either presented as stationary or turning in counter-clockwise or clockwise direction. Patients were asked to move the rod until they perceive it as vertical, i.e., they were asked to align it to their subjective visual vertical (SVV). Afterwards, the difference between true vertical and SVV was calculated as an indicator of visual dependency, i.e., as a measure of the degree of reliance on visual stimuli in spatial orientation (Cousins et al., 2014). While this test can help to identify a peripheral or central deficit, visual dependency can also be influenced by cognitive styles and other psychological factors (Roberts, Da Silva Melo, Siddiqui, Arshad, & Patel, 2016).

Another test that was part of the clinical routine was a posturographic measurement that served to measure static postural control. For this, patients were instructed to stand upright on a stabilometer platform which measured force changes in a total of ten different stance conditions. Each condition was recorded for 30 seconds. The displacement of the centre of pressure was then calculated in medial-lateral and anterior-posterior direction (Schniepp et al., 2013). Different patterns of static postural control can serve as indicators of different underlying dysfunctions. For example, patients with functional VD symptoms have been found to present with a more problematic postural control compared to healthy controls in simple conditions such as standing upright with eyes open. In contrast, postural variability was similar to healthy controls in more difficult conditions such as standing upright on foam with eyes closed (Schniepp et al., 2013).

Further tests that were routinely conducted to assess vestibular functioning were video-oculography with caloric irrigation (Furman & Wuyts, 2012) and a video head impulse test (Halmagyi et al., 2017).

Based on the test results and the neurological assessment, physicians then made a clinical diagnosis as defined by the diagnostic criteria for the different vestibular disorders (Dieterich, 2004). As described in Study 1, the diagnosis of vestibular migraine was given based on the criteria of Neuhauser et al. (Neuhauser, Leopold, Von Brevern, Arnold, & Lempert, 2001), a diagnosis of Menière's disease was based on the criteria of the American Academy of Otolaryngology, Head and Neck Surgery, vestibular paroxysmia was diagnosed after the criteria defined by Brandt and Dieterich (1994). If no structural dysfunction to explain a patient's VD symptoms was found, the symptoms were classified as functional.

After the medical examination was completed, the patients were seen independently by an intensively trained and supervised final year medical or psychology student or psychologist who conducted a structured clinical interview for mental disorders after DSM-IV (SCID-I; Wittchen, Wunderlich, Gruschwitz, & Zaudig, 1997). If possible, the interview was done on the same day. Before the interviews were conducted, interrater reliability was established by independently assessing a simulated patient. Interrater reliability was high (Cohen's $\kappa = 0.94$). Of the $n = 687$ patients that gave written informed consent for the study, $n = 547$ were seen in the structured clinical interview. Reasons why $n = 140$ patients did not undergo psychopathological assessment included organisational reasons (e.g. interview could not be conducted on the same day and patient could not return to the centre due to living outside of Munich) or health reasons (e.g. nausea after caloric testing).

In addition to the clinical interview for mental disorders, patients were asked to complete a variety of self-report questionnaires that aimed to assess psychological factors that were expected to be related to VD symptoms. The areas covered by the questionnaires included vertigo (subjective handicap and vertigo severity), psychopathology related to specific disorders (somatisation, depression, anxiety), illness anxiety, cognitions about body and health, health behaviour, trauma-related factors (traumatisation, depersonalisation, dissociation), personality aspects, and attachment. The criteria of SSD were assessed based on applicable self-report questionnaires, details regarding this are presented in Study 1 and 2. Both of these studies only made use of some of the instruments that were assessed in the larger study framework. Details of the instruments used are presented in the respective studies (see Appendix A and B). The study design of Study 1 and 2 is depicted in Table 1.

Table 1.

Design of the Munich Diagnostic and Predictor Study of Dizziness (Lahmann et al., 2012).

Assessment	Baseline	6-months follow-up	1-year follow-up
Neurological/neurootological examination	x		
Structured clinical interview for mental disorders (SCID-I)	x		
Self-report questionnaires covering different psychopathological aspects	x	x	x

Note. The factors covered by the self-report questionnaires are named in the text. Study 1 made use of the baseline assessment, Study 2 evaluated baseline and 1-year follow-up data.

4.1.3 Statistical analyses

Statistical methods and analyses used in Study 1 and 2 are described in the respective sections of the study papers (see Appendix A and B).

4.2 Methods of Study 3

Study 3 was conducted as a side project to the Munich Diagnostic and Predictor Study of Dizziness (Lahmann et al., 2012). As such, it did not make use of the large database that was established for the longitudinal project described above. Instead, it involved a separate data collection that was conducted between 2012 and 2016 at the Department of Psychosomatic Medicine and Psychotherapy of the University Hospital “Klinikum Rechts der Isar” of the Technical University of Munich. The study had a prospective design with examinations at baseline/admission to the clinic (T0), discharge (T1), and six months post-discharge (T2). Ethical approval for the study was obtained from the ethical committee of the medical faculty of the

Technical University of Munich. The principles of the Declaration of Helsinki and the Guideline for Good Clinical Practice were followed.

4.2.1 Study participants

Study participants were patients assigned for multimodal psychosomatic inpatient treatment at the clinic of the Department of Psychosomatic Medicine and Psychotherapy at the University Hospital “Klinikum rechts der Isar” of the Technical University of Munich. Inclusion criteria were being admitted with functional VD as the main complaint and being at least 18 years of age. Patients were excluded if they suffered from a neurodegenerative disorder (e.g. dementia), psychosis, or a severe and chronic addictive disorder, and/or if they were unable to sufficiently understand and speak the German language.

4.2.2 Material and methods, statistical analyses

Material and methods as well as the statistical analyses used in Study 3 are described in detail in the respective sections of the study manuscript (see Appendix C). The design of Study 3 is depicted in Table 2.

Table 2.

Design of Study 3.

Assessment	Admission	Multimodal psychosomatic inpatient treatment	Discharge	6 months post discharge
Medical/somatic examination	x			
Psychiatric examination	x			
Self-report questionnaires covering different psychopathological aspects	x		x	x

Note. The factors covered by the self-report questionnaires are named in the text of Study 3.

5 Project studies

5.1 Summary of Study 1: DSM-5 somatic symptom disorder in patients with vertigo and dizziness

As the diagnosis of DSM-5 SSD was expected to be a highly relevant diagnosis for patients with VD symptoms, this study investigated the diagnosis of SSD and its prevalence and overlap with former DSM-IV somatoform disorders in this patient group. A further aim was to evaluate the three components of the B-criterion of SSD (impairment on the cognitive, affective, and/or behavioural level). Further, comparisons of psychopathological factors between patients fulfilling diagnostic criteria for either SSD or a somatoform disorder, both diagnoses, or neither of the diagnoses, were conducted.

The study sample consisted of a large group (n = 399) of outpatients presenting to the German Centre for Vertigo and Balance Disorders of the Ludwig-Maximilians-University in Munich. Examinations included an extensive interdisciplinary medical assessment and a structural clinical interview for mental disorders according to DSM-IV (SCID-I). In addition, patients completed a variety of self-report questionnaires. Based on relevant questionnaires, the diagnosis of SSD was assessed retrospectively. Data were analysed with descriptive statistics (frequency analyses, evaluation of Cohen's kappa to assess the concordance between SSD and somatoform disorders) and inferential statistics (analyses of variance).

Results indicated that SSD was almost twice as prevalent as somatoform disorders (53 % vs. 29 %). The most common component of the B-criterion was the behavioural aspect (88 % of patients with SSD). Patients fulfilling all three components of the B-criterion and patients with both diagnoses (SSD and a

somatoform disorder) were most impaired compared to the respective comparison groups.

Findings demonstrate that SSD is highly prevalent in patients with VD symptoms. The overlap with former DSM-IV somatoform disorders is small. The fact that patients fulfilling all three components of the B-criterion are most impaired is in favour of a classification of severity of the condition as a whole based on the number of B-criteria that are fulfilled.

Please refer to Appendix A for the study paper of Study 1.

5.2 Summary of Study 2: Course and predictors of DSM-5 somatic symptom disorder in patients with vertigo and dizziness symptoms - A longitudinal study

Study 2 examined SSD in patients with VD symptoms with a longitudinal design. The natural course of SSD was evaluated over a one-year follow-up period. In addition, an aim was to evaluate predictors of persistent SSD.

A sample of patients (n = 239) presenting at a tertiary care interdisciplinary centre for patients with VD symptoms was investigated. Examinations included a medical examination and a structured clinical interview for mental disorders based on DSM-IV (SCID-I) at baseline, and a variety of self-report questionnaires at baseline and at one-year follow-up. A diagnosis of DSM-5 SSD was assigned based on relevant self-report questionnaires at baseline and one-year follow-up. Descriptive statistics were used to estimate prevalence rates at baseline and follow-up, as well as persistence, incidence and remission rates. Inferential statistics were used to compare patients with persistent SSD, remission and incidence of SSD, and those who never had the diagnosis (analysis of variance) and to evaluate predictors of persistent SSD (hierarchical logistic regression analyses).

Results indicated high prevalence (36 %), persistence (82 %) and incidence rates (50 %), whereas the remission rate was low (18 %). Statistically significant predictors of persistent SSD were a cognitive aspect (self-concept of bodily weakness, OR: 1.52, 95% CI: 1.30-1.78), an increase of depression during the study period (OR: 1.11, 95% CI: 1.02-1.22), and the diagnosis of an anxiety disorder (OR: 7.52, 95% CI: 1.17-48.23) or both depressive and anxiety disorder (OR: 23.14, 95% CI: 2.14-249.91) at baseline.

These findings suggest that there is a high prevalence of SSD in patients with VD symptoms over a one-year period. Further, the incidence rate over a one-year period was markedly higher than the remission rate. Findings point to a need to better address psychological distress in patients with VD symptoms by improving treatment options. The identified predictors of persistent SSD may serve as relevant psychotherapeutic treatment targets.

Please refer to Appendix B for the study paper of Study 2.

5.3 Summary of Study 3: Potential effects of multimodal psychosomatic inpatient treatment for patients with functional vertigo and dizziness symptoms - A pilot trial

Study 3 aimed to establish preliminary evidence of effects of multimodal psychosomatic inpatient therapy for patients with functional VD symptoms in reducing vertigo-related handicap. Moreover, the predictive role of theoretically relevant variables that may influence improvement was investigated.

To address these aims, an uncontrolled clinical pilot trial was conducted at the Department of Psychosomatic Medicine of the Technical University of Munich. Treatment in this hospital follows a psychodynamic approach, taking levels of personality structure into account when aiming to reduce psychopathology. Inpatient treatment duration usually is about 40 days. 72 patients with functional VD that were admitted for treatment were included in the study. As well as medical and psychometric assessment, self-report questionnaires assessing vertigo-related handicap, somatisation, depression, anxiety, health-related quality of life, and body-related locus of control were administered at admission (T0), discharge (T1), and six months post discharge (T2). Data were analysed with descriptive statistics and inferential statistics (multivariate analysis of variance, MANOVA) to assess treatment effects and hierarchical linear regression analyses to investigate predictors.

Results indicated medium effects for the change of vertigo-related handicap (T0-T1: g = -0.60, T0-T2: g = -0.67) and small effects for the change of somatisation (T0-T1: g = -0.29, T0-T2: g = -0.24), mental health-related quality of life (T0-T1: g = 0.43, T0-T2: g = 0.49), and depression (T0-T1: g = -0.41, T0-T2: g = -0.28). The investigated variables did not serve as significant predictors of improvement.

Findings indicate that psychosomatic inpatient therapy may be beneficial in reducing vertigo-related handicap in patients with functional VD symptoms. Future research should investigate this question in a randomised controlled study design and further investigate relevant predictors of treatment effects.

Please refer to Appendix C for the study paper of Study 3.

6 Overall discussion

This project evaluated two objectives. The first aim was to investigate the new DSM-5 diagnosis of SSD in the context of VD symptoms. The second aim was to provide data on potential effects of psychosomatic inpatient therapy for patients with functional VD symptoms. Results of the single studies are discussed in the respective Discussion sections of the study papers (see Appendix). In the following discussion, overall conclusions derived from the studies will be drawn. Regarding the first broad objective, the evaluation of DSM-5 SSD, the main finding was that SSD is a highly prevalent diagnosis in the investigated group of patients presenting at a tertiary care neurological centre that is specialised for VD symptoms. The prevalence of SSD was high regardless of whether symptoms were medically explained or not, i.e., whether they occurred for structural or functional reasons. This indicates that all patients with VD symptoms may suffer psychologically from their condition, not only those who present without an underlying organic disorder. Hence, the introduction of SSD may indeed have helped to reduce mind-body dualism as it was intended by the APA (2013). In the longitudinal analysis, persistence of SSD was high (82 %) and remission low (18 %). Despite existing criticism of the new diagnosis, these numbers point out that the current treatment as usual may be inadequate, given that psychological impairment as captured by SSD is clearly insufficiently reduced. Rather, psychological distress increases as demonstrated by the high incidence rate of 50 %.

As SSD has replaced the former DSM-IV somatoform disorders, another central aim of this project was to compare the prevalence of SSD with that of somatoform disorders. As discussed in Study 1, SSD was almost twice as common as somatoform disorders. Whilst most patients with a somatoform disorder also

fulfilled SSD criteria, only a smaller number of those with SSD also had a somatoform disorder. The former aligns with findings by Huang, Chen, Chen, et al. (2016) who also investigated patients with complaints of both functional and structural origin. Further, the overlap of the diagnoses was small, as indicated by their slight degree of agreement. This suggests that SSD indeed captures different aspects than somatoform disorders did, as was to be expected based on the different diagnostic criteria. Also regarding SSD vs. somatoform disorders, results suggest that patients with both diagnoses are more impaired on almost all investigated variables than those fulfilling only SSD or a somatoform disorder. This diagnostic pattern could likely only be fulfilled by patients with functional complaints since the lack of medical explicability is a diagnostic criterion of a DSM-IV somatoform disorder. Therefore, findings confirm previous evidence that functional VD leads to higher distress than that of structural origin (Tschan et al., 2010). Patients with a diagnosis of either SSD or a somatoform disorder presented with similar levels of impairment, with a tendency of those with SSD being slightly less severely impaired. This diverges from findings by Claassen-van Dessel et al. (2016) who suggested that SSD captures higher impairment than somatoform disorders. As discussed above, a reason may be the different sampling procedures (observing patients with only functional vs. those with both structural and functional complaints).

Another central aspect of investigation was the B-criterion of SSD. Prevalence rates of the single components and patterns of components as well as comparisons regarding impairment are discussed in Study 1. Importantly, results are in favour of a classification of severity based on the number of components of the B-criterion that are fulfilled, as suggested in the DSM-5 (APA, 2013a). Results of Study 1 indicate that the more components of the B-criterion that are fulfilled, the more

psychologically impaired patients are. This was one factor that led to the assumption that the components of the B-criterion at baseline would also serve to predict psychological distress, i.e., persistence of SSD, in the long term. However, only the cognitive aspect, namely having a self-concept of bodily weakness, consistently served as a significant predictor. Hence, whereas all aspects of the B-criterion may indicate high psychological distress, the cognitive aspect may have a more central role than the others. This is important for therapy, as one approach may be to reduce dysfunctional cognitions regarding bodily symptoms, in line with suggestions derived from the cognitive-behavioural model of somatoform symptoms by (Rief & Hiller, 1998). As well as the B-criterion, both studies also looked at the A-criterion of SSD by evaluating the number of reported symptoms. A finding from Study 1 was that the presence of more aspects of the B-criterion was associated with a higher symptom count, and evidence gained in Study 2 suggested that a high symptom count may predict persistent SSD. Thus, as well as discussions about whether to improve the definition of the B-criterion, a revision of the A-criterion may also be necessary. Instead of just one physical symptom that is required for the diagnosis, multiple symptoms or a certain severity of symptom(s) could be required. The current definition of the A-criterion has previously been criticised by Frances (Frances, 2013b) and discussed by Rief & Martin (2014).

By investigating the criteria of SSD, it was hoped that this project would help to make suggestions on how to improve current research criteria of how to assess SSD. In this regard, the finding of a relatively low prevalence of the affective component of the B-criterion was unexpected, particularly considering the prevalence rates of comorbid affective and anxiety disorders. As discussed in Study 1, a potential reason for this finding may be the operationalisation of the affective

component through the Whiteley Index (Pilowsky, 1967), a scale that assesses illness anxiety. A more appropriate scale may have been one that directly assesses different emotions with regard to the respective somatic symptom and does not only focus on anxiety as an affective state. Fortunately, during the time when Study 1 was conducted, a new scale, the Somatic Symptom Disorder – B Criteria Scale (SSD-12; Toussaint et al., 2016) was published and may better serve to capture the B-criterion than current scales. Further, with the development of the Structured Clinical Interview for DSM-5 (SCID-5; First, Williams, Karg, & Spitzer, 2015) and planned translation into different languages, it will likely be easier to assess the diagnosis in the future.

