Digital Collaborative Documentation in Mental Healthcare

Dissertation

zur Erlangung des akademischen Grades
des Doktors der Naturwissenschaften (Dr. rer. nat.)
in der Wissenschaftsdisziplin
Medizinische Informatik

eingereicht an der
Fakultät für Digital Engineering
der Universität Potsdam

von

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Potsdam, Oktober 2019

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Published online at the
Institutional Repository of the University of Potsdam:
https://doi.org/10.25932/publishup-44029
https://nbn-resolving.org/urn:nbn:de:kobv:517-opus4-440292

Abstract

With the growth of information technology, patient attitudes are shifting – away from passively receiving care towards actively taking responsibility for their well-being. Handling doctor-patient relationships collaboratively and providing patients access to their health information are crucial steps in empowering patients. In mental healthcare, the implicit consensus amongst practitioners has been that sharing medical records with patients may have an unpredictable, harmful impact on clinical practice. In order to involve patients more actively in mental healthcare processes, Tele-Board MED (TBM) allows for digital collaborative documentation in therapist-patient sessions. The TBM software system offers a whiteboard-inspired graphical user interface that allows therapist and patient to jointly take notes during the treatment session. Furthermore, it provides features to automatically reuse the digital treatment session notes for the creation of treatment session summaries and clinical case reports. This thesis presents the development of the TBM system and evaluates its effects on 1) the fulfillment of the therapist's duties of clinical case documentation, 2) patient engagement in care processes, and 3) the therapist-patient relationship. Following the design research methodology, TBM was developed and tested in multiple evaluation studies in the domains of cognitive behavioral psychotherapy and addiction care. The results show that therapists are likely to use TBM with patients if they have a technology-friendly attitude and when its use suits the treatment context. Support in carrying out documentation duties as well as fulfilling legal requirements contributes to therapist acceptance. Furthermore, therapists value TBM as a tool to provide a discussion framework and quick access to worksheets during treatment sessions. Therapists express skepticism, however, regarding technology use in patient sessions and towards complete record transparency in general. Patients expect TBM to improve the communication with their therapist and to offer a better recall of discussed topics when taking a copy of their notes home after the session. Patients are doubtful regarding a possible distraction of the therapist and usage in situations when relationship-building is crucial. When applied in a clinical environment, collaborative note-taking with TBM encourages patient engagement and a team feeling between therapist and patient. Furthermore, it increases the patient's acceptance of their diagnosis, which in turn is an important predictor for therapy success. In summary, TBM has a high potential to deliver more than documentation support and record transparency for patients, but also to contribute to a collaborative doctor-patient relationship. This thesis provides design implications for the development of digital collaborative documentation systems in (mental) healthcare as well as recommendations for a successful implementation in clinical practice.

Keywords: medical documentation, psychotherapy, addiction care, computer-mediated therapy, digital whiteboard, patient empowerment, doctor-patient relationship, design research, user experience, evaluation

Zusammenfassung

Die Verbreitung von Informationstechnologie kann die Rolle von Patienten verändern: weg vom passiven Erhalt ärztlicher Zuwendung hin zur eigenverantwortlichen Mitwirkung an ihrer Genesung. Wesentliche Schritte zur Ermündigung von Patienten sind eine gute Zusammenarbeit mit dem behandelnden Arzt und der Zugang zu den eigenen Akten. Unter Psychotherapeuten gibt es jedoch einen impliziten Konsens darüber, dass die Einsicht in psychiatrische Akten unvorhersehbare, nachteilige Effekte auf die klinische Praxis hervorrufen könnte. Um auch Patienten aktiver an der Erhaltung und Wiederherstellung ihrer mentalen Gesundheit zu beteiligen, ermöglicht Tele-Board MED (TBM) das gemeinschaftliche Erstellen von digitalen Notizen. Diese Dissertation beschreibt die Entwicklung des TBM Software-Systems, das es Therapeut und Patient ermöglicht, gemeinsam während der Sitzung wie auf einem Whiteboard Notizen zu machen. Außerdem bietet TBM Funktionen, um auf Grundlage der digitalen Gesprächsnotizen automatisch Sitzungsprotokolle und klinische Fallberichte zu erstellen. Methodologisch basiert die Entwicklung und Evaluierung von TBM auf dem Paradigma für Design Research. Es wurden vielfältige Studien in den Bereichen der Verhaltens- und Suchttherapie durchgeführt, um die Auswirkungen auf folgende Aspekte zu evaluieren: 1) die Erfüllung der Dokumentationspflichten von Therapeuten, 2) das Engagement von Patienten in Behandlungsprozessen und 3) die Beziehung zwischen Patient und Therapeut. Die Studien haben gezeigt, dass Therapeuten dazu geneigt sind, TBM mit ihren Patienten zu nutzen, wenn sie technologie-freundlich eingestellt sind und wenn es zum Behandlungskontext passt. Zur Akzeptanz tragen auch die schnelle Erstellung von klinischen Dokumenten sowie die Erfüllung der gesetzlichen Forderung nach Aktentransparenz bei. Weiterhin schätzen Therapeuten TBM als Werkzeug, um Therapiegespräche zu strukturieren und während der Sitzung schnell auf Arbeitsblätter zuzugreifen. Therapeuten äußerten hingegen auch Skepsis gegenüber der Technologienutzung im Patientengespräch und vollständiger Aktentransparenz. Patienten erhoffen sich von TBM eine verbesserte Kommunikation mit ihrem Therapeuten und denken, dass sie sich besser an die Gesprächsinhalte erinnern können, wenn sie eine Kopie ihrer Akte erhalten. Patienten brachten Bedenken zum Ausdruck, TBM in Situationen zu nutzen, in denen der Beziehungsaufbau im Vordergrund steht, und darüber, dass Therapeuten sich abgelenkt fühlen könnten. Als TBM im klinischen Umfeld eingesetzt wurde, wurde ein erhöhtes Patientenengagement und ein gesteigertes Teamgefühl beobachtet. Außerdem stieg bei Patienten die Akzeptanz ihrer Diagnosen, welche wiederum ein wichtiger Prädiktor für Therapieerfolg ist. Zusammenfassend lässt sich festhalten, dass TBM großes Potential hat: Über die damit mögliche Dokumentationsunterstützung und Aktentransparenz hinaus wird auch die Zusammenarbeit von Therapeut und Patient unterstützt. Diese Dissertation fasst Kriterien zur Entwicklung von gemeinschaftlichen Dokumentationssystemen in der (psychischen) Gesundheitsfürsorge sowie Empfehlungen für eine erfolgreiche Implementierung in der klinischen Praxis zusammen.

Acknowledgments

I would like to thank my doctoral advisor Prof. Dr. Christoph Meinel for giving me the opportunity to work on this fulfilling topic in an inspiring, interdisciplinary environment and for his trust and support during the last years.

My particular appreciation goes to Julia von Thienen for the great teamwork throughout the entire dissertation time. I thank Julia for sharing her knowledge on psychology, questionnaire design and data analysis, her constant support, her energetic and smart impulses, the joint publications and shared joy about successes. I also want to thank Matthias Wenzel for his support in web development and server administration, the enjoyable teamwork and his tips on formatting. Furthermore, I thank my former colleagues Lutz Gericke and Raja Gumienny for introducing me to the Tele-Board system. I also thank Nikolai Wuttke for his support in implementing data security measures. Special thanks go to everyone who contributed to the Tele-Board development – your strong groundwork serves as the technical basis of this research.

My deepest gratitude goes to all study participants, especially patients and therapists, without whom this work would not have been possible.

I want to express my appreciation of the HPI – Stanford Design Thinking Research Program (HPDTRP) for funding the Tele-Board MED project. Special thanks also go to the members of the HPDTRP community for their insightful comments and suggestions during our biannual workshops. I would also like to show my gratitude to the members of the HPI eHealth group – I have greatly benefited from our biweekly meetings. I am thankful to all the members of the chair of Internet Technologies and Systems for their support as well as the stimulating discussions in the kitchen and in our research seminar.