A further factor that was examined in both studies was psychiatric comorbidities. Results of Study 1 suggest that comorbidities were most common in the group fulfilling both diagnoses, with anxiety disorders being most frequent. In addition, the prevalence of an anxiety disorder as well as the prevalence of both an anxiety and an affective disorder had significant value in predicting persistent SSD. This aligns with previous studies that found a relationship between anxiety and VD symptoms (Dieterich & Staab, 2017; Furman et al., 2005; Staab et al., 2014) and suggest that anxiety may have to be considered as a treatment target. As mentioned in Study 1, some, but not all, patients with SSD present with a psychiatric comorbidity. It therefore does not appear that SSD merely serves as an umbrella category of other diagnoses, as was suggested by Häuser et al. (2015), but rather as a distinct disorder.

Results of Study 3 are largely discussed in the corresponding study paper. In summary, results indicate that multimodal psychosomatic inpatient treatment may be effective in reducing self-reported vertigo-related handicap and related

psychopathological aspects for patients presenting with functional VD. However, significant predictors of improvement of vertigo-related handicap could not be identified. Considering findings from Study 1 and 2, it was expected that a low number of comorbidities at baseline and an internal bodily locus of control (as opposed to a self-concept of bodily weakness) would predict improvement. However, results did not support this hypothesis. Potential reasons for this finding include that various aspects, namely the dependent variable, the sample, and the setting, differed between the studies. In Study 2, the persistence of SSD was predicted in a broad sample of patients with all types of VD symptoms whereas Study 3 investigated predictors of improvement in a sample of patients with severe functional VD symptoms after psychosomatic inpatient treatment. As discussed, groups of patients with purely structural vs. purely functional vs. both structural and functional origin of their complaints may differ significantly regarding the severity of their condition.

6.1 Strengths and limitations

Strengths and limitations are discussed in the respective sections of the study papers. In summary, regarding Study 1 and 2, strengths are the large sample size, the longitudinal design of the project, and the interdisciplinary approach of assessing the complaints. The fact that the research questions could be investigated within a cooperation project between a psychosomatic university clinic and a tertiary care neurological university hospital allowed benefit from joint efforts of both disciplines and make a step towards overcoming mind-body dualism. In this regard, it was possible to investigate patients with functional, structural, and a combination of structural and functional origins of their symptoms simultaneously. A central limitation of Study 1 and 2 is that SSD was assessed retrospectively and based on

self-report questionnaires. This was due to the fact that a structured clinical interview for DSM-5 had not been published when the study was conducted and therefore the clinical interview did not include questions regarding SSD criteria. Regarding assessment of SSD, it is also important to note that it was diagnosed differently between Study 1 and 2. While Study 1 assessed the B-criterion based on all three components proposed in DSM-5, namely the affective, cognitive, and behavioural component, Study 2 assessed the B-criterion merely based on the affective and cognitive component. This was because the behavioural component had proven to be unspecific. Nevertheless, the different operationalisation likely contributed to the different prevalence rates.

Regarding Study 3, a strength is that it is one of few studies investigating multimodal psychosomatic inpatient therapy for patients with chronic and severe VD symptoms. Although the focus was on patients with functional VD, the sample also included both somatically and psychologically impaired patients as reflected by multiple diagnoses on both sides. A central limitation of Study 3 is that the design did not include a control condition. A randomised controlled trial would have been a more valuable study design to investigate whether the observed reduction of vertigo-related handicap truly did occur due to the intervention and not due to other variables.

6.2 Implications and future directions

The findings regarding DSM-5 SSD have provided further knowledge regarding the prevalence and course of the diagnosis in patients with VD symptoms. The observed high prevalence rates of SSD may help to sensitise clinicians for the psychological impairment of patients with both structural and functional types of VD. Further, the high persistence and low remission rates indicate that current treatment

as usual is not sufficient to improve the psychological well-being of patients. The currently revised treatment guidelines for patients with functional symptoms may help to overcome these problems, along with an enhanced awareness of psychological distress in patients with different types of physical symptoms, regardless of their aetiology. Further, in accordance with current clinical guidelines (Schaefert et al., 2012), it would be desirable to develop and implement stepped care or collaborative care approaches on a broader scale. Preliminary evidence from a collaborative care approach for patients with functional and somatoform disorders has been gathered and was in favour of the investigated interdisciplinary network (Shedden-Mora et al., 2016). Further research in this area is necessary. Another line of future research is to conduct similar analyses as in the current project, but assess DSM-5 SSD with either a validated scale specific for the diagnosis (e.g., SSD-12; Toussaint et al., 2016) or a structured clinical interview. In addition, it would be interesting to assess SSD in relation to different underlying organic dysfunctions that lead to vertigo symptoms. Similar to findings of different prevalence rates of DSM-IV psychiatric disorders in different vestibular disorders (Lahmann, Henningsen, Brandt, et al., 2015), the prevalence of SSD may also vary between underlying pathologies.

A project that has already been implemented based on the Munich Diagnostic and Predictor Study of Dizziness (Lahmann et al., 2012) is a randomised controlled trial that investigates a psychotherapeutic treatment programme tailored to patients with functional as well as both functional and structural VD symptoms (Lahmann, Henningsen, Dieterich, Radziej, & Schmid, 2015). Preliminary evidence suggests that the therapy programme may help to reduce vertigo-related handicap (Radziej, Schmid-Mühlbauer, Limburg, & Lahmann, 2017). In terms of therapy and considering results of Study 3, it would also be valuable to investigate multimodal psychosomatic

inpatient therapy for patients with VD symptoms and/or SSD with a randomised controlled study design.

7 Declaration of author contribution

As the doctoral candidate, I am the main author of the three study papers. I developed research questions, aims and methodology including the selection of relevant examinations and measures. Since the studies of this dissertation project were parts of larger projects that had been planned before the start of this dissertation project, I was not in charge of the data collection myself. I was responsible for data management and carried out all statistical analyses independently. The manuscripts were drafted by myself and revised with the help of the co-authors. Suggestions for revisions were implemented by myself. Further, I corresponded with the editors during the publication process and implemented reviewers' comments including major revisions and further analyses.

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Appendix

Appendix A

Study 1: DSM-5 somatic symptom disorder in patients with vertigo and dizziness

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DSM-5 somatic symptom disorder in patients with vertigo and dizziness symptoms

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ABSTRACT

Objective: DSM-5 somatic symptom disorder (SSD) could potentially be a highly relevant diagnosis for patients with vertigo and dizziness. The criteria of SSD, particularly the B-criterion with its three components (cognitive, affective, behavioral), have however not yet been investigated in this patient group.
Methods: We evaluated a large sample ($n = 399$) of outpatients presenting in a neurological setting. Physical examinations and a psychometric assessment (SCID-I) were conducted; patients completed self-report questionnaires. The diagnosis of SSD was assigned retrospectively. The prevalence of SSD, its diagnostic criteria, and its overlap with former *DSM-IV* somatoform disorders were evaluated; comparisons were drawn between (1) patients fulfilling different components of the B-criterion and (2) patients with diagnoses after *DSM-IV* vs. *DSM-5*.
Results: SSD was almost twice as common as *DSM-IV* somatoform disorders. Patients with all three components of the B-criterion reported the highest impairment levels. Patients with both *DSM-IV* somatoform disorders and *DSM-5* SSD were more impaired compared to groups with one of the diagnoses; patients with *DSM-IV* somatoform disorders only were more impaired than those with SSD only.
Conclusions: Our findings demonstrate that SSD is highly prevalent in patients with vertigo and dizziness. The classification of severity based on the number of psychological symptoms appears valid and may assist in finding suitable treatment options according to clinical practice guidelines. Future studies should investigate the overlap of SSD and other psychiatric disorders, this may assist in better defining the diagnostic criteria of SSD.
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1. Introduction

Vertigo and dizziness (VD) are common and severely distressing symptoms [1,2]. In about 20 to 50% of patients, VD symptoms occur comorbid with a psychiatric diagnosis [e.g. 3, 4]. VD can occur without an organic cause or persist after an organic pathology has faded; about 20% of patients have been shown to present with functional VD symptoms [5–7]. The term "functional symptoms" generally refers to symptoms that are characterized by high impairment levels although no structural abnormalities are found [8].

Each patient with VD often presents with a particular pattern of thoughts, feelings, and behaviors regarding the VD symptoms: many patients present with specific affective characteristics such as higher scores on anxiety or depression rating scales [9], cognitive patterns such as negative beliefs about the consequences of VD symptoms [10], and/or behaviors such as avoidance behavior [11] and increased health care utilization [12].

Due to these psychological characteristics, a diagnosis that is potentially relevant to patients with VD is somatic symptom disorder (SSD) which has been newly defined in the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM)-5* [13]. The diagnosis SSD has replaced various former *DSM-IV* somatoform disorders [14] and is characterized by one or more somatic symptoms that are very disruptive or distressing (criterion A), accompanied by excessive thoughts, feelings, or behaviors regarding the reported symptoms (criterion B), and time persistent (longer than six months, criterion C) [13].

The B-criterion of *DSM-5* SSD in particular has been subject to a number of previous investigations in psychosomatic settings; its three components outlined above have been proven to be predictively valid criteria of the functional outcome of patients with SSD [15–17]. These investigations do however have a methodological shortcoming as they based their definition of the B-criterion simply on the affective component whilst neglecting the behavioral and cognitive aspects when diagnosing SSD.

As the B-criterion in particular is likely to be prevalent in patients with VD, this group appears to be an ideal sample to investigate the

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criteria of SSD and especially the B-criterion with its three components. To the authors' knowledge, the current diagnostic criteria of SSD have however not yet been evaluated in patients suffering from VD symptoms.

1.1. Aims and hypotheses

As a part of the Munich Diagnostic and Predictor Study of Somatoform Dizziness [18], the present study offered the chance to investigate the diagnosis of *DSM-5* SSD in a large sample of patients presenting with VD. We evaluated the prevalence of the new diagnosis and its overlap with former *DSM-IV* somatoform disorders. We hypothesized that *DSM-5* SSD is more prevalent than *DSM-IV* somatoform disorders and that the overlap is relatively small due to the change in the main diagnostic criterion (medical explicability). We investigated criterion B – as the main innovation of the new diagnosis – by estimating the prevalence of its three components (affective, cognitive, behavioral). After this, different patterns that target each of the aforementioned psychological factors alone and in combination were tested. Comparisons were drawn (1) between these patterns of criterion B and (2) between the current diagnoses after *DSM-IV* and *DSM-5* regarding impairment and a variety of psychological factors. We expected that patients who fulfill all three components of the B-criterion are more impaired than those fulfilling one or two components; further we expected that patients with both diagnoses (*DSM-IV* somatoform disorder and *DSM-5 SSD*) are more impaired than those with only one diagnosis.

2. Method

2.1. Participants

Patients were recruited through routine care appointments at the German Centre for Vertigo and Balance Disorders at the University Hospital Munich, Campus Großhadern, between May 2010 and June 2012. The full details of the sampling procedure and assessments have been described elsewhere [4]. A total of 860 eligible patients were approached, of which 687 gave their informed consent. For organizational reasons, some patients did not undergo a Structured Clinical Interview (SCID-I) [19] to assess mental disorders; other patients did not fill out all of the required self-report questionnaires. Therefore, we only included data from the 399 patients who were both interviewed and had completed the self-report questionnaires. A sensitivity analysis revealed that patients who did and did not participate in both the SCID-I and the self-report questionnaires were comparable concerning age, sex, duration of the vertigo symptoms, and diagnoses.

2.2. Assessment

2.2.1. Neurological assessment

All patients underwent physical examination by medical experts at the German Centre for Vertigo and Balance Disorders including complete neurological, neuro-otological, and neuro-ophthalmological examination. This included the measurements of the subjective visual vertical and ocular torsion for vestibular testing as well as video-oculography with caloric irrigation. The neurologists made a clinical diagnosis based on the results of testing and the established diagnostic criteria for the different vestibular disorders [20]. The diagnosis of vestibular migraine was based on the criteria of Neuhauser and Lempert [21], Menière's disease was diagnosed corresponding to the diagnostic criteria of the American Academy of Otolaryngology, Head and Neck Surgery [22], and the diagnosis of vestibular paroxysmia was based on criteria from Brandt and Dieterich [23]. The co-occurrence of multiple organic vertigo/dizziness diagnoses was allowed if indicated. If no structural dysfunction that explained the symptoms was found, patients were classified as having functional VD symptoms; if the symptoms went beyond what is to be expected from an existing structural dysfunction, patients were classified as having a combination of a structural dysfunction and a functional component.

2.2.2. Psychometric assessment of current DSM-IV disorders

Intensively trained and continuously supervised psychologists and final-year medical or psychology students conducted structured clinical interviews [SCID-I; 19] to assess patients' mental disorders and psychiatric comorbidity according to the *DSM-IV* classification system independently of their diagnoses given by the neurologists. The inter-rater reliability evaluated via interviews with a simulated patient was high (Kappa 0.94).

2.2.3. Self-report questionnaires

Patients were asked to complete a variety of self-report questionnaires at home and send them back to the authors. For the current study, we applied the following instruments: The Patient Health Questionnaire-15 [PHQ-15; 24] was used to capture the number of common somatic symptoms patient present with. We applied the Vertigo Handicap Questionnaire [VHQ; 25, 26] to measure physical and psychosocial impairment caused by vertigo and dizziness; in addition, we used the Short Form Health Survey [SF-12; 27] to assess physical and mental health-related quality of life in general. Illness anxiety or hypochondriasis as an affective aspect was assessed with the Whiteley Index [WI; 28]. We used the Cognitions about Body and Health Questionnaire [CABAH; 29] to measure cognitive factors regarding bodily sensations with its subscales Autonomic Sensations and Bodily Weakness. The Scale for the Assessment of Illness Behavior [SAIB; 30] targets different aspects of illness behavior, we applied three of its five subscales Medication/Treatment, Consequences of Illness, and Scanning. The lower the scores on the subscales, the more illness behavior is present. The Beck Depression Inventory-II [BDI-II; 31] and the Beck Anxiety Inventory [BAI; 32] were used to measure the severity of depression and anxiety.

2.2.4. Assessment of DSM-5 SSD

The diagnosis of SSD was assessed as follows: For criterion A, patients had to report to be severely bothered by at least one symptom on the PHQ-15. In contrast to previous authors who applied solely the WI to assess criterion B [15–17], in the current study we used three different instruments to target the three components of the criterion: To measure the affective component, we applied the Whiteley Index [28] with a cut-off score of 6. For the cognitive component we used the sum scores of the CABAH subscales Autonomic Sensations and Bodily Weakness with cut-off scores of 5 and 8 as these scales have been proven to distinguish between patients with somatoform disorders and those with other psychiatric disorders [29]. The behavioral component was assessed via the sum scores of the three SAIB-subscales Medication/Treatment, Consequences of Illness, and Scanning with cut-off scores of 15, 9, and 11 as these scales distinguish between patients with somatoform disorders and/or depression and non-clinical controls [30]. To endorse one of the components, at least one of the referring subscale scores had to exceed the cut-off or, for the SAIB, fall below the cut-off. In order to fulfill criterion C, the rate of chronicity, symptom(s) had to be present for at least six months.

2.3. Statistical analysis

Statistical analyses were conducted using SPSS 22.0 statistical package. We evaluated the frequencies of neurological and psychiatric diagnoses, the SSD criteria, and the components and patterns of components of the B-criterion. We measured the accordance of the diagnoses through Cohen's Kappa. We conducted two analyses of variance (ANOVA) comparing (1) groups of patients fulfilling different components of the B-criterion and (2) the diagnostic groups of patients with *DSM-IV* somatoform disorders vs. *DSM-5* SSD vs. both diagnoses vs. neither of the diagnoses regarding continuous variables. As we know about the issue of multiple testing, we decided to only include a choice of

subscales from SAIB und CABAH in the comparisons based on content considerations. Chi^2-tests were used for the comparisons regarding categorical variables (functional or structural origin of VD symptoms, duration longer than two years, psychiatric comorbidity).