Furthermore, I would like to thank colleagues and friends who have supported me with valuable advice, constant encouragement, positive vibes, thesis formatting suggestions, as well as feedback and proofreading help in the final phase of this thesis: Dagmar Willems, Harry FreitasDaCruz, Karen von Schmieden, Patrick Rein, Tatiana Gayvoronskaya, Hanadi Traifeh, Thomas Habbe, Mina Rezaei, Haojin Yang, Tamara Slosarek, Falk Uebernickel, Lena Mayer, Mana Taheri, Milena Kraus and Anne Kayem.

Finally, last but not least, I would like to thank my family for their continuous, unconditional support.

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List of Abbreviations

CBT	Cognitive Behavioral Therapy
CSCW	Computer-Supported Cooperative Work
CSS	Cascading Style Sheets
EHR	Electronic Health Record
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
HTTPS	HTTP over Secure Sockets Layer
JSON	JavaScript Object Notation
MVC	Model-View-Controller
NAS	Network-Attached Storage
PAEHR	Patient-Accessible Electronic Health Record
PDF	Portable Document Format
PHR	Personal Health Record
RAID	Redundant Array of Independent Disks
RSA	Cryptosystem named by the authors Rivest, Shamir, Adleman
REST	Representational State Transfer
SHA	Secure Hash Algorithm
SSH	Secure Shell
TBM	Tele-Board MED
UTAUT	Unified Theory of Acceptance and Use of Technology
UX	User Experience
VPN	Virtual Private Network

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Chapter 1

Introduction

With the growth of information technology, patient attitudes are shifting – away from passively receiving care towards actively taking responsibility for their well-being. One approach in supporting this is to create a collaborative relationship between patient and doctor in which decisions are made jointly rather than solely by the doctor. Handling doctor-patient relationships collaboratively and providing patients access to their health information are crucial steps in empowering patients to play an active role in healthcare decisions (Aujoulat et al., 2006; Barr et al., 2015; Koch, 2012). While this has become commonplace in a wide range of medical domains (Ross and Lin, 2003), we note that applying this to the mental healthcare domain has been less straight-forward. For instance, McShane and Rowe (1994) have raised the question as to whether patients should be allowed to read their psychiatric records. The implicit consensus amongst mental healthcare practitioners has been that sharing medical records may have an unpredictable, harmful impact on clinical practice. More recently however, Kahn et al. (2014) and Fors and McWilliams (2016) have argued that showing patients their mental health records can lead them to take a more active interest in their health and to become more involved in their treatment process. Following the 2013 German patients' rights law regulating medical documentation, medical practitioners are required to exercise complete medical record transparency (Bundesgesetz, 2013). This law states that doctors are obliged to document the entire treatment process promptly and comprehensively. Patients have the right to access their files and obtain an electronic copy at any time. In medical domains where documentation is still handled in paper-based form, it is especially difficult to comply with the new legislation. In mental healthcare, handwritten case documentation is still common practice and the use of documentation technology is very limited (Coyle et al., 2007). Therefore, handing out a copy of readable notes to patients is a challenging task.

The research in this thesis addresses the organizational and technological challenges of patient access to health records faced in psychotherapy and addiction care. As a solution to the problems discussed above, this thesis promotes digital collaborative note-taking with *Tele-Board MED* (TBM) as an innovative approach to medical documentation. The TBM software system was developed as an aid to talk-based therapy. It allows doctor and patient to take treatment session notes jointly and allows for the further processing of session notes. The Tele-Board system for creative team work over geographic distances (Gumienny, Gericke, Quasthoff, Willems and Meinel, 2011) serves as TBM's technical basis.

In addressing the topic of digital documentation in talk-based care consulta-

tions, we are faced with a cyclic process in which both problem and solution are interconnected in a complex way (see *wicked problems* described by Rittel and Webber (1973)). For instance, one solution could suggest that therapists take notes on their personal computer during treatment sessions, as is commonly done e.g. in general medicine. However, such a closed and one-sided documentation approach is problematic in talk-based care, where a trustful therapeutic relationship and therapist empathy are crucial factors for treatment success (Lambert and Barley, 2001). One could therefore suggest that therapists create patient-accessible case documents after the session. However, this would massively increase the therapists' administrative workload. Thus, another solution has to be found and the iterative process of problem definition and solution finding continues. Moreover, the individual perspectives on transparent documentation among therapists and patients can be very different. One person might be in favor of using a system like TBM, while another person might decide against using it. Hence, the approach of digital collaborative documentation using TBM cannot be evaluated as true or false, but rather as good or bad. Since there is no ultimate test for evaluating the TBM system, the design and evaluation process was changed flexibly along the way and creative, empirical evaluation methods were applied to answer the research questions. The idea of using a collaborative digital note-taking system in face-to-face mental healthcare sessions is highly novel, daring, and at the same time promising, because it can create value for both doctors and patients.

This thesis is structured as follows:
Chapter 1 covers the research questions, the research framework used, the contribution and the scope of this thesis.
Chapter 2 illustrates the background of psychotherapy and addiction care, the concept of patient access to health records, and related work.
Chapter 3 describes the digital whiteboard software system Tele-Board, which serves as the technical basis of this thesis.
Chapter 4 is dedicated to the digital collaborative documentation system Tele-Board MED and its functionalities, architecture and implementation.
Chapter 5 describes the design of evaluation studies including evaluation environments and applied research methods.
Chapter 6 presents the study results and limitations.
Chapter 7 summarizes the findings and draws conclusions on digital collaborative documentation in healthcare.

1.1 Research Questions

The aim of this thesis is to investigate digital collaborative documentation in order to support patients and therapists in talk-based healthcare consultations. The following research questions (RQ) are addressed:

RQ1. Can digital collaborative documentation support therapists in fulfilling their duties of clinical case documentation?

a) What are therapists' documentation activities and how are they integrated in patient treatments?

b) Which factors contribute to therapists' acceptance of digital collaborative documentation?

c) Which factors lead to therapists' rejection of digital collaborative documentation?

d) What are therapists experiencing when using a digital collaborative documentation system?

RQ2. Can digital collaborative documentation support patient engagement in care processes?

a) Which factors contribute to patients' acceptance of digital collaborative documentation?

b) Which factors lead to patients' rejection of digital collaborative documentation?

c) How does digital collaborative documentation influence patient empowerment?

RQ3. Can digital collaborative documentation support a collaborative doctor-patient relationship?

a) How does digital collaborative documentation influence doctor-patient relationships?

b) Can digital collaborative documentation help to strengthen therapeutic alliances?

These questions are addressed with the development and evaluation of the TeleBoard MED system for digital collaborative documentation.

1.2 Design Research Framework

Research on the development and evaluation of the digital collaborative documentation system Tele-Board MED was conducted under the design research paradigm. Design research, which is also referred to as design science, has gained considerable attention and advocacy in recent years (Hevner et al., 2004; Venable, 2006; Peffers et al., 2007). This thesis' design research is based on the framework of information systems research by Hevner et al. (2004). The core of this framework is the cyclic process of build and evaluate as it is present in many design frameworks, such as the express-test cycle by McKim (1973), the design thinking process (Plattner et al., 2009), and the design innovation process (Kumar, 2012).

According to Hevner et al.'s framework, information systems research should be informed by both the business needs of the researched domain and applicable scientific knowledge. Figure 1.1 shows the framework and content particular to the research of this thesis: The environment is the domain of talk-based healthcare (psychotherapy and addiction care) with actors such as patients and therapists who interact within an organization (e.g. psychotherapeutic clinic) and with technology (e.g. office software). This environment offers a context for business needs, practical problems and improvement opportunities, e.g. documentation transparency requested by law and its effects on therapists and patients. These needs inspire and inform information systems research. In this research, TBM artifacts such as videos and functional prototypes were built. These artifacts were assessed in evaluation studies within multiple clinical environments, which informed the refinement or change of the artifacts.

Design research has the dual objective of delivering contributions to both academia and practice. Thus, the outcome of design science in information systems research should include both additions to the scientific knowledge base and applications of the developed artifacts to the organizational environment. The quality of outcomes corresponds to scientific rigor and practical relevance.