3. Results

Sociodemographic, neurological and psychometric characteristics of the sample ($n = 399$) are presented in Table 1. In the neurological diagnostic workup, a total of 257 patients (64.4%) were diagnosed with a purely structural type of vertigo, for the remaining 142 patients (35.6%), the VD symptoms were not at all or not fully explained by a medical condition, thus they were classified by the neurologists as having functional vertigo or a functional component. About a quarter of patients received more than one diagnosis, thus 507 diagnoses were given all in all. Of those, $n = 142$ (28.1%) were functional VD, $n = 365$ (72.0%) included a structural dysfunction.

3.1. Prevalence of and overlap between DSM-IV somatoform disorders and DSM-5 SSD

The prevalence and overlap of the diagnoses after *DSM-IV* and *−5* is presented in Table 2. The majority (67.8%) of the patients with a *DSM-IV* somatoform disorder also fulfilled the criteria for *DSM-5* SSD whilst only 37.0% of the patients diagnosed with *DSM-5* SSD also had a *DSM-IV* somatoform disorder. Of all patients, $n = 151$ (37.8%) had neither of the diagnoses. The degree of agreement between the diagnostic systems was only slight (Cohen's $\kappa = 0.17$).

3.2. Prevalence of the diagnostic criteria of SSD

A total of 327 patients (82.0%) reported at least one very distressing somatic symptom on the PHQ-15 and thus fulfilled criterion A of SSD. Of these patients, 201 (61.5%) reported a few (up to three) very distressing symptoms, 126 patients (38.5%) reported more than three very distressing symptoms. The B-criterion (cognitive, affective, or behavioral symptoms related to the somatic symptom) was fulfilled by 306 (76.7%) of all patients; 316 (79.2%) of all patients reported suffering from the symptoms for longer than 6 months and thus fulfilled criterion C.

Table 1
Sociodemographic and medical characteristics of the sample.

Variable	
Age, M (SD)	53.8 (15.8)
Female gender, n (%)	224 (56.1)
Marital status (n, % married)	248 (62.2)
Education	
9th grade or less, n (%)	164 (41.1)
10th grade, n (%)	124 (31.1)
High school graduate, n (%)	43 (10.8)
University graduate, n (%)	64 (16)
Any psychiatric diagnosis (*DSM-IV*), n (%)	178 (44.6)
Affective disorder, n (%)	67 (16.8)
Anxiety disorder, n (%)	134 (33.6)
Somatoform disorder, n (%)	115 (28.8)
Neurological diagnoses	
Functional VD symptoms	142 (28.1)
Vestibular paroxysmia, n (%)	32 (6.3)
Vestibular migraine, n (%)	72 (14.2)
Multisensory deficit, n (%)	59 (11.6)
Benign paroxysmal positional vertigo, n (%)	66 (13.0)
Central vertigo, n (%)	24 (4.7)
Meniere's disease, n (%)	59 (11.6)
Vestibular neuritis, n (%)	22 (4.3)
Bilateral Vestibulopathy, n (%)	31 (6.2)

Note. Multiple psychiatric and neurologic diagnoses were allowed if indicated.

Table 2
Overlap between diagnoses of *DSM-IV* somatoform disorders and *DSM-5* SSD.

		DSM-IV somatoform disorder		
		No (n)	Yes (n)	Total (n)
DSM-5 SSD	No (n)	151	37	188
	Yes (n)	133	78	211
	Total (n)	284	115	399

3.3. Evaluation and comparison of the three components of criterion B

The prevalence and overlap of the three components of the B-criterion is presented in Fig. 1. About a quarter (24%) of the patients with *DSM-5* SSD fulfilled all three components; more than one third (37%) fulfilled a combination of two components. The behavioral component emerged as being highly prevalent, with 88% of the patients with SSD fulfilling the component alone or in combination with the remaining two components.

A comparison between groups of patients fulfilling the different patterns of components is shown in Table 3. Due to small subsample sizes, the affective component group and the group fulfilling a combination of the affective and cognitive component were not included in the analysis. The differences between the groups were significant for all the continuous variables investigated. Patients who fulfilled all three components of the B-criterion reported significantly higher impairment (VHQ, PHQ-15, HAS, WI, CABAH, BDI, BAI), significantly lower physical and mental quality of life (SF-12), and significantly more illness behavior (SAIB) compared to the remaining groups. Patients who fulfilled two components of the B-criterion were significantly more impaired than those fulfilling one component.

Investigation of the categorical variables showed that the numbers of patients with psychiatric comorbidities differed significantly between the groups and was most severe in patients who fulfilled all three components of the B-criterion. The percentage of patients with functional VD symptoms and duration of the VD complaints for over 2 years tended to be the highest for the group with all three components fulfilled, however, the group differences were not significant.

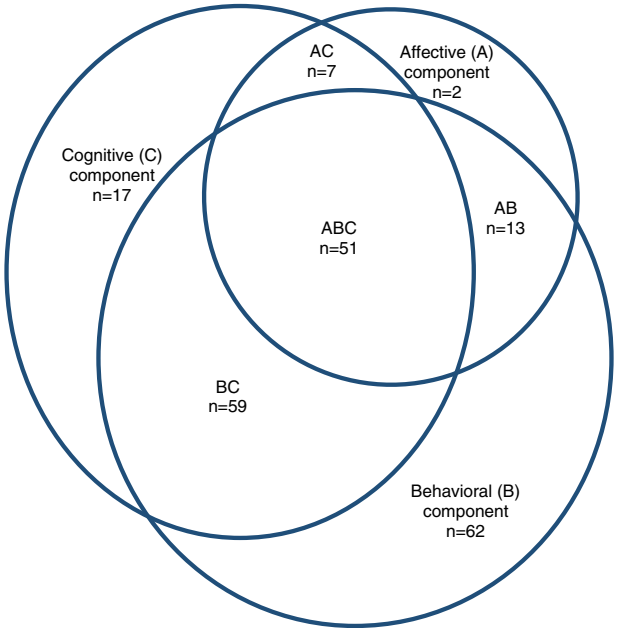

Fig. 1. Prevalence and overlap of the components of the B-criterion of DSM-5 SSD. Each area pictures a particular pattern of component/s of the B-criterion. A = affective component, B = behavioral component, C = cognitive component.

Table 3
Group differences between five groups of patients with SSD representing the different patterns of the B-criterion (i.e., patient groups fulfilling the different components or combinations of components of the B-criterion of DSM-5 SSD). The upper part of the table presents a comparison of the groups on continuous variables (one-way ANOVA), the lower part presents a comparison of the groups on categorical variables.

	DSM-5 SSD-B-criterion – diagnostic patterns							
	(1) One component fulfilled		(2) Two components fulfilled		(3) Three components fulfilled	ANOVA (post-hoc pairwise comparisons; *p*-values)		
Continuous variables	Cognitive component ($n = 17$)	Behavioral component ($n = 62$)	Cognitive and behavioral component ($n = 59$)	Affective and behavioral component (n = 13)	Cognitive, affective, and behavioral component ($n = 51$)	One vs. two components	One vs. three components	Two vs. three components
VHQ sum score, *M* (*SD*)	43.9 (4.1)	41.7 (2.2)	45.8 (2.0)	47.2 (3.2)	60.2 (1.7)	0.05	<0.001	<0.001
SF-12 physical component score, *M* (*SD*)	36.6 (2.8)	43.5 (1.3)	35.7 (1.3)	38.8 (2.0)	34.1 (1.4)	<0.001	<0.001	0.30
SF-12 mental component score, *M* (*SD*)	47.3 (3.7)	50.1 (1.5)	46.0 (1.8)	43.8 (3.3)	38.0 (1.5)	0.03	<0.001	<0.01
Number of reported symptoms on the PHQ-15, *M* (*SD*)	3.7 (0.6)	2.3 (0.2)	3.6 (0.3)	2.6 (0.4)	4.3 (0.3)	0.01	<0.001	0.08
WI sum score, *M* (*SD*)	3.00 (0.5)	3.0 (0.3)	3.7 (0.2)	8.1 (0.5)	8.5 (0.2)	<0.001	<0.001	<0.001
CABAH Autonomic Sensations, *M* (*SD*)	5.2 (0.4)	3.1 (0.2)	5.0 (0.2)	3.7 (0.4)	6.1 (0.3)	<0.001	<0.001	<0.001
CABAH Bodily Weakness, *M* (*SD*)	9.2 (0.8)	4.6 (0.3)	10.1 (0.4)	6.4 (0.6)	11.4 (0.3)	<0.001	<0.001	<0.01
SAIB Medication/Treatment, *M* (*SD*)	16.3 (0.4)	12.6 (0.3)	11.6 (0.3)	10.7 (0.6)	11.1 (0.3)	<0.001	<0.001	0.07
SAIB Consequences of Illness, *M* (*SD*)	14.4 (0.5)	14.7 (0.3)	12.9 (0.3)	12.9 (0.5)	11.1 (0.3)	<0.001	<0.001	<0.001
SAIB Scanning, *M* (*SD*)	12.8 (0.4)	11.1 (0.3)	11.1 (0.3)	9.0 (0.8)	9.3 (0.3)	0.12	<0.001	<0.001
BDI sum score, *M* (*SD*)	14.2 (2.5)	8.3 (0.8)	12.2 (1.2)	9.9 (1.9)	18.6 (1.0)	0.06	<0.001	<0.001
BAI sum score, *M* (*SD*)	12.3 (1.94	10.0 (0.9)	15.8 (1.1)	15.1 (2.6)	21.9 (1.5)	<0.001	<0.001	<0.001
Note. In case of significant group effects, pairwise comparisons between the patterns of the B-criterion (one vs. two vs. three components fulfilled) were drawn.								
Categorical variables						Chi-square		
Patients with functional VD symptoms, n (%)	5 (29.4)	24 (38.7)	17 (28.8)	6 (42.6)	25 (49.0)	5.7		
Duration longer than 2 years, n (%)	5 (29.4)	31 (50.0)	29 (49.2)	4 (30.8)	32 (62.7)	8.1		
Comorbid psychiatric disorder (*DSM-IV*), n (%)	10 (58.5)	18 (29.0)	27 (45.8)	7 (53.8)	37 (72.5)	22.2***		
Comorbid affective disorder (*DSM-IV*), n (%)	4 (23.5)	4 (6.5)	8 (13.6)	2 (15.4)	19 (37.3)	19.3**		
Comorbid anxiety disorder (*DSM-IV*), n (%)	7 (41.2)	15 (24.2)	20 (33.9)	7 (53.8)	26 (51.0)	10.6*		

Note. Percentages refer to the proportion of patients within the corresponding group, not within the displayed sample. *DSM-5* - Diagnostic and Statistical Manual of Mental Disorders (5th ed.), *DSM-IV* - Diagnostic and Statistical Manual of Mental Disorders (4th ed.), SD – somatoform disorder, SSD – somatic symptom disorder. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

3.4. Comparison between DSM-IV somatoform disorders and DSM-5 SSD

A comparison between groups of patients diagnosed with a *DSM-IV* somatoform disorder, *DSM-5* SSD, both diagnoses, or neither of these diagnoses is shown in Table 4. The differences between the groups were significant for all the variables investigated. Post-hoc tests revealed that patients with both diagnoses showed a pattern of higher impairment (VHQ, PHQ-15, HAS, WI, CABAH, BDI, BAI), lower quality of life (SF-12), and more illness behavior (SAIB) compared to the remaining groups; these observed group differences were significant in most cases. The group with SSD only presented with a pattern of lower impairment and higher well-being compared to the group with both diagnoses, these group differences were significant across almost all variables for this comparison. For the comparison between *DSM-5* SSD only vs. *DSM-IV* somatoform disorders only, significant differences occurred for the WI and the SF-12 (physical component score) with the group with SSD only being less impaired than those with somatoform disorders.

The group differences were also significant for all investigated categorical variables: The group with diagnoses after *DSM-IV* and *DSM-5* had the highest rate of functional VD symptoms. The duration of the VD complaints was similar for all three groups with a diagnosis after *DSM-IV* and/or *DSM-5* and significantly shorter for the group with neither of the diagnoses.

The number of patients with a psychiatric comorbidity differed significantly between the groups. Around three quarters of patients suffered from a psychiatric comorbidity in both the groups with *DSM-IV* somatoform disorder and both diagnoses while only a third of the patients in the *DSM-5* SSD group and the group with no diagnosis presented with a comorbidity. For SSD in particular, half of the patients with this diagnosis also had a psychiatric comorbidity. A comorbid affective disorder was most common in the group with both diagnoses; a comorbid anxiety disorder was most common in the *DSM-IV* somatoform disorder group compared to the remaining groups.

4. Discussion

4.1. Findings and implications

We investigated the diagnosis of *DSM-5* SSD with its diagnostic criteria in a large sample of patients presenting with VD and compared it to the diagnosis of *DSM-IV* somatoform disorders. As expected, *DSM-5* SSD was diagnosed twice as often and there was only a slight degree of agreement between the two diagnoses.

Table 4
Group differences between the four diagnostic groups (i.e. groups of patients assigned with different diagnoses or combinations of diagnoses). The upper part of the table presents a comparison of the groups on continuous variables (one-way ANOVA), the lower part presents a comparison of the groups on categorical variables.

	Diagnoses				ANOVA (post-hoc pairwise comparisons; *p*-values)			
Continuous variables	(1) Only *DSM-5* SSD, no *DSM-IV* SD ($n = 133$)	(2) Only *DSM-IV* SD, no *DSM-5* SSD ($n = 37$)	(3) *DSM-5* SSD and *DSM-IV* SD ($n = 78$)	(4) Neither *DSM-IV* SD nor *DSM-5* SSD ($n = 151$)	(1) vs. (2)	(1) vs. (3)	(1) vs. (4)	(2) vs. (3)
VHQ sum score, *M* (*SD*)	45.6 (16.9)	43.3 (16.1)	52.5 (15.0)	36.7 (16.9)	0.441	0.004	<0.001	0.005
SF-12 physical component score, *M* (*SD*)	39.0 (9.7)	42.0 (9.8)	35.8 (9.4)	43.3 (9.4)	0.154	0.033	0.001	0.005
SF-12 mental component score, *M* (*SD*)	47.8 (11.4)	42.3 (10.9)	40.6 (11. 7)	48.7 (11.0)	0.025	<0.001	0.527	0.493
Number of reported symptoms on the PHQ-15, *M* (*SD*)	3.0 (2.2)	2.3 (2.2)	4.1 (2.4)	1.9 (2.3)	0.067	0.002	<0.001	<0.001
WI sum score, *M* (*SD*)	4.2 (2.7)	5.9 (3.1)	6.5 (3.1)	3.0 (2.5)	0.001	<0.001	<0.001	0.338
CABAH Autonomic Sensations, *M* (*SD*)	4.2 (2.2)	4.2 (2.6)	5.1 (2.1)	3.3 (2.4)	0.925	0.006	0.001	0.043
CABAH Bodily Weakness, *M* (*SD*)	8.0 (3.8)	7.6 (3.3)	9.3 (3.7)	5.2 (3.1)	0.525	0.011	<0.001	0.019
SAIB Medication/Treatment, *M* (*SD*)	12.6 (2.8)	13.5 (3.5)	11.9 (2.6)	15.0 (3.2)	0.125	0.129	<0.001	0.014
SAIB Consequences of Illness, *M* (*SD*)	13.6 (2.7)	14.1 (2.6)	12.3 (2.4)	15.4 (2.6)	0.370	<0.001	<0.001	0.001
SAIB Scanning, *M* (*SD*)	11.0 (2.5)	11.0 (2.4)	10.2 (2.5)	12.3 (2.3)	0.937	0.016	<0.001	0.116
BDI sum score, *M* (*SD*)	11.3 (8.0)	12.5 (6.9)	15.6 (9.4)	9.2 (7.7)	0.438	<0.001	0.040	0.064
BAI sum score, *M* (*SD*)	13.5 (8.8)	15.0 (8.7)	18.9 (10.8)	9.5 (8.1)	0.399	<0.001	<0.001	0.033
Note. In case of significant group effects, pairwise comparisons between the different diagnoses were drawn.								
Categorical variables					Chi-square			
Patients with functional VD symptoms, n (%)	31 (23.3)	25 (67.6)	51 (65.4)	35 (23.2)	65.6***			
Duration longer than 6 months, n (%)	133 (100)	15 (83.3)	78 (100)	90 (76.9)	52.2***			
Duration longer than 2 years, n (%)	67 (50.4)	10 (55.6)	38 (48.7)	38 (32.5)	10.2*			
Comorbid psychiatric disorder (*DSM-IV*), n (%)	45 (33.8)	26 (70.3)	60 (76.9)	47 (31.1)	60.2***			
Comorbid affective disorder (*DSM-IV*), n (%)	12 (9.0)	10 (27.0)	28 (35.9)	17 (11.3)	32.2***			
Comorbid anxiety disorder (*DSM-IV*), n (%)	36 (27.1)	22 (59.5)	43 (55.1)	33 (21.9)	39.2***			

Note. Percentages refer to the proportion of patients within the corresponding group, not within the displayed sample. *DSM-5* - Diagnostic and Statistical Manual of Mental Disorders (5th ed.), *DSM-IV* - Diagnostic and Statistical Manual of Mental Disorders (4th ed.), SD – somatoform disorder, SSD – somatic symptom disorder. *p < 0.05, **p < 0.01, ***p < 0.001.