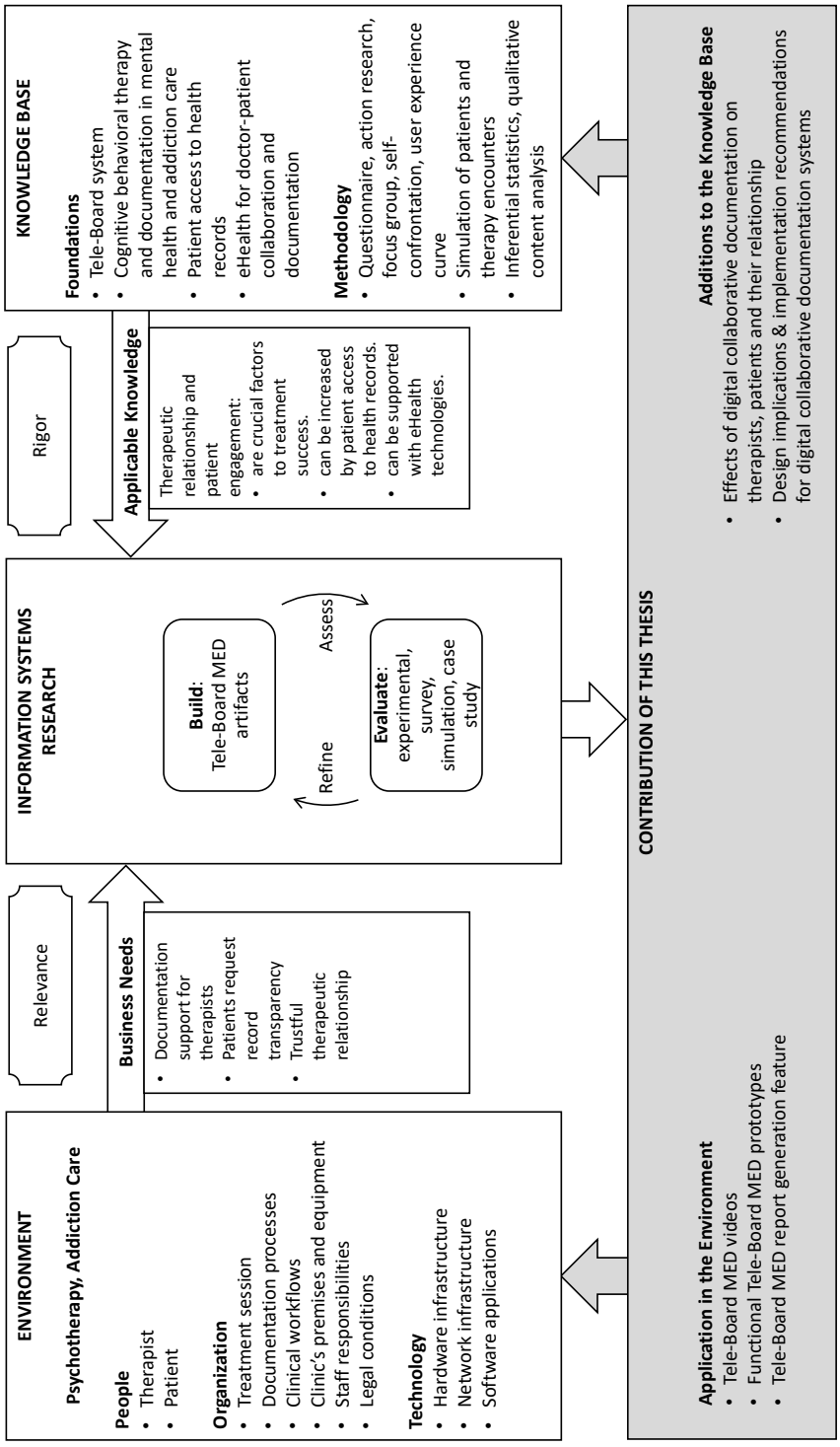


Figure 1.1: Research of this thesis illustrated via the information systems research framework (layout adapted from Hevner et al. (2004)).

1.3 Contribution

This thesis presents digital collaborative note-taking as an approach to transforming treatment documentation into a cooperative activity between patient and therapist. The contribution of this research is twofold – relevant to both practice and academia – as illustrated in Figure 1.1.

Practical contribution: Artifacts applied to therapists and patients in simulated and real clinical environments are videos and functional prototypes of the digital collaborative documentation system Tele-Board MED (see Section 5.3). The technical core contribution of this work is the implementation of the medical report generation feature which turns the digital notes collected during a treatment session into official clinical documents (see Section 4.5).

Theoretical contribution: Theoretical contributions include the results of evaluation studies as answers to the research questions (see Chapter 6) as well as design implications and implementation recommendations for collaborative documentation in talk-based healthcare (see Chapter 7).

The development and evaluation of TBM was done in a joint effort of a multidisciplinary team. Every team member had a specific field of expertise and followed their own research interests. Julia von Thienen, who has a background in psychology, took the leading role in understanding the needs of therapists and patients. She designed the documentation templates for psychotherapeutic use cases (von Thienen, 2019). Matthias Wenzel, who has a background in computer science, made a key contribution in the development of the Tele-Board whiteboard client (see Wenzel et al., 2013). Moreover, he implemented the handwriting and speech recognition features (see Wenzel et al., 2019). I, Anja Perlich, the author of this thesis, am trained in medical informatics. I took the key position of technically adapting and extending the Tele-Board system to the clinical context. Furthermore, I implemented the medical report generation feature and data security measures for TBM use in clinical contexts.

This work is situated in the field of health informatics (i.e. at the intersection of the domains of computer science and healthcare), and more specifically combines the fields of information systems development, design research, medical care, and user experience. The studies were conducted mainly in Germany and partly in the United States of America.

1.4 Scope

The scope of this thesis is limited to digital collaborative documentation in cognitive behavioral therapy (CBT) and addiction care treatment sessions. Both fields share a talk-based care approach. The face-to-face treatment scenario makes the use of technology both challenging and promising. The population of interest includes therapists and adult patients in both outpatient and stationary treatment contexts. We included therapists with diverse levels of experience – from therapists in training up to senior therapists. We did not exclude any patients, but involved those who were undergoing treatment and who were willing to use the TBM system. Therapist-patient interactions in remote scenarios (e.g. online counselling) are excluded from this research.

In mental healthcare, another talk-based treatment modality next to CBT is psychoanalytic therapy, which aims to bring unconscious forces to the conscious mind in order to understand and influence a patient's behaviors, thoughts, and emotions. Commonly, the therapist takes private notes and sits behind the patient who is lying on a couch. The approach of psychoanalytic therapy was excluded from this research, because digital collaborative note-taking does not seem to support its goals and principles.

Chapter 2

Background

Problems in mental health and addiction can be successfully treated with talk-based care and have the potential to be supported with documentation technology. This chapter describes the background of talk-based healthcare including the concepts of patient empowerment and a therapeutic relationship. Afterwards, documentation activities and the patient and therapist perspectives on treatment documentation are described. This chapter also covers related work on technologies for documentation and collaboration in healthcare. Finally, the concept of information technology acceptance is illustrated.

2.1 Psychotherapy and Addiction Care

Mental health disorders account for over 40% of all chronic diseases and are the biggest cause of years lived with disability in the developed countries (WHO, 2005). Symptoms of mental disorders may include depressed mood, anxiety, phobia and obsessive-compulsive behavior.

Addiction counselling offers help for people facing problems with drugs, such as alcohol, medicines and illegal substances, or with compulsive behaviors such as excessive gambling and media consumption. Worldwide, alcohol consumption is responsible for 3.3 million deaths annually, and is a causal factor in more than 200 disease and injury conditions (WHO, 2014).

Patients and Therapists Recipients of psychotherapy and addiction therapy are called patients, clients, consumers or customers (Deber et al., 2005). In this thesis, the term *patient* is used, because it acknowledges the person's suffering as well as the ethical duty of the therapist to care. Care providers in these domains are called therapists, psychotherapists, psychiatrists, doctors or counsellors depending on the concrete field of practice and the educational qualification.

2.1.1 Cognitive Behavioral Therapy

Cognitive behavioral therapy (CBT) is a popular form of talk-based care in both psychotherapy and addiction treatment. CBT aims at enhancing patient self-efficacy when facing problems such as phobias or drug abuse. In psychotherapy, CBT techniques include, e.g., social skills training, coping tactics and relaxation training

(O'Donohue et al., 2004). Common addiction treatment techniques include functional analysis of drug use and social skills training (Carroll and Onken, 2005). Psychotherapy and addiction care comprise multiple treatment sessions of approximately 50 minutes and involve comprehensive conversations between patient and therapist. The patient's share of the conversation is large compared to other medical domains such as surgery or dermatology. In anamnesis sessions, the patient history is explored. Behavior analyses are conducted to understand the patient's behavior, such as phobic reactions or drug relapse. Besides therapy and counselling techniques, treatment success heavily depends on relational factors, such as patient self-efficacy, therapist empathy and the therapeutic relationship (Miller and Moyers, 2015).

2.1.2 Therapeutic Relationship

In psychotherapy, a positive therapist-patient relationship is known to be a major predictive factor for treatment success and can be considered a necessary prerequisite for the effectiveness of all therapeutic interventions (Lambert and Barley, 2001). *Therapeutic alliance* describes the ideal patient-provider relationship and is defined as "a dynamic interactional process in which the patient and provider collaborate to carry out negotiated mutual goals in a shared partnership" (Kim et al., 2008, p. 85). The *Kim Alliance Scale* was designed to measure the quality of therapeutic alliances and covers the four dimensions of collaboration, integration, empowerment, and communication (Kim et al., 2001, 2008). *Collaboration* implies that both therapist and patient establish shared goals for the treatment and commit to pursuing them. The dimension of *integration* refers to mutual respect and a reduction of the power differential between patient and care provider. In the *empowerment* process, patients take on more responsibility for their own care, develop self-efficacy, and become partners in making decisions. The dimension of *communication* implies a mutual, comprehensible information exchange in a nonjudgmental and empathic manner, as well as patient-provider bonding.

Until the end of the twentieth century, the relationship between patient and care provider was a patriarchal one. Physicians and therapists had exclusive access to medical knowledge and patient data, and thus also the power and full responsibility of decision-making in the treatment process. Patients, on the other hand, assumed the role of passive, obedient recipients of healthcare. Over the last decades, due to the growing opportunities for patients to acquire medical knowledge via information technology, the patient-provider relationship has started to change and the balance of power is shifting from care providers to patients (see also Section 2.4).

2.1.3 Patient Empowerment

Patient empowerment is a concept which is based on a collaborative relationship between patient and doctor as well as an increased responsibility that a patient takes for his or her personal health. Barr et al. (2015, p. 14) define patient em-

powerment as "a process achieved through patient-centered care, or as an outcome" which "includes elements relating to both patient and healthcare professional roles, shared decision-making, patient self-efficacy and coping." Patient self-efficacy, i.e. a patient's belief that his or her own abilities and knowledge are sufficient to overcome a problem, is a crucial personal resource for treatment success in psychotherapy and addiction care. According to Bandura (1997), patients' perceived self-efficacy influences their coping behaviors in stressful situations, as well as how much personal effort they expect to put forth to reach a certain goal.

The patient-provider relationship classification system by Agarwal and Murinson (2012) focuses on patient characteristics and builds on the three dimensions of patient values, patient autonomy and patient knowledge. *Patient values* concern the beliefs or principles related to personal health and the medical sphere. *Patient autonomy* relates to the patient's involvement in the discussion and the decision-making process during the encounter. *Patient knowledge* reflects the level of medical information a patient has and to which extent it is incorporated in the therapeutic dialogue. This patient-centered model for relationship classification can be combined with the dimensions of therapeutic alliance (see Section 2.1.2). Combining both approaches highly resonates with the concept of patient empowerment, which according to Aujoulat et al. (2006) is a process that can be described in two dimensions, namely the patient and the patient-provider interaction. Figure 2.1 shows our patient empowerment model which combines both approaches.

In the process of patient empowerment, the patient's access to information is considered the first mandatory step, followed by the subsequent steps of building knowledge and transforming knowledge into action (Koch, 2012). Information technology can support shifting the power balance from healthcare professionals to patients and thereby support patients' empowerment (see Section 2.5).

2.2 Documentation Activities in Talk-Based Care

Psychotherapy and addiction care entail the collection of patient information and the creation of various documents. It is common practice for therapists to take notes on patient treatments for personal purposes. Furthermore, as part of their professional duties, therapists create official clinical documents, such as case reports, for communication with third parties. Documentation activities are also influenced by legal regulations on data privacy and patients' rights.

2.2.1 Note-Taking

Therapists take notes on patient sessions to overview the treatment, to recall the last therapy session, and to synchronize the patient's progress with the treatment plan. It is common practice for therapists to write down personal observations that are not intended to be seen by the patient. Such personal notes may include e.g. observations about the patient's interaction behavior, personality, intellectual capacities, and psychopathological findings. Furthermore, session protocols may be

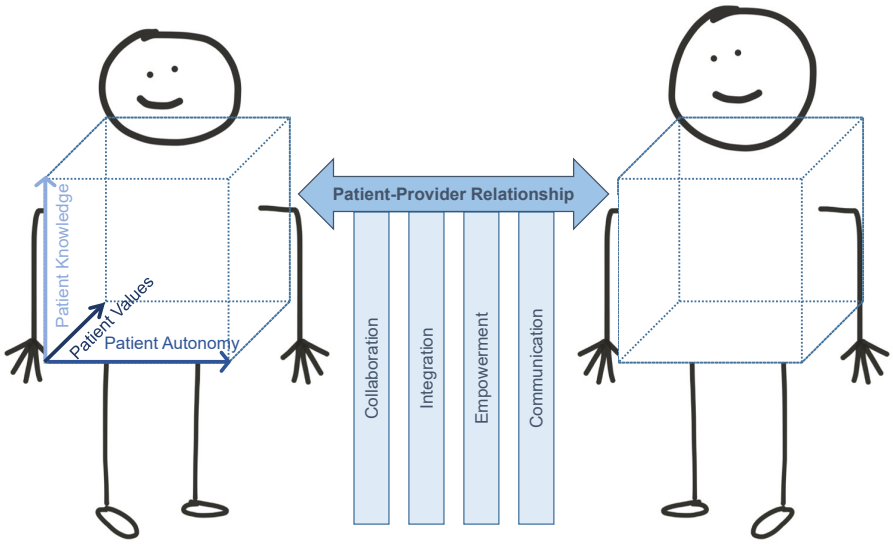


Figure 2.1: A combined patient empowerment model. Patient attributes are illustrated on the left. Dimensions of the therapeutic relationship are shown in the middle (adapted from Perlich, von Thienen, Wenzel and Meinel (2017)).

used to summarize the most important interventions and outcomes of a treatment session.

In the United States of America, the *American Psychiatric Association* (APA, 2002) makes a marked distinction between *medical progress notes* and *psychotherapy notes* in terms of content and confidentiality. Notes on the patient's progress are part of the official treatment record, which should contain objective findings such as progression of symptoms, diagnosis, treatment plan, prognosis and treatment modalities and frequencies. These official medical progress notes should cover the minimum of information needed for clinical care and obtaining insurance reimbursement. Personal psychotherapy notes, on the other hand, are kept by therapists as private notes on intimate personal content, topics discussed in therapy sessions, clinical speculations and observations of patient interactions.

In Germany, there is no specific standard for psychotherapeutic treatment documentation. Laireiter and Baumann (2009) recommend differentiating between three groups of data, namely 1) intervention and progress data, 2) process data about the therapeutic relationship, and 3) diagnostics data. Moreover, conspicuous features in the patient's mood should be noted, e.g. aggression or the expression of suicidal thoughts.

While note-taking in psychotherapy is often a one-sided activity carried out by the therapist, there are methods that trigger the patients' involvement in information capturing. Patient-reported information addressed in diagnostics and treatment sessions is often mapped to models for e.g. behavior analysis (Kanfer and Saslow, 1965) and addiction relapse (Marlatt, 1996). Common tools for information visualization are flipcharts, analogue whiteboards, work sheets or blank paper sheets.

2.2.2 Report Writing for Therapy Funding

When treatment should be covered by third parties, such as health or state pension insurance companies, the planned treatment needs to be justified. In the German public healthcare system, after therapy need and treatment possibilities are assessed in up to five probatory anamnesis sessions, the therapist submits a case report to the patient's health insurance company to apply for long-term therapy. The case report covers three subjects: 1) a description of the patient case, 2) a problem analysis (diagnosis), and 3) a justified treatment plan. Creating these reports is usually done by transferring handwritten notes into a digital format. This is a time-intensive task for therapists and often involves browsing through session memos, work sheets and questionnaires along with deciphering handwriting. For many years, case reports were expected to be written in continuous text. Only recently, the German case report guidelines have allowed for a bullet point writing format (KBV, 2017).