A potentially important aspect of SSD is the B-criterion with its "positive features" [33], which replaces the dissatisfying issue of a lack of medical or organic explanation. Its behavioral component could be confirmed in the majority of the patients with SSD. Our broad operationalization of the behavioral component may have contributed to its high prevalence as it was based on items that would likely apply to the majority of patients with no regard to whether they experience clinically relevant high distress or not (e.g. "I am not able to concentrate on my work when suffering from physical complaints"). The relatively low rate of patients fulfilling the affective component of the B-criterion was surprising in light of a pronounced affective impairment in those patients [9]. The definition of the affective criterion exclusively based on the WI (a scale measuring illness anxiety) may have underestimated affective impairment in relation to the symptoms. Accordingly, the BDI scores of patients with SSD (and *DSM-IV* somatoform disorders) point out that there may be subclinical affective impairment.

The comparison of the patterns of the B-criterion demonstrated that, corresponding to our hypothesis, patients fulfilling all three components were more impaired in all psychopathological and vertigo-related domains; patients with two components were more impaired than those fulfilling one component. In line with views of former researchers [e.g. 34] our results support the already included option of a classification of severity of SSD based on the number of psychological symptoms [13]. This is also in accordance with the most recent clinical practice guidelines for non-specific, functional, and somatoform bodily complaints which suggest diagnosis and treatment according to severity levels ("stepped care"). These guidelines recommend a collaborative approach with the inclusion of disorder-oriented specialist psychotherapy in addition to somatic medical care only for more severe courses; milder courses are recommended to be managed mainly by the primary care physician [35]. As a consequence, previous concerns of potentially misusing the psychiatric diagnosis and stigmatizing patients by e.g. prescribing psychotherapy unnecessarily should be at least partly rebutted [36,37].

In the comparison between the two diagnostic systems (*DSM-IV* somatoform disorders vs. *DSM-5* SSD), patients with diagnoses according to both systems were more impaired on all investigated domains; patients with only *DSM-5* SSD presented with lower impairment compared to those with only *DSM-IV* somatoform disorder (pointing out a low specificity of SSD). Our findings additionally confirm previous investigations that functional VD induces higher psychosocial distress compared to VD of structural causes [38]. When studying patients with various symptoms of functional origin, Claasen-van Dessel et al. [39] recently found that SSD criteria potentially identify more severe cases than *DSM-IV* somatoform disorders. This is not the case in our sample, likely because we investigated patients with functional and structural symptoms. Tomenson et al. [40] moved beyond categorizing symptoms into functional or structural and found that the total somatic symptom score was associated with health status even more so than the number of functional symptoms, which may indicate a point in favor of the new diagnosis.

Our results regarding comorbidities confirm previous study findings that VD symptoms occur frequently comorbid with anxiety and affective disorders [e.g., 41, 42–44]. The relevance of anxiety in particular relates to evidence for common neural pathways of the vestibular system and systems involved in anxiety conditioning [45]; further, anxiety disorders probably lead to a higher risk of developing a form of structural vertigo [46]. As aspects of anxiety and depressive disorders potentially contribute to the B-criterion of SSD, the new diagnosis carries some risk of prematurely diagnosing patients with SSD when the actual pathology may rather be related to an anxiety or depressive disorder, leading to unfavorable consequences for therapy. For *DSM-IV* somatoform disorders, meta-analytic evidence affirms large overlap of somatization, depression, and anxiety, but also the existence of distinct single syndromes [47]. The same seems to apply to our sample and SSD, since about half, but not all patients with SSD had another psychiatric comorbidity. Thus, SSD does not serve merely an umbrella category of all psychiatric illnesses that occur in relation to VD. Existing studies in the area

of DSM-IV somatoform disorders may suffer from a lack of transferability of their findings to SSD. So, Häuser et al. [15] found that nearly all patients with SSD also fulfilled the criteria of an anxiety or depressive disorder. However, our findings suggest that this most extensive overlap may not apply to all sorts of (functional) somatic symptoms.

4.2. Strengths and limitations

In contrast to previous investigations conducted in psychosomatic inpatient settings [15–17], we observed a large sample of outpatients presenting in a specialized tertiary care setting, offering the highest possible standards of neurological examination and including patients with a wide range of VD syndromes. As patients who present in tertiary care are previously treated by medical practitioners of various fields in secondary care, a selection bias in our investigation can be assumed because only patients who do not sufficiently benefit from secondary care are referred to tertiary care. The psychometric assessment was conducted by trained clinical staff with the use of the gold-standard methods of that time (i.e. SCID-I) and covered only diagnoses after *DSM-IV*; the decision regarding a diagnosis of *DSM-5* SSD had to be made retrospectively. A particular strength of our study is our operationalization of the B-criterion through the three scales WI, CABAH, and SAIB; this is an improvement compared to previous studies that only applied the WI to assess the B-criterion while not paying attention to the differentiation of the three components. Nevertheless, it remains uncertain how valid our operationalization of SSD, which is based on single subscales of psychometric tests, was. For the affective component in particular it is desirable to be able to use a scale that measures affective states in direct relation to a somatic symptom so as to guarantee a somatoform diagnosis would indeed be more appropriate than e.g. a depressive or anxiety disorder. To our knowledge there is no scale to date that meets this requirement for affective states in particular; however, a recently developed short version of the Health Attitude Survey [HAS; 48] may be appropriate to assess the psychological factors of *DSM-5* more reliably. Further, the Somatic Symptom Disorder – B Criteria Scale [SSD-12; 49], an instrument to assess the psychological features of *DSM-5* SSD, is currently being developed and will potentially improve the operationalization of the B-criterion.

5. Conclusion

Our findings point out that SSD is considerably prevalent in patients with VD and often, but not always, occurs comorbid with other psychiatric conditions such as anxiety and depression. Thus, it seems worthwhile to further investigate the overlap of those disorders as this may help to better define the diagnostic criteria of SSD. The classification of severity of SSD based on the number of psychological symptoms may assist in finding suitable treatment options according to the current clinical practice guidelines [35]. Future research on all three components of the B-criterion in medical settings other than the neurological setting is needed; for this it is desirable to assess *DSM-5* SSD based on clinicians' ratings instead of self-report measures. Longitudinal investigations, e.g. on the prediction of treatment outcome with consideration of the definition of the B-criterion or on the course of the disorder and the associated impairment over time are also required.

Conflict of interest

The authors have no competing interests to report.

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Appendix B

Study 2: Course and predictors of DSM-5 somatic symptom disorder in patients with vertigo and dizziness symptoms - A longitudinal study

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Course and predictors of DSM-5 somatic symptom disorder in patients with vertigo and dizziness symptoms – A longitudinal study

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Abstract

Background: Somatic symptom disorder (SSD) is a diagnosis that was newly included in *DSM-5*. Currently, data on the course of SSD are largely lacking. The present study aimed to evaluate the natural course of SSD in a one-year follow-up study in patients with vertigo and dizziness (VD) symptoms.
Methods: We investigated $n = 239$ outpatients presenting in a tertiary care neurological setting over a one-year period. Patients had a medical examination at baseline and completed self-report questionnaires, which were re-assessed after 12 months. *DSM-5* SSD was assigned retrospectively. We evaluated the prevalence of SSD at baseline and 12-month follow-up and investigated predictors of the persistence of SSD during the study period.
Results: The prevalence rate of SSD was 36% at baseline and 62% at 12-months follow-up. The persistence rate of SSD was 82% and the incidence rate was high, leading to a markedly increased prevalence rate at follow-up. Risk factors for persistent SSD were a self-concept of bodily weakness (OR: 1.52, 95% CI: 1.30–1.78) and an increase of depression during the study period (OR: 1.11, 95% CI: 1.02–1.22). Further, the diagnosis of an anxiety disorder (OR: 7.52, 95% CI: 1.17–48.23) or both anxiety and depressive disorder (OR: 23.14, 95% CI: 2.14–249.91) at baseline were significant predictors.
Conclusions: Our findings point out that SSD is highly prevalent in patients with VD symptoms, the incidence of the disorder widely outweighs its remission. Potential predictors of a persistence of SSD are discussed and can be chosen as a focus in therapy.
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1. Introduction

Somatic symptom disorder (SSD) is a new diagnosis defined in *DSM-5*[1] that has replaced various diagnoses subsumed under the category 'somatoform disorders' in *DSM-IV*[2]. A major change of SSD is that both patients with medically explainable and medically unexplainable (i.e., structural and functional) symptoms can be considered for the diagnosis as long as they fulfill the B-criterion of SSD, which includes psychological impairment on the affective, cognitive, or behavioral level in relation to the symptoms [1].

Regarding somatoform disorders of *DSM-IV*, several studies investigated them on a longitudinal base. Gureje and Simon [3] examined the persistence of somatoform disorders in a large sample of primary care patients over a 12-months-period and found them to be moderately stable (in about 46% of patients), with self-rated poor health and occupational disability being associated with a higher risk of persisting somatoform disorders; similar findings occurred in a previous study by Speckens et al. [4], authors identified female gender and a high symptom count as predictors. Lieb et al. [5] investigated the natural course of somatoform disorders in adolescents and young adults and also found

Abbreviations: DSM, Diagnostic and Statistical Manual of Mental Disorders; SSD, somatic symptom disorder; VD, vertigo and dizziness; BDS, bodily distress syndrome; SCID, Structured Clinical Interview for DSM Disorders; PHQ, Patient Health Questionnaire; VHQ, Vertigo Handicap Questionnaire; WI, Whiteley Index; CABAH, Cognitions about Body and Health Questionnaire; SAIB, Scale for the Assessment of Illness Behavior; BDI, Beck Depression Inventory; BAI, Beck Anxiety Inventory.

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somatoform disorders to be relatively stable over around three years; variables such as female gender, substance abuse, anxiety and depressive disorders, and traumatic events contributed to a higher risk of a new onset of somatoform disorders. Similar findings emerged when Budtz-Lilly [6] examined bodily distress syndrome (BDS) in primary care patients, a diagnosis that integrates somatoform disorders and functional syndromes [7]: about half of the patients had persistent BDS over a 2-year period of time. A systematic review on the course and prognosis of functional symptoms [8] identified a more optimistic view as between half and three quarters of patients with functional symptoms improve over the study period, however, about one quarter of patients deteriorated. Interestingly, they did not find evidence for psychiatric comorbidities influencing the course of functional symptoms. Instead, the authors identified the number of symptoms and the seriousness of the condition as a whole at baseline as having potential prognostic value. This particular finding is in line with findings of a high somatic symptom count at baseline being associated significantly with a higher risk of subsequent functional somatic syndromes, lower quality of life (QoL), and psychopathology [9–11].

Due to the novelty of SSD, longitudinal studies on this diagnosis are rare; consequently, there has been a recent call for more longitudinal research in the context of SSD [12]. Voigt et al. [13,14] investigated the predictive validity of SSD, particularly of the components of the B-criterion in a sample of psychosomatic inpatients. The following psychological symptoms appeared to be valid criteria to predict the functional outcome: health anxiety, cognitive aspects (i.e., cognitions about bodily weakness, intolerance of bodily complaints, and health habits), and behavioral aspects (i.e. illness behavior and body scanning). Klaus et al. [15] also found that the psychological criteria of SSD (the B-criterion), i.e. affective, cognitive and/or behavioral features (body checking, catastrophizing of physical sensations, a self-concept of bodily weakness, negative affectivity, and avoidance behavior) are strong predictors of the medium- and long-term occurrence of somatoform disorders.

Taken together, several studies have examined predictors of the functional outcome in the context of somatoform disorders or SSD in different settings. While the number of somatic symptoms at baseline, and the components of the B-criterion, i.e., high levels of hypochondriasis or health anxiety and cognitive and behavioral features were consistently found to have predictive value regarding the functional outcome, the prognostic role of psychiatric comorbidities such as depression and anxiety is unclear.

Previous prospective investigations on SSD have in common that they focused on patients with functional symptoms. To our knowledge, studies on populations with physical symptoms including both those with structural and functional origin do not yet exist. Thus, it is unclear whether the predictors stated above are equally relevant for both patient groups. Since a first investigation in patients with vertigo and dizziness (VD) symptoms has found prevalence rates of SSD of more than 50% and only slight agreement between *DSM-IV* somatoform disorders and *DSM-5* SSD [16], it seems worthwhile to investigate the course of SSD and its predictors in this patient group. VD symptoms are usually severely distressing [17] and frequently presented [18]. Although there are multiple structural causes for VD symptoms, the symptoms are of a functional origin in a substantial part of patients, namely in around 20% [19], meaning that investigating the diagnosis of SSD in a sample of patients with VD allows integrating findings toward both patients with structural and functional symptoms.

1.1. Aims and hypotheses

In light of these findings, the current study aimed to investigate the natural course of SSD in a tertiary care sample of patients with VD symptoms. Firstly, we evaluated the prevalence, persistence, incidence, and remission of SSD over time; secondly, we compared groups of patients who persistently or never had SSD during the study period as well as those with remission or incidence of SSD. Finally, we investigated regression models predicting the persistence of SSD. Based on theoretical considerations derived from the literature, we expected that a high number of symptoms presented at baseline, the B-criterion of SSD (affective aspects/health anxiety, cognitive aspects, and behavioral aspects), the amount of depression and anxiety symptoms along with the change on those variables between baseline and follow-up, and comorbid psychiatric disorders would serve as predictors of persistent SSD.

2. Material and methods

2.1. Participants

The study was conducted as part of the "Munich Diagnostic and Predictor Study of Somatoform Dizziness" [20], full details of the sampling procedure and neurological and psychological assessments at baseline have been described elsewhere [19]. Patients were recruited at the German Centre for Vertigo and Balance Disorders at the University Hospital Munich, Campus Großhadern, between May 2010 and June 2012. A total of 860 eligible patients were approached, 687 of those gave their informed consent at baseline (T0) and were contacted again at 12-month follow-up (T1). Due to incomplete baseline clinical interviews for psychiatric disorder and dropouts over time, we could include a total of $n = 239$ cases with assessments at baseline and 12-month follow-up in the current study. Single missing data at follow-up were estimated using a multiple imputation approach, as described below.

2.2. Assessment

2.2.1. Baseline assessment

All patients underwent physical examination by medical experts at the German Centre for Vertigo and Balance

Disorders including complete neurological, neuro-otological, and neuro-ophthalmological examination. This included the measurements of the subjective visual vertical and ocular torsion for vestibular testing as well as video-oculography with caloric irrigation. The neurologists made a clinical diagnosis based on the results of testing and the established diagnostic criteria for the different vestibular disorders [21]. More details on the neurological assessment are provided elsewhere [16]. Clinical staff (a clinical psychologist and trained medical or psychology students in their final year under clinical supervision) conducted a structured clinical interview via SCID-I, the gold standard of this time to assess patients' psychiatric disorders according to the *DSM-IV*[22].

Further, patients completed a number of self-report questionnaires. The following instruments were relevant to the current study: We used the Patient Health Questionnaire-15 [23] to identify kind and number of somatic symptoms. The Vertigo Handicap Questionnaire [VHQ; 24,25] served to measure impairment caused by vertigo and dizziness (vertigo-related handicap). Illness anxiety was assessed via the Whiteley Index [WI; 26]. Cognitive factors regarding bodily sensations were assessed with the Cognitions about Body and Health Questionnaire [CABAH; 27] with its subscales Catastrophizing Cognitions, Intolerance of Bodily Complaints, Bodily Weakness, Autonomic Sensations, and Health Habits. Aspects of illness behavior were measured by the Scale for the Assessment of Illness Behavior [SAIB; 28] with three of its five subscales Medication/Treatment, Consequences of Illness, and Scanning. Lower scores on the subscales are associated with more illness behavior. The Beck Depression Inventory-II [BDI-II; 29] and the Beck Anxiety Inventory [BAI; 30] were applied to assess the severity of depression and anxiety, respectively.

2.2.2. Follow-up assessment

Patients completed a set of self-report follow-up questionnaires 12 months after baseline assessment. For the current study, relevant questionnaires at follow-up were PHQ-15, VHQ, WI, CABAH, BDI, and BAI. There were no systematic treatments, however, participants were free to follow any treatment suggestions they were given. Thus, this study presents the natural course of patients initially presenting with vertigo and dizziness over a one-year period.