In addiction care, a so-called social report is submitted to state pension or health insurance companies to request treatment funding.

2.2.3 Diagnosis Classification

Official documents for administrative and billing purposes often refer to diagnosis classification codes. The two most common terminology systems for mental health diagnoses are the WHO's *International Classification of Diseases* (ICD) and the APA's *Diagnostic and Statistical Manual of Mental Disorders* (DSM). Based on these diagnosis classification schemes, interview guidelines have been developed to support therapists. The most commonly used interview guidelines for the diagnosis of mental disorders are the *Structured Clinical Interview for DSM* (SCID) (First, 2016) and the WHO's *Composite International Diagnostic Interview* (CIDI). The SCID is a diagnostic instrument based on DSM version IV and consists of the following parts: The SCID-I is designed to determine major mental disorders listed in DSM-IV part I (e.g. anxiety disorder). The SCID-II is used to determine personality disorders listed in DSM-IV part II (e.g. borderline personality disorder). The CIDI is a comprehensive, fully structured interview guideline for the assessment of mental disorders according to the definitions and criteria of both the ICD-10 and DSM-IV.

2.2.4 Data Protection Regulations

Protecting patient data is deeply rooted in the medical profession. The code of secrecy states that everyone working in health services has to keep patient information strictly confidential. Data privacy should guarantee that every individual can decide which personal data is gathered, for which purpose, and to whom it is transferred (Leiner et al., 2009). In countries of the European Union, the statutory regulations on data security are based on the *European General Data Protection Regulation* (GDPR).[1]

[1] GDPR (EU) 2016/679, German *Datenschutz-Grundverordnung* (DSGVO)

When personal health data is stored or processed outside of the clinical practice management system, a contract has to be made between the clinic and the third party – in accordance with the GDPR (Article 28). A responsible data processing authority, e.g. the clinic or research institution, fulfills its numerous obligations towards the owners of the data – in particular the information obligation (Art. 13) and the notification obligation (Art. 19). Furthermore, data owners have the rights to access the collected data (Art. 15), to request the correction (Art. 16) or deletion (Art. 17), to set restrictions on the processing of data (Art. 18) and on the data transferability (Art. 20). Data owners have the right to file an objection (Art. 21). Furthermore, the GDPR states the data processing authority has to keep a directory of data processing operations in order to support their accountability (Art. 5). Besides the GDPR, country-specific regulations should be considered, such as the German Federal Data Protection Act.[2]

2.2.5 Patient's Rights Law

The 2013 German patients' rights law (Bundesgesetz, 2013) states that care providers are obliged to document the entire treatment process promptly and comprehensively (§630f). Care providers must communicate to the patient in an understandable manner the diagnosis and the possible treatment options (§630e). It is then the patient who decides how to continue the treatment (§630d). Furthermore, the law grants patients the right to see their records and to obtain electronic copies of their files at any time (§630g). The law calls for complete medical record transparency and thus promotes patient access to information as a crucial step towards patient empowerment. This law has provoked discussions among psychotherapists regarding whether it is in the interest of patients and best treatment outcomes to provide unexceptional access to the notes (see also Section 2.4).

[2]German *Bundesdatenschutzgesetz* (BDSG)

2.3 Needs of Patients and Therapists

The way in which patients seek health information as well as the power balance between patients and care providers are changing. Traditionally, the patient was expected to comply with the instructions given by the doctor, who had exclusive access to knowledge. Nowadays, along with the patient empowerment movement, healthcare is becoming a collaborative process in which patients and care providers jointly work on solving health problems. Patients' rights laws call for complete record transparency and grant patients the right to obtain electronic copies of their files. For therapists in mental healthcare and addiction counselling, fulfilling these legal requirements seems almost impossible. The common documentation approach is handwriting, yielding treatment records which are neither clearly legible for patients nor easily accessible in an electronic format. Creating official clinical documents such as case reports implies retyping the handwritten treatment notes into a digital document. These administrative tasks are very stressful and time consuming.

While the written information resides with the therapist, patients often lack access to their files. However, therapy plays a crucial role in the patient's life in relation to everything else and beyond the encounter with the therapist. For patients, it is therefore important to recall the treatment session content in order to reflect on their case, to complete assigned homework and have informed conversations with those close to them. The needs of patients and therapists in talk-based therapy are illustrated in Figure 2.2.

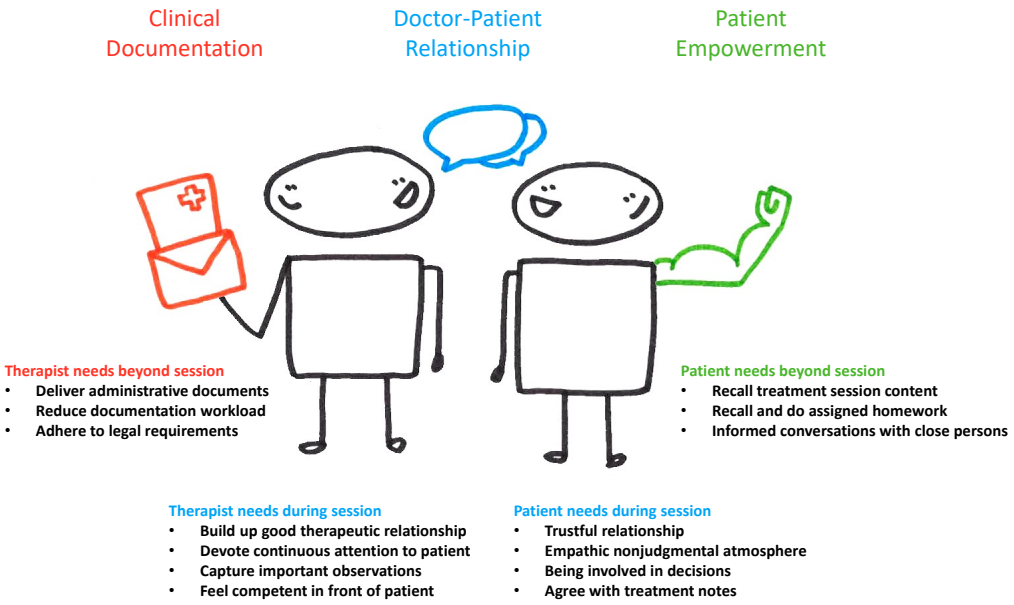


Figure 2.2: Needs of therapists and patients in talk-based health interventions both during and beyond treatment sessions (based on Perlich and Meinel, 2017).

2.4 Patient Access to (Mental) Health Records

This section reviews patient access to mental health records and describes approaches to increase the patient's acceptance and understanding of treatment documentation.

2.4.1 A Review

The history of medical records dates back to ancient times (Dalianis, 2018; Gillum, 2013). In 1600 BC, Egyptians described different surgery cases on papyrus. 1200 years later (in 400 BC), the Greek physician Hippocrates wrote down detailed patient case histories. For a very long time, the documentation of patient cases solely served the physicians as a memory support in their personal learning process. With the development of healthcare systems and the implementation of statutory health insurances (e.g. 1883 in Germany (Tunder and Ober, 2017)), patient records also became a communication tool for healthcare staff to share case information. The health professional's exclusive access to medical files has been challenged since the late 20th century and patient access to health records is proliferating as a means to empower patients (Koch, 2012; Ross and Lin, 2003). Today, in Germany, the USA and other countries, patient record transparency is regulated by law.

While patient access to records is proliferating in primary care and other somatic medical domains, to date there are still strong debates taking place about whether mental health patients should be allowed to read their records (McShane and Rowe, 1994; Ross and Lin, 2003; Clinton, 2014). However, already in 1979, the American Psychiatric Association (APA) published a model law promoting the right of mental health patients to see and copy their psychiatric records. The strongest arguments for providing medical and psychiatric patients access to their records were the patient right to privacy and the necessity for informed consent for the release of records (Schwartz and Rachlin, 1985). After all, an informed consent about the disclosure of personal information, e.g. for third-party reimbursements, can only be given if the patient is able to verify the accuracy of the information in the record.