2.2.3. Assessment of DSM-5 SSD

The assessment of SSD is described in full detail elsewhere [16]. We used the PHQ-15 to assess criterion A (one or more very disruptive somatic symptoms). We decided to assess the B-criterion of SSD based on the affective and cognitive component only because we previously found a low specificity of the behavioral component as it was fulfilled in almost all patients (88%) [16]. We applied the WI for the affective component and the CABAH subscales Autonomic Sensations and Bodily Weakness for the cognitive component. For criterion C (rate of chronicity), the symptoms had to be present for at least six months.

2.3. Statistical analysis

The statistical analysis was conducted using SPSS 22.0 [31]. We used descriptive statistics to summarize sample characteristics (including group comparisons to investigate differences between patients with complete data and dropouts) and to investigate the prevalence of the diagnosis of SSD over time. We formed groups regarding the prevalence of SSD over time (persistence, remission, incidence, and never SSD group) and conducted analysis of variance (ANOVA) with post-hoc tests to compare selected groups on continuous variables and chi^2-tests for comparisons on categorical variables. We used multivariable logistic regression analyses controlling for age, gender, and baseline vertigo-related handicap to identify predictors of the persistence of SSD during the study period. To conduct the regression analyses, we formed a dichotomous variable for 'persistent SSD' (coded 1) vs. all other groups (coded 0).

Prior to analysis, data screening revealed between 15% and 20% missing data on single relevant variables within the study sample of $n = 239$ patients. Multiple imputations were implemented as follows: First, a sensitivity analysis was conducted to investigate whether patients with and without missing data differed in order to decide whether data were "missing at random". Patients with missing data were younger than those with complete data (mean age 52.4 vs. 57.0, $F = 4.39$, $p = 0.04$), with consequences for the generalizability of the results. Apart from this, the assumption of "missing at random" for missing data was not rejected. Finally, the multiple imputation algorithm in SPSS 22 was applied in order to get an estimate of single missing data in concerned patients [32].

3. Results

A flow diagram depicting the participant flow and reasons for dropout is shown in Fig. 1; sociodemographic and medical characteristics of the sample ($n = 239$) and the dropout group ($n = 448$) along with group comparisons on relevant variables are presented in Table 1. Study sample and dropout group differed only regarding age (with the study sample being significantly older) and marital status (with a higher proportion of the study sample being married). In the neurological diagnostic workup, a total of 157 patients (65.7%) of the study sample were diagnosed with a purely structural type of vertigo, for the remaining 82 patients (34.3%), the VD symptoms were not at all or not fully explained by a structural dysfunction, thus they were classified by the neurologists as having functional vertigo or a functional component. About a quarter of patients received more than one diagnosis, thus 292 diagnoses were given overall. Of those, $n = 82$ (28.1%) were functional VD, $n = 210$ (72.0%) included a structural dysfunction.

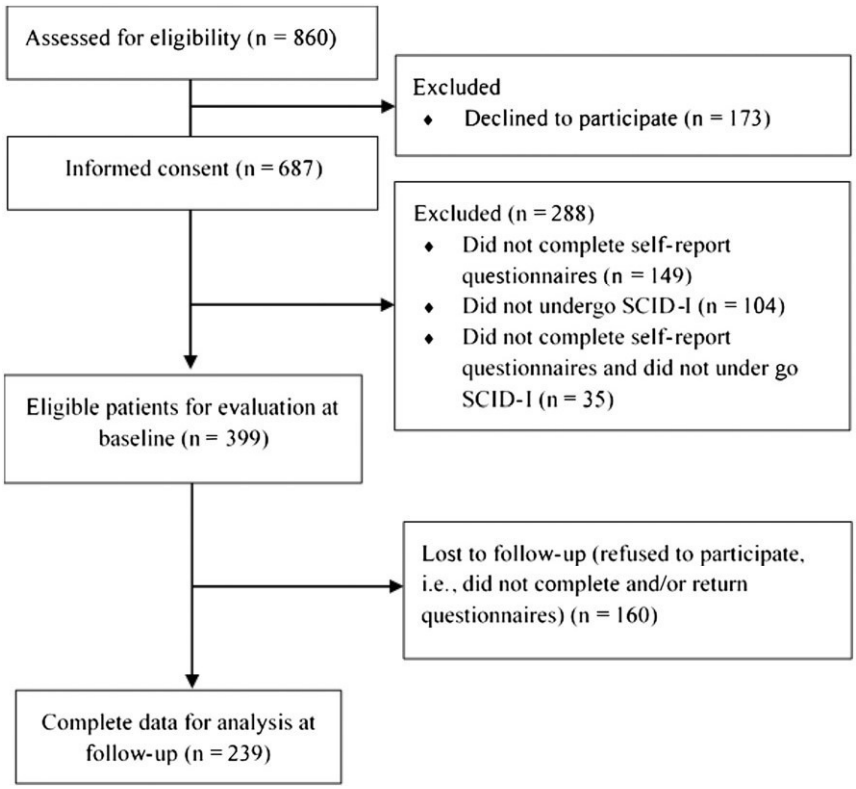

Fig. 1. Flow diagram of the formation of the study sample, including number of and reasons for dropout.

Of all participants, $n = 87$ (36%) fulfilled the diagnosis of SSD at baseline and $n = 147$ (62%) at follow-up. The prevalence and overlap of the SSD diagnosis is presented in Table 2. A total of $n = 16$ out of 87 patients with SSD at baseline had a remission of SSD during the study period (remission rate 18%); $n = 71$ of those 87 patients fulfilled the diagnosis at follow-up, too (persistence rate 82%). $N = 76$ out of 152 patients with VD symptoms but no SSD at baseline had a new onset of SSD (incidence rate 50%). $N = 76$ (32%) of all patients never fulfilled SSD during the study period.

For those with a new onset of SSD, most changes that led to the new diagnosis appeared in criterion B: $n = 55$ (45%) of all patients who did not fulfill the cognitive component at baseline had it fulfilled at 12-month follow-up, $n = 41$ (23%) of patients newly fulfilled the affective component at follow-up (data not shown).

3.1. Comparison of patients with SSD at baseline and/or 12-month follow-up

A comparison of the observed groups is presented in Table 3. The overall differences between the groups were significant for all investigated continuous variables at baseline except for the cognitive aspect Illness Behavior (CABAH) and the behavioral aspects Verification of Diagnosis and Scanning (SAIB) (data not shown). There were no significant differences between incidence and remission group on continuous variables. The persistence group was significantly older, presented with significantly higher vertigo-related handicap, lower physical QoL, more physical symptoms, higher illness anxiety, cognitive, and behavioral distress at baseline compared to the incidence group. Further, the persistence group presented with a significantly higher cognitive impairment regarding Catastrophizing (CABAH) compared to the remission group; no further differences between those groups were significant. The group who never fulfilled SSD at both time points presented with a significantly lower vertigo-related handicap, significantly higher physical and mental QoL, fewer vertigo symptoms, a significantly smaller degree of somatization, significantly lower illness anxiety, cognitive and behavioral impairment, and lower scores regarding depression and anxiety compared to persistence and incidence group.

Moreover, the groups differed significantly regarding gender (with the incidence group presenting with the highest proportion of female patients), psychiatric comorbidity rates, particularly the rates of comorbid depressive and anxiety disorders, and psychotherapeutic treatment. The remission group had the highest rates of psychiatric comorbidities in general and anxiety disorders in particular at baseline. The persistence group presented with the highest rates of psychotherapeutic treatment.

Table 1
Sociodemographic and medical characteristics of the study sample and the dropout group at baseline.

	Study sample (n = 239)	Dropout group (n = 448)	X^2 or T
Variable			
Age, M (SD)	57.8 (15.2)	52.24 (16.42)	$T = -3.9$***
Female gender, n (%)	137 (57.3)	264 (58.9)	$X^2 = 0.1$
Marital status (n % married)	159 (66.5)	163 (36.4)	$X^2 = 9.0$*
Education			$X^2 = 8.6$
9th grade or less, n (%)	104 (43.5)	107 (23.9)	
10th grade, n (%)	75 (31.4)	85 (19.0)	
High school graduate, n (%)	17 (7.1)	38 (8.5)	
University graduate, n (%)	39 (16.3)	44 (9.8)	
Information not available, n (%)	4 (1.7)	0 (0)	
Any psychiatric diagnosis (DSM-IV), n (%)	77 (32.2)	179 (40.0)	$X^2 = 0.06$
Affective disorder, n (%)	34 (14.2)	70 (15.6)	$X^2 = 0.09$
Anxiety disorder, n (%)	57 (23.8)	134 (29.9)	$X^2 = 2.3$
Somatoform disorder, n (%)	52 (21.8)	123 (27.5)	$X^2 = 3.8$
Neurological diagnoses			
Functional VD symptoms	82 (28.1)	182 (40.6)	$X^2 = 2.8$
Vestibular paroxysmia, n (%)	15 (5.1)	35 (7.8)	$X^2 = 0.51$
Vestibular migraine, n (%)	32 (11.0)	85 (19.0)	$X^2 = 3.9$
Multisensory deficit, n (%)	19 (6.5)	32 (7.1)	$X^2 = 0.04$
Benign paroxysmal positional vertigo, n (%)	43 (14.7)	68 (9.6)	$X^2 = 1.0$
Central vertigo, n (%)	19 (6.5)	30 (6.7)	$X^2 = 0.40$
Meniere's disease, n (%)	44 (15.0)	57 (12.7)	$X^2 = 4.2$
Vestibular neuritis, n (%)	12 (4.1)	22 (4.9)	$X^2 = 0.01$
Bilateral Vestibulopathy, n (%)	26 (9.0)	35 (7.8)	$X^2 = 1.9$
Psychopathology			
Vertigo-related handicap (VHQ), M (SD)	42.2 (18.0)	43.9 (17.4)	$T = 1.05$
Depression (BDI-II), M (SD)	11.5 (8.7)	11.5 (8.2)	$T = 0.08$
Anxiety (BAI), M (SD)	13.4 (9.8)	13.7 (9.6)	$T = 0.28$
Somatization (PHQ-15), M (SD)	9.6 (4.8)	9.9 (5.1)	$T = 0.68$
Illness Anxiety (WI), M (SD)	4.2 (3.0)	4.5 (3.3)	$T = 0.97$
Catastrophizing (CABAH), M (SD)	13.8 (6.9)	13.3 (6.4)	$T = -0.78$
Bodily Weakness (CABAH), M (SD)	7.0 (3.9)	7.4 (3.8)	$T = 1.14$
Intolerance of Bodily Complaints (CABAH), M (SD)	4.3 (2.3)	4.3 (2.3)	$T = 0.21$
Illness Behavior (CABAH), M (SD)	5.7 (1.7)	5.7 (1.9)	$T = 0.27$
Consequences of Illness (SAIB), M (SD)	14.0 (2.9)	14.1 (2.8)	$T = 0.14$
Scanning (SAIB), M (SD)	11.3 (2.6)	11.2 (2.5)	$T = -0.50$

Multiple psychiatric and neurologic diagnoses were allowed if indicated. DSM = Diagnostic and Statistical Manual of Mental Disorders; PHQ = Patient Health Questionnaire; VHQ = Vertigo Handicap Questionnaire; WI = Whiteley Index; CABAH = Cognitions about Body and Health Questionnaire; SAIB = Scale for the Assessment of Illness Behavior, BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory.

* $p < 0.05$,

*** $p < 0.001$.

3.2. Prediction of persistent SSD during the study period

We conducted multivariable logistic regression analyses to test a model of predictors of persistent SSD; results are presented in Table 4. We implemented additional logistic regression analyses to investigate predictors of remission and incidence of SSD during the study period. However, since none of the potential predictor variables were found to significantly influence remission or incidence of SSD, those analyses are not depicted here and we focused on the group who persistently fulfilled SSD.

In model 1, we only included the control variables age and gender, in model 2, vertigo-related handicap was added as a control variable; model 3 also included the number of somatic symptoms as predictors; model 4 additionally evaluated the components of the B-criterion of SSD. Regarding the cognitive and behavioral component of the B-criterion, since the respective scales (CABAH and SAIB) include numerous subscales, we chose relevant subscales for the regression analyses based on the results of the ANOVA, i.e., we investigated variables for which the differences of the

Table 2
Prevalence and overlap of SSD at the two time points (n = 239).

		SSD at T1		
		Yes	No	Sum
SSD at T0	Yes	71	16	87
	No	76	76	152
	Sum	147	92	239

SSD = DSM-5 somatic symptom disorder, T0 = baseline, T1 = 12-month follow-up.

Table 3
Group differences between four groups of patients depending on whether they fulfill the diagnosis of SSD at T0 and/or T1 or not (n = 239).

Continuous variables	*DSM-5* SSD-diagnosis at T0 and T1				ANOVA				
					Post-hoc pairwise comparisons between groups; *p*-values				
	Persistence group (SSD at T0 and T1) (*n* = 71)	Remission group (SSD at T0, not at T1) (*n* = 16)	Incidence group (no SSD at T0, but at T1) (*n* = 76)	Never SSD (no SSD at T0 and T1) (*n* = 76)	'Remission group' vs. 'incidence group'	'Persistence group' vs. 'incidence group'	'Persistence group' vs. 'remission group'	'Persistence group' vs. 'never SSD'	'never SSD' vs. 'incidence group'
Age, *M* (*SD*)	62.25 (14.36)	55.38 (15.66)	55.55 (16.55)	56.29 (13.89)	.85	.01	.18	.02	.80
VHQ sum score, *M* (*SD*)	50.24 (15.66)	47.12 (17.57)	44.65 (17.56)	31.62 (15.59)	.81	**.04**	.31	**<0.001**	**<0.001**
Number of reported symptoms on the PHQ-15, *M* (*SD*)	3.87 (2.37)	2.78 (2.05)	2.45 (2.41)	1.52 (1.49)	0.43	**<0.001**	0.21	**<0.001**	0.25
WI sum score, *M* (*SD*)	5.73 (2.48)	4.88 (3.24)	4.68 (2.85)	2.22 (2.21)	0.12	**<0.001**	0.62	**<0.001**	**<0.001**
CABAH Catastrophizing, M (SD)	16.77 (6.51)	13.84 (8.40)	13.02 (6.38)	11.83 (6.58)	0.11	**<0.001**	**<0.001**	**<0.001**	**<0.001**
CABAH Bodily Weakness, *M* (*SD*)	10.42 (2.94)	7.62 (3.52)	6.62 (3.37)	4.20 (2.54)	0.64	**0.02**	0.32	**<0.001**	**<0.001**
CABAH Intolerance of Bodily Complaints, *M* (*SD*)	5.16 (1.90)	4.26 (2.34)	3.96 (2.13)	3.88 (2.47)	0.43	**<0.001**	0.21	**<0.001**	0.25
CABAH Illness Behavior, *M* (*SD*)	5.68 (1.64)	5.16 (2.23)	5.62 (1.63)	5.69 (1.75)	0.41	0.79	0.51	0.88	0.90
SAIB Consequences of Illness, *M* (*SD*)	12.61 (2.73)	13.35 (3.08)	13.70 (2.91)	15.65 (2.18)	0.34	**0.03**	0.66	**<0.001**	**<0.001**
SAIB Scanning, *M* (*SD*)	10.67 (2.65)	11.24 (2.63)	11.28 (2.55)	11.90 (2.51)	0.57	0.20	0.83	**0.01**	0.18
BDI sum score, *M* (*SD*)	15.26 (9.72)	12.63 (8.97)	13.26 (8.34)	6.35 (5.07)	0.91	0.12	0.28	**<0.001**	**<0.001**
BAI sum score, *M* (*SD*)	17.21 (9.85)	15.92 (10.26)	14.65 (9.78)	7.76 (6.22)	0.73	0.25	0.72	**<0.001**	**<0.001**

In case of significant group effects, pairwise comparisons as depicted above were drawn. P-values printed in bold mark significant group differences on the 95- or 99%-level.