In a literature review, Ross and Lin (2003) found therapeutic reasons for record transparency, namely positive effects on doctor-patient communication, improved patient autonomy and self-efficacy. The majority of psychiatric patients who made use of accessing their records had favorable attitudes about it. However, the therapists' resistance towards record transparency in mental healthcare persists. Therapists often reason that psychiatric patients may be particularly fragile and can be easily harmed by reading about themselves (Fors and McWilliams, 2016). Moreover, therapists may be insecure about revealing their record-keeping habits, including the completeness and correctness of notes and their style of writing. Notes that are written in a judgmental, patronizing, or disrespectful way are rather likely to trigger undesirable patient reactions, which can be counter-therapeutic and detrimental to the patient-therapist relationship. Potential risks of disclosing psychiatric records to patients include the cause of emotional harm (e.g. feelings of anger,

shame, pessimism), psychological harm (e.g. in the case of psychosis where patients have difficulties determining what is real and what is not) or physical harm (e.g. self-injury or suicide attempts) (Clinton, 2014). Ross and Lin (2003) therefore suggest that a mental health professional be available when patients review their notes. This recommendation is recognized with the digital collaborative documentation system suggested in this thesis, because patients and therapists watch and edit treatment notes jointly (see Chapter 4). Fors and McWilliams (2016) explore the collaborative reading of medical records together with the care provider as an empowerment intervention in psychoanalytic psychotherapy. They identify the benefits of sharing a psychiatric record at three levels, namely 1) informational value for both therapist and patient, 2) relational value in equalizing power aspects of the relationship and in conveying that no information is withheld, and 3) therapeutic value in encouraging patient responsibility, supporting patient memory and facilitating therapeutic insight. Especially in patients with a long psychotherapeutic history, a joint exploration of records from previous care providers helps to create a mutual understanding of the patient's problems and treatment attempts. Kahn et al. (2014) also strongly support the idea of showing patients their mental health records and expect a reduction of stigma and an increase in health problem acknowledgement.

2.4.2 Towards Patient-Supportive Health Records

In order for healthcare to be effective, important decisions are made based on the medical information regarding the patient's health problem, treatment options and prognoses. Therefore, an effective exchange of medical information between care provider and patient is crucial. Patients' understanding and recall of information exchanged at doctors' visits determines their adherence to the recommended treatment. Strikingly, patients forget up to 80% of the information provided by healthcare practitioners as soon as they leave the doctor's office (Kessels, 2003). Possible reasons can be found on the doctor's side (e.g. in the usage of difficult terminology) and on the patient's side (e.g. in their education and expectations) as well as in the mode of communication (e.g. written, spoken or non-verbal).

Most medical consultations take place only verbally. It has been shown that spoken instructions are better remembered and lead to better treatment adherence when they are accompanied by written or visual material (Kessels, 2003). Furthermore, the patient's memory performance is also influenced by the organization of information. Explicit categorization, e.g. by putting information in a predefined order, increases the recall of medical information. There are examples of visual communication modes leading to enhanced recall of spoken medical instructions, such as cartoons used in wound care (Delp and Jones, 1996) and pictographs used in cancer care (Houts et al., 1998).

Reading mental health records can support patients if they are written in a respectful, sensitive way. Kahn et al. (2014, p. 1291) illustrate the difference between labeling the patient and using a descriptive, nonjudgmental language to describe patient behaviors. For example, instead of writing about a person with schizophrenia

that he has delusional ideas about being spied upon, the written note could read "Mr Smith and I continue to 'agree to disagree' about his conviction that his apartment is bugged." The following note could illustrate a personality disorder: "Ms Jones and I continued our discussion of her tendency to use 'black-or-white-thinking' in ways that make her relationships at work problematic."

2.5 Related Work

Providing patients with access to their electronic health records is considered a highly important eHealth service (Walker et al., 2014; Wiljer et al., 2008; Essén et al., 2018). The term *eHealth* relates to the use of information and communication technology for health and wellbeing and is considered a central driver for empowering patients (Koch, 2012). The Healthcare Information and Management Systems Society (HIMSS, 2003, p. 1) defines eHealth as "the application of Internet and other related technologies in the healthcare industry to improve the access, efficiency, effectiveness, and quality of clinical and business processes utilized by healthcare organizations, practitioners, patients, and consumers to improve the health status of patients."

An electronic health record (EHR) is a documentation system which allows the storage and retrieval of patient data and case documents. EHRs are populated by multiple healthcare institutions with the purpose of sharing patient case information among care providers (Tang et al., 2006). They are designed in a data-centered way, in which the data classes and categories support the care providers' administrative documentation work.[3] Patient-accessible EHRs (PAEHRs) are portals which provide patients with online access to their electronic health records and thus allow them to view e.g. clinical notes and hospital discharge letters (Wiljer et al., 2008). Some successful efforts have been made to give patients online access to their electronic health records containing information on their physical health (Woods et al., 2013; Bhavnani et al., 2011; Hägglund et al., 2018). As opposed to (patient-accessible) EHRs, personal health records (PHRs) are lifelong systems under the control of the patient. PHRs contain information which is at least partly entered by the patient and allow for the management, access and sharing of personal data by the individual (ISO, 2005).

Currently, extensive studies of patients' access to their medical records are ongoing in the *OpenNotes* project – an initiative advocating fundamental change in the way visit notes are managed.[4] By promoting ready access to notes, the OpenNotes team (see Walker et al., 2014) pursues the mission to empower patients, families, and caregivers to feel more in control of healthcare decisions, and to improve the quality and safety of care. Patients with mental health or substance use disorders seem to

[3] There are attempts to standardize EHR data storage and transmission. Health Level 7 (`http://www.hl7.org`) is a universally accepted standard for the exchange of medical and administrative patient data in hospitals. OpenEHR (`https://www.openehr.org/`) provides a large set of free specifications, tools and other resources supporting interoperable and effective EHRs.

[4] `https://www.opennotes.org`

be excluded from OpenNotes research initiatives, because physicians decided to do so in order to prevent patient harm in reading their records (Walker et al., 2014; Delbanco et al., 2012).

2.5.1 Collaborative eHealth Tools

Computerized medical records have the potential to be used as collaborative tools in the examination room. Studying the use of computers in doctor-patient encounters is strongly linked to the field of *computer-supported cooperative work* (CSCW). CSCW combines the understanding of how people work together with enabling computer-based technologies and associated hardware, software, networks, services and techniques (Wilson, 1991). CSCW tools can be classified according to the time (synchronous vs. asynchronous) and space (colocated vs. remote) in which people collaborate (see Figure 2.3). Designing collaborative documentation and communication tools for the healthcare context is a research field that has attracted attention over the last decades (Fitzpatrick and Ellingsen, 2012). The bulk of applications are designed for remote interaction, e.g. video conferencing tools, online chats for (anonymous) consultations, internet forums or instant messaging apps (see Fig. 2.3).

	same time synchronous	**different time** asynchronous
same place colocated	**Face-to-face interactions** electronic health records used in examination room	**Continuous task** electronic patient survey in waiting room
different place remote	**Remote interactions** video conferencing, online chat, phone call	**Communication & coordination** email, internet forum, SMS (short message service), instant messaging, health tracking tools

Figure 2.3: The time/space matrix of computer-supported cooperative work (see Johansen, 1988) filled with technology artifacts that support the collaboration between patient and care provider (adapted from Perlich, von Thienen, Wenzel and Meinel (2017)).

In recent years, tools have been suggested for face-to-face collaboration between patient and care provider. Mafi et al. (2018) promoted the concept of *OurNotes* – an intervention in which patients and families co-produce medical notes with clinicians. An evaluation using expert interviews showed that OurNotes has the potential to promote patient engagement, patient-centered care and patient-provider collaboration, as well as to offload work from busy doctors. Anderson et al. (2017) assessed the effects of patients typing their visit agenda into the electronic medical record before seeing their clinicians. They concluded that patient-written visit agendas improve the communication between patient and clinician and can increase the collaborative nature of clinical encounters. McGrath et al. (2007) assessed the usage of electronic records in patient encounters in an internal medicine hospital ward via the physician's personal computer. They identified different spatial designs, all of which clearly position the physician as the primary user of the system. In a more open arrangement, physicians were able to establish direct eye contact with the patient and – by swinging the computer screen while the patient leans forward – a joint viewing of the record was possible. Asan et al. (2018) studied the shared use of electronic health records in a general medicine clinic by means of mirroring the clinician's screen on a patient-facing monitor. Thus, both were able to view the same display on individual screens. However, the ability to edit the record was reserved for the clinician. Their study showed that providing patient access to the EHR during the doctor's visit may improve patient engagement.