Categorical variables	Persistence group	Remission group	Incidence group	Never SSD	Chi-square
Female, n (%)	34 (48)	8 (50)	56 (74)	39 (51)	12.3*
Patients with functional VD symptoms, n (%)	16 (23)	6 (38)	33 (43)	25 (33)	7.3
Duration longer than 2 years at baseline, n (%)	36 (51)	6 (38)	22 (42)	26 (41)	2.4
Comorbid psychiatric disorder (DSM-IV), n (%)	28 (49)	9 (64)	26 (41)	14 (23)	12.7**
Comorbid affective disorder (DSM-IV), n (%)	16 (28)	0 (0)	11 (17)	7 (11)	8.8*
Comorbid anxiety disorder (DSM-IV), n (%)	18 (32)	9 (64)	22 (35)	8 (13)	16.5**
Ever received psychotherapeutic treatment, n (%)	30 (42)	6 (38)	21 (28)	13 (17)	16.0*

Percentages refer to the proportion of patients within the corresponding group, not within the whole sample. Due to missing data in SCID-I interviews and missing treatment data, the referring sample sizes differ slightly amongst each other. DSM-5 - Diagnostic and Statistical Manual of Mental Disorders (5th ed.), DSM-IV - Diagnostic and Statistical Manual of Mental Disorders (4th ed.), SSD – DSM-5 somatic symptom disorder.

The upper part of the table presents a comparison of the groups on continuous variables (one-way ANOVA); the lower part presents a comparison of the groups on categorical variables at baseline.

* $p < 0.05$,

** $p < 0.01$

Table 4
Hierarchical logistic regression analyses to predict persistent SSD during the study period.

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Predictor at baseline	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Step 1												
Age	1.03**	1.01–1.05	1.04**	1.01–1.06	1.04**	1.01–1.06	1.03*	1.00–1.07	1.03*	1.00–1.07	1.01	0.98–1.05
Gender (male)	0.63	0.36–1.13	0.43*	0.23–0.82	0.43*	0.22–0.83	0.74	0.33–1.66	0.81	0.36–1.84	0.88	0.32–2.39
Step 2												
Vertigo-related handicap (VHQ)			1.05***	1.03–1.07	1.04**	1.01–1.06	1.01	0.98–1.04	1.01	0.98–1.04	1.01	0.97–1.04
Step 3												
Nr. of somatic symptoms					1.30**	1.12–1.52	1.20	1.00–1.45	1.30*	1.04–1.64	1.24	0.93–1.65
Step 4												
Affective aspect – illness anxiety (WI)							1.08	0.92–1.26	1.10	0.93–1.30	1.07	0.87–1.31
Cognitive Aspects (CABAH)												
Catastrophizing							0.97	0.90–1.05	0.96	0.89–1.04	0.94	0.86–1.03
Bodily Weakness							1.50***	1.29–1.75	1.51***	1.29–1.77	1.71***	1.37–2.14
Intolerance of Bodily Complaints							1.06	0.83–1.36	1.08	0.83–1.40	1.10	0.80–1.50
Behavioral aspects (SAIB)												
Consequences of Illness							1.03	0.86–1.22	1.03	0.86–1.24	1.01	0.81–1.25
Scanning							0.98	0.81–1.20	0.99	0.81–1.20	0.96	0.76–1.21
Step 5												
Depression (BDI-II)									1.01	0.95–1.08	1.03	0.94–1.12
Change in depression from baseline to follow-up (BDI-II)									1.07	1.00–1.15	1.11*	1.02–1.22
Anxiety (BAI)									0.96	0.90–1.03	0.96	0.88–1.05
Step 6												
Anxiety Disorder (SCID-I)											7.52*	1.17–48.23
Depressive Disorder (SCID-I)											6.00	0.88–41.00
Anxiety and Depressive Disorder (SCID-I)											23.14*	2.14–249.91
Other Psychiatric Disorders (SCID-I)											6.90	0.66–72.79
Nagelkerke R^2	0.07		0.07		0.29		0.51		0.54		0.60	

Gender was captured as a dichotomous variable with female as a reference category, psychiatric disorders (SCID-I) were coded as a dummy-coded variable with 'no diagnosis' as a reference category.
* $p < 0.05$,
** $p < 0.01$,
*** $p < 0.001$.

group comparison between persistence and the other groups were significant and sufficiently large. In model 5, we added depression and anxiety (the sum scores of BDI and BAI) as predictors. In this regard, we first investigated the change on these scales between baseline and follow-up and found significant differences for the BDI (M $(SD)_{\text{baseline}}$: 14.8 (9.3), M $(SD)_{\text{follow-up}}$: 16.8 (8.7), $T = -3.1$, $df = 86$, $p < 0.01$). Changes on BAI were not significant (M $(SD)_{\text{baseline}}$: 17.9 (10.5), M $(SD)_{\text{follow-up}}$: 18.4 (10.6), $T = -0.5$, $df = 86$, $p = 0.60$). Thus, we included the change of depression measured by the difference of the BDI scores as a predictor variable along with the baseline scores of both measures. Finally, in model 6, the psychiatric comorbidities (SCID-I) were entered as a dummy-coded variable.

In models 1 to 5, age turned out to have a significant effect (e.g. model 5: OR: 1.03, 95% CI [1.00–1.07]), pointing out that older age is associated with a higher risk of persistent SSD. In model 3 and 5, the symptom count played an important role as an increase of one symptom was associated with a 30% higher risk of persistent SSD (e.g. model 5: OR: 1.30, 95% CI [1.04–1.64.]. In the final model, which explained most variance ($R^2 = 0.60$), the cognitive aspect of a self-concept of bodily weakness, an increase in depression during the study period and the diagnosis of an anxiety disorder or both anxiety and depressive disorder served as significant predictors of persistent SSD. For example, a one point gain on the scale Bodily Weakness was associated with a 71% higher risk of persistent SSD; an increase of depression of one point was associated with an 11% higher risk. The influence of comorbid psychiatric disorders was associated with a particularly elevated risk of persistent SSD compared to having no psychiatric comorbidity. The severity of depression and anxiety alone did not have additional predictive value.

4. Discussion

4.1. Findings and implications

We investigated the natural course of SSD in a large tertiary care sample of patients with VD over a one-year period. The high prevalence of SSD in our sample supports the diagnosis as being relevant to patients with VD. There is evidence for a high risk of chronicity of SSD in patients with VD symptoms as the vast majority of our sample who had the diagnosis at baseline persistently fulfilled the criteria. The persistence rate of SSD in our sample was even higher compared to previous findings on somatoform disorders [3,5] and considerably higher compared to findings on affective and anxiety disorders [33]. These rates point out that the factual medical treatment might be delivered in an unsatisfying manner, even after a thorough examination and appropriate referrals to further medical or psychosomatic treatment in a specialized tertiary care setting. This is in line with findings on functional VD [34] that found the functional VD symptoms themselves and the associated emotional distress to take a chronic course over 3 years. Thus, adequate treatment for mental health issues in relation to VD symptoms seems not to be routine, although there is first evidence that psychotherapeutic options may be effective in patients with VD [35–37].

In line with findings on somatization [5], patients with a new incidence of SSD were more frequently female compared to all other groups and, in accordance with meta-analytic evidence on functional symptoms [8], had lower mental quality of life at baseline compared to the remission group. Those with persistence of SSD were older and more impaired on all three components of the B-criterion compared to the other groups. The incidence group was more impaired on all three components at baseline compared to those who never had SSD. These findings may support the B-criterion as having value for predicting outcome (i.e., presence of SSD), however, in this case one would also expect clearer differences between other groups (i.e., incidence vs. remission, persistence vs. remission).

Interestingly, the remission group had the highest comorbidity rates, particularly for anxiety disorders. Anxiety disorders often are underlying psychopathologies of VD symptoms [38–40] and there are well-established psychotherapeutic treatment approaches for anxiety disorders [41]. Thus, an explanation for this finding may be that the patients with anxiety disorders underlying their vertigo symptoms may have been referred to suitable treatment (i.e., psychotherapy) more frequently than those with functional VD symptoms without a more distinct psychiatric diagnosis. If the underlying pathology was treated, the functional VD symptoms and thus the SSD diagnosis may have faded, too. As we assigned SSD retrospectively, we were unable to give treatment recommendations based on this diagnosis.

The persistence group presented with the highest psychotherapeutic treatment rates at baseline, potentially indicating an increased degree of suffering from symptoms and/or psychological strain. It may also point out that those with persistent SSD have already been psychologically impaired previously and thus may be more prone to remain in a state of persistent SSD.

A central aim of the present study was to investigate a regression model to predict the persistence of SSD. First, in accordance with previous investigations on functional somatic symptoms and syndromes that found more somatic symptoms to be associated with higher symptom severity [9–11], higher symptom count was associated with a higher risk of persistently fulfilling SSD. Second, we could partly confirm our hypothesis that psychological variables would serve as predictors of the persistence of SSD; the cognitive aspect of having a concept of bodily weakness was a significant predictor. This is partly in accordance with former studies which found that dysfunctional cognitive aspects are predictive of somatoform disorders in the general population [15] and within patients with VD [42]. However, we could not confirm the role of affective and behavioral aspects as proposed by previous authors [13–15]. The findings toward the affective aspect of illness anxiety were

unexpected as, next to its previously shown predictive role for the functional outcome, there also is previous evidence for illness anxiety differentiating between patients with somatoform disorders and other disorders like depression or anxiety [43]. Our findings for the behavioral component, which did not serve as a predictor in the multivariable regression analyses, can be seen in line with a seemingly low specificity of this component for the diagnosis of SSD [16].

Regarding the predictive role of psychopathology, i.e. depression and anxiety symptoms, and common comorbid psychiatric disorders, there were different findings: although the groups significantly differed in this aspect, the predictive role of baseline depression and anxiety symptom severity was not confirmed in the multivariable regression analyses. Interestingly, however, an increase of depression symptom severity over the study period had predictive value; this influence of depression is in line with findings that depression often occurs comorbid with VD symptoms [19,39,44–46], a change in depression may also influence the amount of impairment experienced due to a bodily symptom. Further and more specific to VD patients, findings of previous psychiatric disorders influencing the amount of impairment caused by a vestibular dysfunction exist [47]. Other authors have found an association in a different direction: They observed the intensity of vestibular deficits as one factor leading to the development of reactive psychiatric disorders or exacerbating existing psychiatric conditions [48]. Both those findings lead to the assumption that common psychiatric disorders such as depression and anxiety may also play a predictive role in SSD; this was confirmed in the final model of our regression analyses that explained 60% of the variance (although a depressive disorder at baseline alone did not have predictive value). This finding may indicate that depression and anxiety disorders are somehow intertwined with SSD and are in accordance with conclusions by Häuser et al. [49] who studied patients with fibromyalgia. They found that the vast majority of patients with SSD also fulfilled the criteria of a depressive disorder and thus questioned the need for a distinct diagnostic category of SSD. In contrast, in the context of *DSM-IV* there is evidence for somatoform disorders being a distinct diagnostic entity [50], meta-analytic evidence also confirmed somatoform disorders as a distinct syndrome category [51]. It is important to note that the predictive role of comorbid depression and anxiety disorders in our sample may be sample-specific since high comorbidity rates between these disorders and VD have been found [19]. To the authors' knowledge, studies on the overlap of SSD and other syndromes are rare, thus, further prospective studies should focus on the potentially dynamic and intertwined processes between different diagnostic entities, i.e., SSD and other psychiatric/mental conditions.

4.2. Strengths and limitations

Our sample that combines both patients with structural and functional causes of their complaints is relevant for investigating SSD and in this regard different from previous study samples that included patients characterized by the somewhat fuzzy term "medically unexplained symptoms" [e.g., 13,14,52]. The data cannot be easily transferred to the general population, since the referral to a tertiary care unit might be a relevant selection bias, e.g. selection of more severe or seldom cases. The psychometric assessment was conducted by trained clinical staff with the use of the recent gold-standard methods of that time (i.e. SCID-I), which obviously cover only diagnoses after *DSM-IV*; *DSM-5* SSD had to be assigned retrospectively. Our operationalization of the B-criterion through the affective and cognitive component is a strength of our study and differs from previous investigations who only used the affective component to define the B-criterion. We chose to not apply the behavioral component because we had previously found a low specificity of this component in the same sample; this can be seen controversially as it may have led to an underestimated number of diagnoses. The responding patients probably were not fully representative for the patients' group of interest; external validity may be limited since younger patients tended not to respond. In addition to this, we had a limited number of complete data at follow-up. Further, the study period of 12 months may have been too short to fully understand factors that may have led to the presented (co-)morbidities. Also, we did not consider characteristic features of the different structural pathologies underlying the VD symptoms, although it has been shown previously that patients with different structural pathologies differ in their psychiatric comorbidity [19]. It is not fully clear that the scales we did use were appropriate for the operationalization or the diagnostic criteria. For future studies it will be worthwhile to use the Somatic Symptom Disorder – B Criteria Scale [SSD-12; 53], an instrument to assess the psychological features of *DSM-5* SSD which is currently being developed and will potentially improve the operationalization of the B-criterion.

4.3. Conclusion

Our findings provide evidence that the diagnosis of SSD seems to be highly relevant to be considered in patients presenting with VD symptoms in tertiary care; the low remission, high incidence, and high persistence rates point out that there is a high risk of chronicity. Various psychological aspects may serve as predictors of the persistence of SSD over time, the cognitive aspect of having a self-concept of bodily weakness may be especially relevant here. Comorbid psychiatric disorders, particularly depression and anxiety disorders, may also be important to predict the maintenance of SSD, although it is important to note that this point needs further investigation. Findings reveal that there is urgent need to refer patients with SSD to more adequate (psychotherapeutic) treatment as this currently may not be the case on a regular level.

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Title: Course and predictors of DSM-5 somatic symptom disorder in patients with vertigo and dizziness symptoms – A longitudinal study

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Appendix C

Study 3: Potential effects of multimodal psychosomatic inpatient treatment for patients with functional vertigo and dizziness symptoms - A pilot trial

Limburg, K., Schmid-Mühlbauer, G., Sattel, H., Dinkel, A., Radziej, K., Gonzales, M., Ronel, J., & Lahmann, C. (2018). Potential effects of multimodal psychosomatic inpatient treatment for patients with functional vertigo and dizziness symptoms - A pilot trial. *Psychology and Psychotherapy: Theory, Research and Practice*. Epub ahead of print. https://doi.org/10.1111/papt.12177

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Potential effects of multimodal psychosomatic inpatient treatment for patients with functional vertigo and dizziness symptoms – A pilot trial

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Objectives. Functional vertigo and dizziness (VD) are frequent and severely distressing complaints that are often described as hard to treat. Our aim was to provide preliminary data on potential effects of multimodal psychosomatic inpatient therapy for patients with functional VD symptoms in reducing vertigo-related handicap and related psychopathology, and to evaluate the role of symptom burden and body-related locus of control in predicting vertigo-related handicap at follow-up.

Design. We conducted an uncontrolled clinical pilot trial.

Methods. We included data of $n = 72$ inpatients with functional VD as a primary symptom and various psychopathological and/or physical comorbidities admitted for multimodal psychosomatic inpatient treatment. Patients completed self-report questionnaires assessing vertigo-related handicap (VHQ), somatization (PHQ-15), depression (BDI-II), anxiety (BAI), health-related quality of life (HRQOL; SF-36), and body-related locus of control (KLC) at admission (T0), discharge (T1), and 6 months after discharge (T2).

Results. We observed medium effects for the change of vertigo-related handicap (T0–T1: $g = -0.60$, T0–T2: $g = -0.67$) and small effects for the change of somatization (T0–T1: $g = -0.29$, T0–T2: $g = -0.24$), mental HRQOL (T0–T1: $g = 0.43$, T0–T2: $g = 0.49$), and depression (T0–T1: $g = -0.41$, T0–T2: $g = -0.28$) from admission to discharge and admission to follow-up. Body-related locus of control did not predict vertigo-related handicap at follow-up.

Conclusions. Findings provide preliminary evidence for the beneficial role of psychosomatic inpatient treatment for patients with functional VD symptoms. Potentially relevant predictors of outcome at follow-up are discussed.

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Practitioner points

- The change of vertigo-related handicap and related variables through multimodal psychosomatic inpatient treatment was evaluated in a clinical pilot trial in patients with functional vertigo and dizziness.
- We observed medium effects for the change of vertigo-related handicap and small effects for the change of somatization, mental health-related quality of life, and depression.
- Internal body-related locus of control at admission did not predict vertigo-related handicap at follow-up.

Vertigo and dizziness (VD) are highly prevalent symptoms (Neuhauser, 2009). VD symptoms can occur due to several organic pathologies, after an organic pathology has faded, or without an organic cause; that is, they can be of functional origin (Dieterich & Staab, 2017). Regardless of their aetiology, VD symptoms are usually severely distressing and interfere with patients' every day and working life (Eckhardt-Henn, Tschan, Best, & Dieterich, 2009). It has been shown that they often occur comorbid with mental disorders, most prevalent diagnoses are somatoform, depressive, and anxiety disorders (Best, Eckhardt-Henn, Tschan, & Dieterich, 2009; Lahmann *et al.*, 2015). In addition, the diagnosis of a somatic symptom disorder (SSD) which has been defined in DSM-5 is highly prevalent and persistent (Limburg, Sattel, Radziej, & Lahmann, 2016; Limburg *et al.*, 2017).

A systematic review provided some preliminary evidence that outpatient cognitive-behavioural psychotherapy (CBT) may be effective in reducing vertigo-related handicap; however, the review was unable to determine the long-term efficacy of these interventions since follow-up evaluations were and still are rare (Schmid, Henningsen, Dieterich, Sattel, & Lahmann, 2011). CBT has also been proven effective in specific somatoform disorders and functional complaints such as irritable bowel syndrome, fibromyalgia, or chronic fatigue syndrome (Henningsen, Zipfel, Sattel, & Creed, 2018). In addition, there is some evidence that psychodynamic interpersonal therapy can reduce somatization and improve physical quality of life (Sattel *et al.*, 2012). To investigate the efficacy of the intervention in patients with VD symptoms, a similar treatment programme that has been tailored to these patients and common comorbid psychopathologies is currently being evaluated (Radziej, Schmid-Mühlbauer, Limburg, & Lahmann, 2017).

Although outpatient treatment has been shown to be effective, under certain circumstances inpatient treatment may be preferred. Factors such as insufficient improvement in outpatient psychotherapy, severe somatic or psychological comorbidity, severely limited psychosocial functioning (e.g., long-lasting inability to work or major conflicts at home), and/or severe biographical stressors can be indicators to refer patients with functional symptoms such as VD to psychosomatic inpatient treatment (Lahmann, Henningsen, Noll-Hussong, & Dinkel, 2010; Schaefert *et al.*, 2012). Of note, this form of treatment currently is specific to the German health care system, findings regarding its effectiveness may however be of general relevance. Psychosomatic inpatient therapy applies a biopsychosocial approach to treating illness and as such goes beyond what is known as 'medical rehabilitation' in other countries. It has been described in more detail by Linden (2014). Regarding multimodal psychosomatic inpatient therapy, findings of a study in patients with long-lasting VD symptoms suggest effectiveness of an integrated approach including psychotherapy as well as vestibular and balance training (Schaaf & Hesse, 2015); the latter has been shown to be a useful intervention for interoceptive exposure training to feared sensations, that is, VD symptoms (Staab, 2011). Otherwise, evaluations of multimodal psychosomatic inpatient treatment for patients with persistent VD symptoms are rare, although this form of treatment is recommended by the current

German clinical practice guideline for patients with severely impairing and chronic functional symptoms (Schaefert *et al.*, 2012).

Next to evaluating treatment effectiveness, it is of interest to identify factors which contribute to improvement or rather, which factors may hinder improvement. In psychosomatic inpatient treatment of somatoform disorders, psychological symptoms such as intolerance of bodily complaints, health habits, and somatic attribution have been shown to be predictive of physical functioning at 12-month follow-up (Voigt *et al.*, 2013).

Regarding the development and/or maintenance of somatoform disorders or functional complaints, established predictors are female gender (Lieb *et al.*, 2002; Speckens, Van Hemert, Bolk, Rooijmans, & Hengeveld, 1996), high physical symptom count (olde Hartman *et al.*, 2009; Tomenson *et al.*, 2013), self-reported psychological distress (Jørgensen, Fink, & Olesen, 2000), alexithymia, that is, a deficit in perceiving and expressing emotional states, and/or impaired affect regulation (e.g., Duddu, Isaac, & Chaturvedi, 2003; Probst, Sattel, Henningsen, Gundel, & Lahmann, 2017; Waller & Scheidt, 2004). Further, internal body-related locus of control has been found to be related with bodily well-being (Albani *et al.*, 2007), whereas external (or uncontrollable) illness attributions such as vulnerability or organic causes have been associated with somatoform disorders, more illness behaviour, and thus a higher somatic symptom burden (Rief, Nanke, Emmerich, Bender, & Zech, 2004). Despite its association with somatoform disorders, to our current knowledge, body-related locus of control has not been investigated regarding its role in predicting somatoform disorders and/or treatment outcome yet. Since a high somatic symptom burden is an established predictor of somatoform disorders, it would be worthwhile to evaluate the predictive role of both somatic symptom burden and body-related locus of control to identify whether an internal locus of control would still be beneficial despite a high symptom burden.

Aims and hypotheses

The present study aimed to provide preliminary data on potential effects of a multimodal psychosomatic inpatient treatment programme for patients suffering from functional VD symptoms and comorbid psychiatric and somatic pathologies in reducing vertigo-related handicap as the primary outcome, vertigo symptom severity, comorbid psychopathology, and enhancing health-related quality of life (HRQOL). The second aim was to evaluate whether somatic and psychopathologic symptom burden and body-related locus of control are predictors of improvement of vertigo-related handicap.

Methods

Participants

All patients with functional VD as a main complaint who were admitted for inpatient treatment at the Department for Psychosomatic Medicine and Psychotherapy of the Technical University of Munich, Germany, between 2012 and 2016 were eligible. Prior to admission, patients were examined by a psychosomatic specialist and a clinical interview was carried out. Psychiatric diagnoses were assessed after the classification system ICD-10 (World Health Organization, 2013). Physical diagnostics were assessed by specialized physicians. It was evaluated whether all medical examinations necessary to decide whether the complaints were of a functional origin had been carried out. If examinations were incomplete, patients were transferred to appropriate specialists prior to admission,

for example to the German Centre for Vertigo and Balance Disorders. Patients were referred to our department from primary care, secondary care (e.g., neurologist), or tertiary care (i.e., the German Centre for Vertigo and Balance Disorders). Contraindications were severe psychiatric conditions (i.e., psychosis, addiction disorders, severe or acute suicidal tendencies) or severe cognitive impairments such as dementia, and insufficient German language abilities. All patients were seen in the outpatient department first. Those patients with an indication for inpatient treatment were contacted via telephone during the waiting period prior to admission and informed about the study. Thereafter, informed consent was obtained. During the course of the study, patients were asked to complete a set of self-report questionnaires at admission (T0), discharge (T1), and 6-month follow-up (T2). Single missing data at follow-up were estimated using a multiple imputation approach, as described below. The study was approved by the ethical committee of the medical faculty of the Technical University of Munich. The principles of the Declaration of Helsinki and the GCP Guidelines were followed.

Psychosomatic inpatient treatment

Psychosomatic inpatient treatment usually is multimodal and multidisciplinary, with a clear focus on psychotherapeutic interventions and not comparable to inpatient psychiatric treatment. The type of psychotherapeutic treatment applied varies considerably between the different hospitals in Germany. Hospitals offer psychodynamic, cognitive-behavioural, or specialized concepts, or they may combine several approaches in an integrative way. In case of a psychodynamic treatment model, psychodynamic principles of structural psychopathology are often applied (Cierpka, Grande, Rudolf, von der Tann, & Stasch, 2007; Westen, Gabbard, & Blagov, 2006); that is, patients are treated according to their level of personality structure while aiming at reducing their psychopathological symptomatology.

In our study, patients were treated according to a psychodynamic approach, taking levels of personality structure into account. The average duration of treatment in our department is 40 days, and the patients included in the current study were treated on average for 43.2 (SD = 16.0) days. In addition to medical-somatic treatment, patients received psychotherapeutic one-on-one sessions (2 × 50 min per week), group psychotherapy (2 × 75 min per week), and patient-centred nursing as standard therapeutic elements. Aside from that, there are further interventions that are tailored to each patient in terms of therapeutic focus, dosage and frequency. These interventions include body-psychotherapeutic treatment, counselling from a social worker, art therapy, patient education, and physiotherapeutic interventions. It is important to note that interventions do not only focus on the vertigo complaints, but take into account the broader context in which a patient's symptoms appear. This is in line with current clinical practice guidelines that recommend multimodal treatment for patients with severe functional symptoms (Schaefert *et al.*, 2012). The treatment is based on a biopsychosocial perspective. Therefore, treatment aims at targeting the complaints from all three perspectives, that is by establishing medical diagnostics and taking necessary steps, changing feelings, behaviours, and thoughts regarding the complaints as well as considering and – if necessary – amending a patient's social circumstances. Since the treatment is not manualized, contents can vary depending on each patient's specific pathology, comorbidities, and circumstances. All in all, treatment of patients with functional VD therefore differed only slightly from psychosomatic inpatient treatment for patients with

different disorders. For example, patients with VD received more vertigo-specific physiotherapy. Hence, specific needs of patients with functional VD were able to be addressed and the programme can be considered feasible in the context of psychosomatic inpatient treatment. To maintain treatment fidelity, there were regular team meetings, clinical supervision sessions, and ward rounds. In terms of acceptability, patients' treatment satisfaction and subjective treatment success have been rated high (Hertle, 2016).

Assessment

Self-report questionnaires

Patients completed a set of self-report questionnaires at baseline, discharge, and 6-month follow-up either at home or in the hospital. The following instruments were applied: The Vertigo Handicap Questionnaire (VHQ; Tschan *et al.*, 2010; Yardley, Masson, Verschuur, Haacke, & Luxon, 1992; Yardley & Putman, 1992) was used to measure physical and psychosocial handicap caused by VD which was defined as the primary outcome. It consists of 45 items rated on 5-point Likert scales and allows to calculate a sum score over all items to get an index of vertigo-related handicap. Higher scores indicate larger handicap. The German version of the VHQ has been proven to be internally consistent (Cronbach's α: .92; Tschan *et al.*, 2010). In our sample, we observed $\alpha = .93$.

The following measures were applied to assess secondary outcomes: We used the Vertigo Symptom Scale (VSS; Tschan *et al.*, 2008; Yardley *et al.*, 1992) to capture the subjective vertigo severity and related anxiety. It consists of 34 items rated on 5-point Likert scales that are used to establish two subscale sum scores representing a Vertigo (VER) Scale and an Autonomic Arousal (AA) Scale, the latter representing vertigo-related anxiety expressed by autonomic arousal. Higher scores on the scales indicate higher impairment regarding the two aspects. Both scales of the German version of the VSS are internally consistent (Cronbach's α: VER: .79, AA: .89; Tschan *et al.*, 2008); in our sample, we observed $\alpha = .89$ for VER and $\alpha = .90$ for AA.

The sum score of the Patient Health Questionnaire-15 (PHQ-15; Gräfe, Zipfel, Herzog, & Löwe, 2004; Kroenke, Spitzer, & Williams, 2002) was applied to establish an index of somatization. It consists of 15 items in total: 13 of those assess bodily symptoms regarding their severity and two items assess depressive symptoms regarding their prevalence on a 3-point scale. The German version has been shown to have an internal consistency of $\alpha = .79–.88$ (Gräfe *et al.*, 2004); in our sample, we found $\alpha = .83$.

We administered the Short Form Health Survey (SF-36; Bellach, Ellert, & Radoschewski, 2000; Ware, Kosinski, & Keller, 1996) to assess physical and mental HRQOL. The SF-36 consists of eight subscales representing physical functioning, physical role functioning (capturing role limitations due to physical health problems), bodily pain, general health perceptions, vitality, social functioning, emotional role functioning (capturing role limitations due to emotional health problems), and mental health. The *z*-scores of the subscale scores are then multiplied with a regression coefficient for a physical or mental factor, respectively, and added. Internal consistency has been estimated at $\alpha = .94$ for the physical factor and $\alpha = .89$ for the mental factor (Gandek, Sinclair, Kosinski, & Ware, 2004); in our sample, we observed $\alpha = .87$ and $\alpha = .88$ for the respective factors.

The sum scores of the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996; Hautzinger, Keller, & Kühner, 2006) and the Beck Anxiety Inventory (BAI; Beck & Steer, 1990; Margraf, Beck, & Ehlers, 2007) were used to measure the severity of

depression and anxiety, respectively. Both BDI-II and BAI consist of 21 items that can be rated from 0 to 3. For the BDI-II, sum scores of 14–19 indicate mild depression, 20–28 indicate moderate depression, and scores of 29–63 indicate severe depression. For the BAI, sum scores of 10–16 indicate mild anxiety, 17–29 indicate moderate anxiety, and 30–63 indicate severe anxiety. In terms of internal consistency, we found $\alpha = .92$ and $\alpha = .93$ for BDI and BAI, respectively, in our sample.

All previously mentioned scales have been used in intervention studies before. For example, VHQ, VSS, and PHQ have been applied by Tschan *et al.* (2012), the SF-36 has been used by Sattel *et al.* (2012), the BDI-II has been implemented by Kleinstäuber, Lambert, and Hiller (2017), and the BAI was used in studies included in a meta-analysis by Cuijpers *et al.* (2016) to assess differences on the corresponding outcomes before and after therapy. Thus, sufficient sensitivity to change can be assumed for the measures we applied to assess treatment effects.

The Body-Related Locus of Control questionnaire (KLC; Albani *et al.*, 2007; Mrazek, 1989) with its two subscales covering internal and external body-related locus of control was applied to assess the two corresponding dimensions. Body-related locus of control refers to the concept of whether a person perceives that he or she has control over bodily symptoms (internal locus of control) or interprets the symptoms as by chance or due to outer influences that cannot be controlled by the person him-/herself (external locus of control). The KLC has been developed in German and consists of 18 items rated on 5-point Likert scales, and the two subscales are built by adding the scores of their nine corresponding items. The scales have been tested in two large norm samples (Albani *et al.*, 2007; Mrazek, 1989) and shown to be internally consistent (Cronbach's $\alpha = .83$ for external locus of control, .82 for internal locus of control; Albani *et al.*, 2007). In our sample, we found $\alpha = .84$ for external and $\alpha = .85$ for internal Locus of Control.

Statistical analysis

Statistical analyses were conducted using SPSS 23.0 (IBM Corp., Armonk, NY, USA) statistical package. Prior to analysis, data screening revealed between 15% and 20% missing data on single relevant variables within the study sample of $n = 72$ patients. Thus, multiple imputation was applied to get an estimate of single missing data in concerned patients (Lüdtke, Robitzsch, Trautwein, & Köller, 2007) by using the multiple imputation algorithm in SPSS 23.0. The algorithm imputes five datasets; all following analyses are conducted on each of these datasets. The results of these analyses are then pooled and as such depicted below.

We utilized descriptive statistics to evaluate sample characteristics including psychiatric and somatic diagnoses. We applied multivariate analyses of variance (MANOVA) with repeated measurements to assess treatment effects across baseline, discharge and follow-up. We used Hedges' g as an effect size measure for the differences between time points. Effect sizes were interpreted as follows: small effect if $0.2 \leq |g| < 0.5$, medium effect if $0.5 \leq |g| < 0.8$, large effect if $|g| > 0.8$ (Cohen, 1988). In addition, according to Angst, Aeschlimann, and Angst (2017), an effect size between 0.30 and 0.50 was considered as being minimally clinically important. The minimal clinically important difference (MCID) is a parameter that assists in deciding whether a difference in symptom intensity is subjectively perceivable for a patient and thus clinically meaningful (Angst *et al.*, 2017). Hierarchical linear regression analyses were conducted to analyse regression models predicting the primary outcome, vertigo-related handicap, at 6-month follow-up. We tested three models altogether, each model including the control variables

age, gender, and vertigo-related handicap at baseline. In addition to the control variables, Model 2 also contained the numbers of psychiatric and somatic diagnoses as indicators of psychopathological and somatic symptom burden. In Model 3, we added internal locus of control and external locus of control as predictors.

Results

A total of 98 patients gave their informed consent prior to admission to inpatient treatment. Due to admission cancellations and incomplete return of questionnaires, we obtained 72 complete datasets at admission (T0), discharge (T1), and 6-month follow-up (T2). A diagram of the patient flow and reasons for dropout is depicted in Figure 1. Sociodemographic and medical characteristics of the sample (n = 72) along with a sensitivity analysis comparing study sample and dropout group are presented in Table 1. Study sample and dropout group differed significantly regarding education with the dropout group being more highly educated. Otherwise, there were no significant differences. Patients of the study sample presented with an average of 2.4 (SD = 0.8, range: 1–4) psychiatric and 2.5 (SD = 1.8, range: 0–4) somatic diagnoses, the most prevalent primary psychopathological conditions were somatoform disorders (88.9%), and the most prevalent somatic diagnoses were diseases of the inner ear and vestibular organ (20.5%).