2.5.2 eHealth in Mental Healthcare

In mental healthcare, patient access to electronic health records and the use of technology in patient encounters is very limited. Most eHealth technologies in psychotherapy and addiction care provide patients with access to services and information (Coyle et al., 2007; Johnson et al., 2011). *Computerized therapy* offers therapeutic support independent of face-to-face therapist consultations (Knowles et al., 2014; Kuester et al., 2016). There is a remarkable number of options available, including anonymous online counselling, mindfulness apps and guided self-help applications for specific mental health problems. Therapeutic techniques, such as emotion regulation and exposure, can be enhanced by virtual or augmented reality and thereby increase patient engagement (Baus and Bouchard, 2014; Gonçalves et al., 2012). However, there are only a few examples of *computer-mediated therapy*, i.e. the integration of technology-delivered content with the health professional's input. Coyle and Doherty (2009) designed the roleplaying computer game *Personal Investigator* to be played by an adolescent patient together with a therapist in a treatment session. The patient explores the game world, engages in dialogues with game characters and uses a digital notebook for personal reflection. The game dialogues are designed to structure the delivery of therapeutic content and to provide context for more detailed conversations between patients and therapists. Matthews and Doherty (2011) developed the web and mobile phone application *My Mobile Story* to trigger children's self-reflection by incorporating the therapeutic agent of

telling the story of their mental health problems. This application allows the patients to capture information about their case in visual and multimedia-based ways, which is shared with the therapist remotely between treatment sessions.

In summary, the existing tools partially allow for patient access and patient contribution to their medical files. There seem to be no digital tools for patient-centered, collaborative note-taking in (mental) healthcare encounters. Digital collaborative note-taking tools used in e.g. educational classroom settings, business contexts and legal courtroom settings (Mueller and Oppenheimer, 2016) can inspire healthcare settings. For example, the shared whiteboard system and educational practice *Livenotes* was introduced in lectures to facilitate cooperative note-taking in classrooms (Kam et al., 2005). The digital whiteboard software system Tele-Board serves as the technical basis for this thesis (see Chapter 3).

2.6 Information Technology Acceptance

There are various theories used in healthcare to predict the acceptance of information technology (Holden and Karsh, 2010). Venkatesh et al. (2003) introduced the *Unified Theory of Acceptance and Use of Technology* (UTAUT) as a tool to assess the likelihood of information technology system adoption by potential users and to understand the drivers of technology acceptance. The UTAUT model consists of four variables that predict the intention to use a system, namely performance expectancy, effort expectancy, social influence, and facilitating conditions. Furthermore, there are four indirect determinants of the intention to use a system: gender, age, experience and voluntariness of use. The intention to use (acceptance) eventually determines the actual use (see also Section 6.2.2.2).

Chapter 3

Tele-Board: A Digital Whiteboard Software System

Tele-Board is a web-based software system designed to support teams distributed across different geographic locations during their creative, collaborative work (Gumienny, Gericke, Quasthoff, Willems and Meinel, 2011; Gericke et al., 2011). The core feature of Tele-Board is a whiteboard-inspired graphical user interface, which allows users to edit whiteboard panels freely as they fill them with sticky notes, pictures, and scribbles (see Figure 3.1). Tele-Board can be used like an analogue whiteboard. However, it is not only usable on interactive whiteboards, but on a variety of hardware devices, such as desktop computers, laptops, tablet computers and smartphones.

Figure 3.1: Tele-Board user scenario (copied from Gumienny, Gericke, Quasthoff, Willems and Meinel (2011)). A team distributed across different geographic locations is working on a shared digital whiteboard interface in real-time. The team in one location can see the team in the other location via a video conferencing overlay.

3.1 Functionality

Tele-Board is a web-based whiteboard system and consists of the following components, which can be accessed via a web browser on a variety of hardware devices.

Whiteboard Client The whiteboard client is the core feature of the Tele-Board system and allows the editing of whiteboard panels. The whiteboard interface allows

the user to create and manipulate sticky notes, to create and erase scribbles, to integrate images and to freely arrange and cluster these elements (see Figure 3.2). The pinning feature allows the user to lock the position of a sticky note that should not be moved. Notes can be unpinned and thus made moveable again. Furthermore, sticky notes can be marked with a voting dot. Inspired by the marking of paper sticky notes with small, colorful stickers, the voting dot feature serves as a means to highlight notes. Users can see remote panel actions by other authorized users in real-time. For remote, synchronous collaboration, there is a video overlay feature which allows users to view their collaboration partners' faces and expressions (Wenzel and Meinel, 2016).

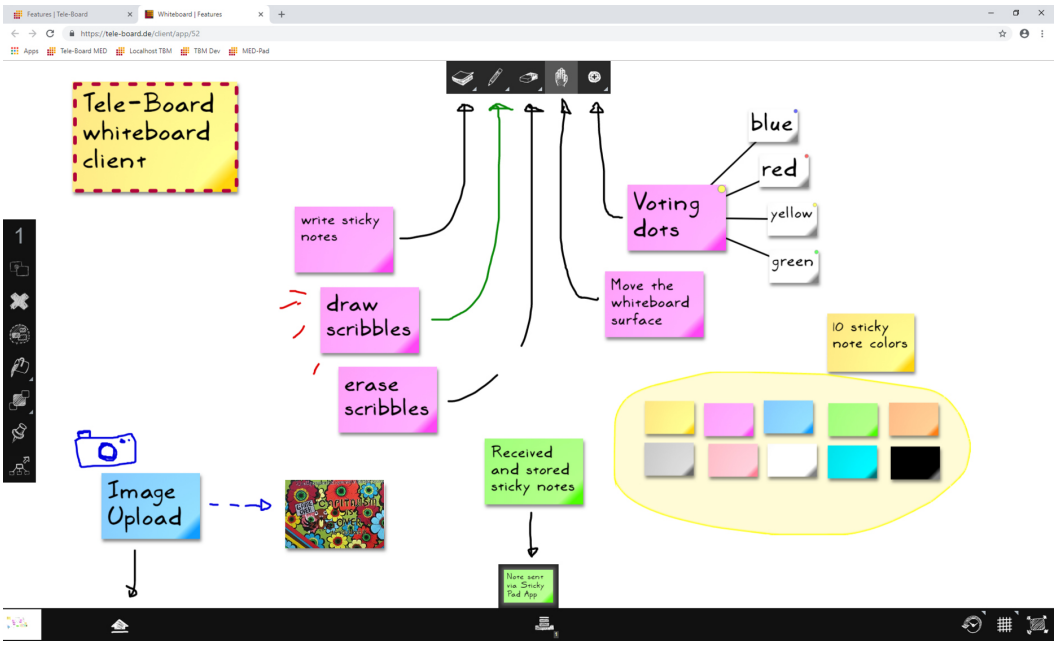


Figure 3.2: Screenshot of the Tele-Board whiteboard client. The whiteboard panel can be filled with sticky notes, clusters, images and scribbles.

Web Portal The initial access point for the user is the login screen to the web portal accessible via a URL.[1] Following a successful login with the user name and password, the user can create whiteboard panels and organize them by project. A panel represents a virtual whiteboard, including its elements, e.g. sticky notes and scribbles, and its development over time. Projects represent directories, which can contain panels and subprojects. In order to support the collaboration over distances, the web portal allows project members to determine with whom the whiteboard panels are shared. Furthermore, users with administrative rights are allowed to manage the user accounts. The web portal also offers features to manage the whiteboard panels. Users can view a screenshot, create a copy of the panel,

[1] https://tele-board.de

export the panel as a picture or *Word* file, and share the panel with other users. The whiteboard history browser allows the users to retrace the working process and reconstruct former whiteboard states (Gericke et al., 2010; Gericke, Gumienny and Meinel, 2012).