Effectiveness of intervention

A comparison of handicap and psychopathology measures across the time points is depicted in Table 2. On average, patients presented with clinically relevant impairment

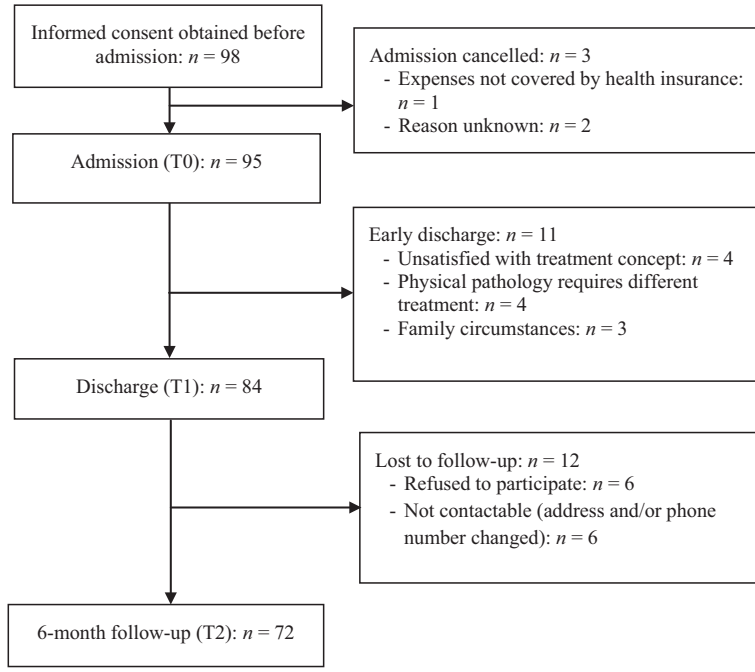

Figure 1. Flow diagram of the formation of the study sample.

Table 1. Sociodemographic and medical characteristics of the study sample ($n = 72$) and sensitivity analysis with the dropout sample on relevant variables

Variable	Study sample ($n = 72$)	Dropout group ($n = 26$)	X^2 or T
Age, *M* (*SD*)	49.0 (14.9)	50.9 (15.3)	$T = -0.5$
Male gender, *n* (%)	38 (52.8)	12 (46.2)	$X^2 = 0.4$
Marital status (*n*, % married)	31 (43.1)	12 (46.2)	$X^2 = 0.1$*
Education			
9th grade or less, *n* (%)	29 (40.3)	3 (11.5)	$X^2 = 6.4$*
10th grade, *n* (%)	24 (33.3)	9 (34.6)	
High school graduate, *n* (%)	4 (5.6)	2 (7.7)	
University graduate, *n* (%)	11 (15.3)	7 (26.9)	
Information not available, *n* (%)	4 (5.6)	5 (19.3)	
Psychopathology			
Vertigo-related handicap (VHQ), *M* (*SD*)	54.03 (18.05)	52.7 (19.8)	$T = 0.3$
Vertigo severity (VSS-VER)	22.33 (16.59)	20.0 (8.7)	$T = 0.8$
Autonomic Arousal (VSS-AA)	23.22 (13.04)	27.7 (10.5)	$T = -1.2$
Somatization (PHQ-15), *M* (*SD*)	12.62 (5.42)	13.1 (4.0)	$T = -0.3$
Physical Quality of Life (SF-36)	37.98 (9.18)	39.1 (12.6)	$T = -0.5$
Mental Quality of Life (SF-36)	36.16 (12.31)	34.4 (11.6)	$T = 0.5$
Depression (BDI-II), *M* (*SD*)	16.81 (11.13)	20.6 (8.7)	$T = -1.4$
Anxiety (BAI), *M* (*SD*)	18.57 (11.44)	21.7 (10.6)	$T = -1.0$
Duration of inpatient treatment in days, *M* (*SD*)	43.2 (16.0)		
Number of psychiatric diagnoses, *M* (*SD*)	2.4 (0.8)		
Number of somatic diagnoses, *M* (*SD*)	2.5 (1.8)		
Main psychiatric diagnosis (ICD-10), *n* (%)			
Somatoform disorder, *n* (%)	64 (88.9)		
Dissociative disorder, *n* (%)	3 (4.2)		
Affective disorder, *n* (%)	3 (4.2)		
Anxiety disorder, *n* (%)	2 (2.8)		
Secondary psychiatric diagnoses (ICD-10)			
Somatoform disorder, *n* (%)	17 (17.8)		
Dissociative disorder, *n* (%)	1 (1.0)		
Affective disorder, *n* (%)	52 (54.2)		
Anxiety disorder, *n* (%)	13 (13.5)		
Substance use disorder, *n* (%)	7 (7.3)		
Post-traumatic stress syndromes, *n* (%)	2 (2.1)		
Obsessive-compulsive disorder, *n* (%)	2 (2.1)		
Eating disorder, *n* (%)	1 (1.0)		
Other, *n* (%)	1 (1.0)		
Somatic diagnoses			
Diseases of the ear and vestibular organ, *n* (%)	36 (20.5)		
Cardiovascular diseases, *n* (%)	27 (15.3)		
Blood diseases, *n* (%)	2 (1.1)		
Disorders of the nervous system, *n* (%)	14 (8.0)		
Endocrine diseases, *n* (%)	35 (19.9)		
Diseases of the eye, *n* (%)	9 (5.1)		
Diseases of the digestive system, *n* (%)	16 (9.1)		
Respiratory diseases, *n* (%)	5 (2.8)		

Continued

Table 1. (*Continued*)

Variable	Study sample (n = 72)	Dropout group (n = 26)	X^2 or T
Diseases of the skin, *n* (%)	3 (1.7)		
Diseases of the urogenital system, *n* (%)	7 (4.0)		
Diseases of the musculoskeletal system, *n* (%)	15 (8.5)		
Others, *n* (%)	7 (4.0)		

Notes. Multiple secondary psychiatric and somatic diagnoses were allowed if indicated.
BAI = Beck Anxiety Inventory; BDI-II = Beck Depression Inventory-II; PHQ-15 = Patient Health Questionnaire-15; SF-36 = Short Form Health Survey-36; VHQ = Vertigo Handicap Questionnaire; VSS = Vertigo Symptom Scale.
*$p < .05$.

on all psychopathology and handicap measures at baseline. The primary outcome vertigo-related handicap significantly decreased during the study period, and effect sizes (Hedges' g) were medium, $M\,(SD)_{T0} = 54.03\,(18.05)$, $M\,(SD)_{T1} = 43.23\,(20.89)$, $M\,(SD)_{T2} = 41.89\,(20.66)$, Hedges' $g_{T0\text{-}T1} = -0.60$***, $g_{T0\text{-}T2} = -0.67$***). Thus, the change of vertigo-related handicap can be considered as being clinically important. The secondary outcomes somatization and the severity of depression symptoms also significantly decreased while mental quality of life significantly increased during the study period. Effect sizes were small for the change of somatization, mental HRQOL, and depression from admission to discharge and admission to follow-up. Effect sizes were above 0.3 and thus minimally clinically important for the increase in mental HRQOL and the decrease in depression. Changes in vertigo severity, physical quality of life, and anxiety were not significant.

Prediction of vertigo-related handicap at follow-up

Hierarchical linear regression analyses showed that vertigo-related handicap at admission was the only significant predictor of vertigo-related handicap at follow-up in all models. All other investigated predictors did not have significant predictive value. The final Model 3 explained approximately the same amount of variance as Model 1, indicating that additional predictors (number of psychiatric and somatic diagnoses, internal and external body-related locus of control) did not add predictive value beyond the control variables included in Model 1 (see Table 3). The same analyses were conducted for vertigo-related handicap at discharge as a dependent variable. Results were similar; that is, vertigo-related handicap at admission was the only significant predictor.

Discussion

Findings and implications

In the present pilot trial, we investigated potential effects of a multimodal psychosomatic inpatient treatment programme for patients with functional VD symptoms reporting high somatic and psychopathological symptom burden in reducing vertigo-related handicap, vertigo severity, and related psychopathology and improving HRQOL during the time of

Table 2. Means and standard deviations of all outcome measures at all time points, results of the ANOVA, and effect sizes

	M (*SD*)			ANOVA/*t*-test			Effect sizes (Hedges' *g*)	
Variable	T0	T1	T2	*F*	*df*	*p*	T0–T1	T0–T2
Vertigo-related handicap (VHQ)	54.03 (18.05)	43.23 (20.89)	41.89 (20.66)	15.5	2	<.001	−0.60***	−0.67***
Vertigo severity (VSS-VER)	22.33 (16.59)	20.46 (14.00)	19.20 (16.37)	1.23	2	.30	−0.11	−0.18
Autonomic avrousal (VSS-AA)	23.22 (13.04)	22.22 (12.41)	21.35 (10.30)	1.22	2	.30	−0.08	−0.14
Somatization (PHQ-15)	12.62 (5.42)	11.06 (6.00)	11.30 (6.17)	4.05	2	.04	−0.29***	−0.24**
Physical quality of life (SF-36)	37.98 (9.18)	39.65 (10.27)	39.73 (12.16)	1.47	2	.26	0.18	0.19
Mental quality of life (SF-36)	36.16 (12.31)	41.44 (13.73)	42.18 (14.27)	6.77	2	<.01	0.43*	0.49**
Depression (BDI-II)	16.81 (11.13)	12.23 (10.94)	13.70 (11.30)	5.89	2	<.01	−0.41**	−0.28
Anxiety (BAI)	18.57 (11.44)	15.95 (12.78)	15.82 (11.57)	3.31	2	.06	−0.23	−0.24

Notes. BAI = Beck Anxiety Inventory; BDI-II = Beck Depression Inventory-II; PHQ-15 = Patient Health Questionnaire-15, SF-36 = Short Form Health Survey-36; T0 = Baseline, T1 = at discharge, T2 = 6-month follow-up; VHQ = Vertigo Handicap Questionnaire; VSS = Vertigo Symptom Scale.
*$p < .05$; **$p < .01$; ***$p < .001$.

Table 3. Hierarchical linear regression analyses to predict vertigo-related handicap at 6-month follow-up (VHQ at T2) controlling for sociodemographic variables and baseline vertigo-related handicap

	Model 1				Model 2				Model 3			
	B	*SE* of *B*	β	*p*	*B*	*SE* of *B*	β	*p*	*B*	*SE* of *B*	β	*p*
Step 1												
Constant	10.14	13.73		.47	8.58	17.23		.63	18.07	26.68		.51
Age	0.13	0.17	.10	.46	0.13	0.20	.10	.51	0.09	0.19	.07	.65
Gender	−6.24	5.30	−.13	.24	−6.31	5.27	−.13	.23	−6.26	5.18	−.13	.23
Vertigo-related handicap at baseline (VHQ)	0.55	0.16	.48	<.001	0.54	0.15	.47	<.001	0.48	0.16	.43	<.001
Step 2												
Number of psychiatric diagnoses					1.12	4.50	.04	.81	0.70	4.59	.02	.88
Number of somatic diagnoses					−0.14	1.60	.00	.93	−0.29	1.67	−.02	.86
Step 3												
Internal body-related locus of control (KLC)									−5.11	4.36	−.16	.24
External body-related locus of control (KLC)									5.00	5.30	.16	.36
R^2		.21				.19				.21		

Note. VHQ = Vertigo Handicap Questionnaire; KLC = Body-Related Locus of Control Questionnaire.

psychosomatic admission and at 6-month follow-up. We observed medium and clinically important effects regarding vertigo-related handicap, while effects in improving somatization, mental quality of life, and depression were small and only partly clinically important. Improvements remained stable beyond the time of inpatient treatment until 6-month follow-up. Levels of depression remained constant during follow-up. To our knowledge, no previous study evaluating psychosomatic inpatient treatment for patients with functional VD symptoms exists. In comparison with outpatient psychotherapeutic treatment, our effects in reducing vertigo-related handicap, depression, and anxiety both from admission to discharge and follow-up are larger than those observed in a systematic review by Schmid *et al.* (2011) who found medium effects (Cohen's $d = 0.46$) for vertigo-related handicap and no significant effects for depression and for anxiety. Effects are also larger than those observed by Tschan *et al.* (2012) who examined outpatient CBT with a 12-month follow-up and observed very small effect sizes for reducing handicap and non-significant effects for anxiety, depression, and somatization. Similar to our findings, Tschan *et al.* as well observed a very small reduction in vertigo symptom severity measured with the VSS.

Compared to effects observed in previous evaluations of psychosomatic inpatient treatment programmes for patients with various disorders (Wunner, Reichhart, Strauss, & Sollner, 2014) and somatoform pain (Pieh *et al.*, 2014) who found medium to large effects for depression, our observed effects in reducing depression are smaller. Regarding somatization, our effects are similar to those found by Wunner *et al.* (2014). Effects for depression and anxiety were also smaller compared to a study evaluating an inpatient treatment programme for patients with VD symptoms of various underlying structural, that is organic, causes (Schaaf & Hesse, 2015). In addition, our effects were slightly smaller compared to a meta-analysis of psychotherapeutic inpatient treatment that found overall medium effects in reducing handicap parameters (Liebherz & Rabung, 2013). The fact that our study brought up smaller improvements than previous studies in patients with different psychosomatic disorders may indicate that patients with functional VD symptoms as a main complaint represent a severely impaired patient group. This is also shown by the high number of comorbidities and high baseline psychopathology scores. Further, our patients had very small and non-significant reductions of vertigo symptom severity. This aspect is in accordance with studies describing VD as a chronic condition that is hard to treat (Dieterich & Staab, 2017).

Regarding our second aim, investigating body-related locus of control along with somatic and psychiatric symptom burden as predictors of improvement of vertigo-related handicap, our regression analyses demonstrated that none of the investigated variables had predictive value beyond the control variables. This was unexpected since internal locus of control has been discussed as advantageous in various contexts (Fresson, Dardenne, Geurten, & Meulemans, 2017; Goldzweig, Hasson-Ohayon, Alon, & Shalit, 2016; Rizza *et al.*, 2017). Further, patients with somatoform disorders and functional symptoms have been found to present with more maladaptive illness perceptions compared to patients with physical symptoms and no somatoform disorder; low personal control has been linked to higher health care use in patients with somatoform disorders (Frostholm, Petrie, Ørnbøl, & Fink, 2014). Baseline psychopathological and somatic symptom burden, that is the number of comorbidities, also did not prove to be influencing improvement. Hence, psychosomatic inpatient treatment can be beneficial even for severely suffering patients with a high symptom burden. One has to keep in mind, though, that effects are in the medium or small to

medium range; thus, our provided treatment may be a first important step in initiating improvement; to maintain the effects, additional outpatient psychotherapy probably is needed. To further investigate predictors of improvement in psychosomatic inpatient treatment of patients with VD, it would be worthwhile to evaluate the role of other established predictors. For example, previous authors found health anxiety and health-related cognitions to be predictive of physical functioning of psychosomatic inpatients at follow-up (Voigt *et al.*, 2013); those factors may be relevant in patients with functional VD, too.

Strengths and limitations

To our knowledge, this is one of the first studies investigating multimodal psychosomatic inpatient therapy for patients with severely impairing and persistent functional VD symptoms. Our sample includes patients with various comorbid conditions. Due to this naturalistic setting, the external validity of our findings is high. We investigated the change in a range of outcome variables and observed consistent and lasting improvement; however, effect sizes were mostly medium or small. Limitations include the fact that we did not apply a randomized controlled study setting. Therefore, we are unable to draw causal conclusions due to our study design. Although a waitlist control group would have been an option, considering the high baseline psychopathology levels of our patients, it seemed problematic to implement a control group that does not receive treatment at all. Despite this major limitation, we believe that the results of this pilot trial still contribute meaningful evidence. As stated above, VD symptoms often take a chronic course (Dieterich & Staab, 2017; Limburg *et al.*, 2017) and as such, it is not to be expected that they improve due to their natural course in a relatively short period of time of 40 days. Consequently, it can likely be assumed that the treatment did have effects on the symptom reduction that was observed in our analysis. Nevertheless, to be able to draw more substantial or causal conclusions on whether the treatment led to symptom change, future controlled studies are necessary. Hence, the current study can be considered a pilot trial that requires further investigations to verify our findings. Furthermore, although a variety of administered therapeutic interventions (e.g., group and one-on-one psychotherapy) are part of the standard therapy programme, the multimodal treatment approach of our clinic includes that the therapeutic programme is individually compiled towards the needs of each patient. In addition, long-term psychosomatic inpatient treatment is still rather specific to the national German health care system. This aspect limits the generalizability of our findings. Another limitation is that all our outcome measures were self-report questionnaires and may hence limit the interpretability of our findings.

Conclusion

Our findings point out that a multimodal psychosomatic inpatient treatment for patients with functional VD symptoms may be beneficial in reducing vertigo-related handicap and related aspects of psychopathology. The expected role of internal body-related locus of control in predicting improvement could not be confirmed. Other variables such as health anxiety or health-related cognitions may be more relevant predictors.

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