Sticky Pad App The sticky pad app is an equivalent to a paper sticky note pad and allows the creation and sending of sticky notes to the whiteboard client. It is a web browser-based application intended but not limited for use on mobile devices, such as tablet computers or smartphones. This app is designed to allow users to contribute to the whiteboard using their own mobile devices. Users can take pictures, draw scribbles or write texts with a finger or a digital pen. When a user is authenticated, he/she can send sticky notes to the whiteboard client, where it pops up in the central bottom area (see Figure 3.2).

3.2 Architecture

The Tele-Board system consists of four main software components: one server component and three client components, including the web portal, the whiteboard client and the sticky note pad app described above. Figure 3.3 shows a block diagram[2] of the Tele-Board system.

The server component contains a web proxy server, the web portal's backend, a server for the synchronization of the whiteboard panel elements, as well as a database. The web proxy server handles the communication with the client applications, the communication with the web portal backend and the communication with the synchronization server. The synchronization server coordinates the synchronization across whiteboard panels and thus allows for real-time updates across remote partners. Designed as the central component of a star topology, the synchronization server receives and forwards whiteboard panel actions to all connected clients.

When a user launches the whiteboard client through the web portal, a new browser tab with the whiteboard interface opens up. In the background, a connection to the synchronization server is established. This connection, which allows users to send and receive whiteboard panel changes to the database and from other connected clients, is maintained until the browser tab is closed. When a user works on a particular panel, the whiteboard client sends the information to the synchronization server, which in turn broadcasts it to all other connected whiteboard clients. Every whiteboard input is stored in the database on the server automatically and thus there is no need to explicitly save the edited whiteboard panel. When a user sends a sticky note from the sticky pad app, the information is sent to the server component, which in turn sends the sticky note to the corresponding whiteboard panel.

The server component holds two databases. One database covers the whiteboard element data representing sticky notes, scribbles, uploaded pictures, voting dots,

[2] in Fundamental Modeling Concepts notation, http://www.fmc-modeling.org/

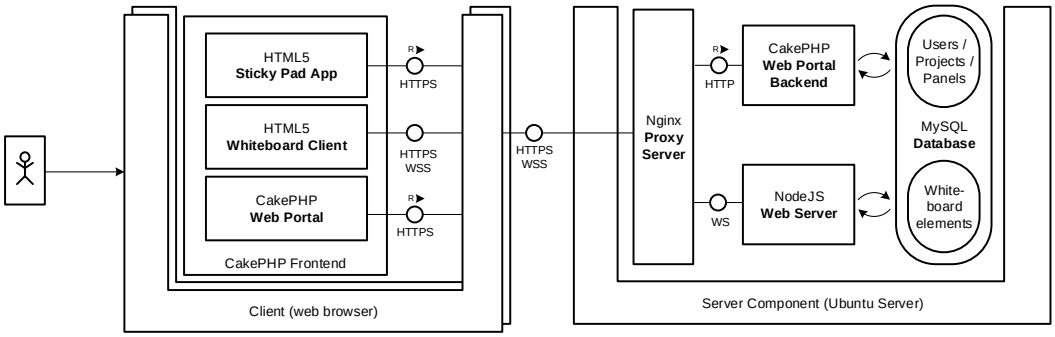


Figure 3.3: Block diagram of the Tele-Board system.

clusters and whiteboard navigation movements. The other database is read and updated by the web portal backend, and contains data about users, projects and panels.

3.3 Implementation

The Tele-Board web portal is a *PHP*[3] application based on the *CakePHP* framework[4] version 2. It follows the *model-view-controller* (MVC) pattern and is thus separated into three main layers. The model layer is based on the *MySQL*[5] database and handles the validation, storage and retrieval of data. The controller layer handles requests from users and coordinates and prepares the responses for the client, e.g. the rendering of views. Views are the presentation layer responsible for generating specific responses to the user's requests, e.g. in the form of a website.

The whiteboard client is implemented as a *single page application* (SPA) represented as an *HTML* (Hypertext Markup Language) document and its related assets, such as *CSS* (Cascading Style Sheets) and *JavaScript* files (see Wenzel et al., 2013). The sticky pad app is implemented as a single page application as well.

The *Nginx*[6] web proxy server handles the communication with the client applications, the web portal's backend and the synchronization server. It can be addressed through the standard port 443, allowing for encrypted communication via *HTTPS* (HTTP over Secure Sockets Layer (SSL)) and *Secure WebSocket* (WSS) (see Wenzel and Meinel, 2016). Whenever users operate the whiteboard client, the server forwards a serialized object representation in *JSON* (JavaScript Object Notation) format to all other connected whiteboards. The *Socket.IO*[7] library is used for managing the whiteboard connections and for broadcasting the whiteboard changes to all clients that participate in a panel session. The whiteboard element database is read and written by the synchronization server and the data is stored in *JSON* format.

[3] PHP: Hypertext Preprocessor
[4] https://cakephp.org/
[5] https://www.mysql.com
[6] https://www.nginx.com/
[7] https://socket.io/docs/

Figure 3.4 shows the *JSON* representation of a sticky note. For the transmission of sticky notes from the sticky pad app to the whiteboard client, the web proxy server also provides *REST* (Representational State Transfer) endpoints. The synchronization server is written in *JavaScript* and uses the *NodeJS* [8] runtime environment (see Wenzel and Meinel, 2016).

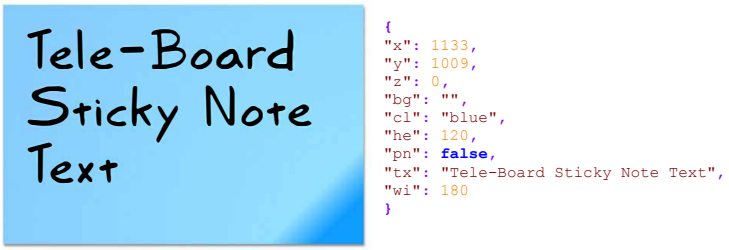


Figure 3.4: Representation of sticky note whiteboard elements. The JSON string (right) contains the position, size, color, and text of a sticky note, as well as a link to a possible background picture and an attribute selecting whether or not the note is pinned to the whiteboard.

[8] https://nodejs.org

Chapter 4

Tele-Board MED: A System for Collaborative Medical Documentation

Tele-Board MED (TBM) is a digital collaborative documentation system designed for therapists and patients in talk-based healthcare. It was built based on the Tele-Board system described in the previous chapter. While Tele-Board is designed to support collaboration among creative teams over distances, Tele-Board MED supports collaboration between doctors and patients in face-to-face encounters. Tele-Board MED was developed as an aid in talk-based therapy and allows the patient and therapist to document their session jointly. This chapter describes TBM's functionalities, user scenarios, the system architecture as well as detailed descriptions of its software features.

4.1 Functionalities for Doctors and Patients

Tele-Board MED (TBM) is designed to support treatment session scenarios with doctors and patients that follow a talk-based care approach. More specifically, TBM is applied to the domains of cognitive behavioral therapy and addiction care and is aimed at supporting the needs of both patients and therapists. Traditionally, the therapist takes handwritten notes, which are not visible to the patient (see Figure 4.1). With TBM, the doctor and patient work on the session notes together in a visual and collaborative way (see Figure 4.2). The note-taking can be done on a blank whiteboard panel or on prepared templates for shared therapy contents, exercises or treatment approaches. The system allows for capturing notes via typing or handwriting and speech recognition. Tele-Board MED also supports the subsequent use of session notes. Patients can receive print-outs or digital copies of the whiteboard panels to take home after the session. Furthermore, the medical report feature allows therapists to create case reports semi-automatically on the basis of session notes. Thus, with TBM, note-taking becomes augmented, in the sense that notes can be taken in tandem with prepared template elements and turned into official clinical documents afterwards. The whiteboard panels can be freely structured and filled with sticky notes, uploaded images, and scribbles. Just like in Tele-Board, the panels are organized into projects, which can be considered the organizational equivalent of a patient folder. By capturing case information, session notes and therapy material, digital and visually enhanced patient files can be created.

4.1.1 Designing for Dyadic Human-Computer Interaction

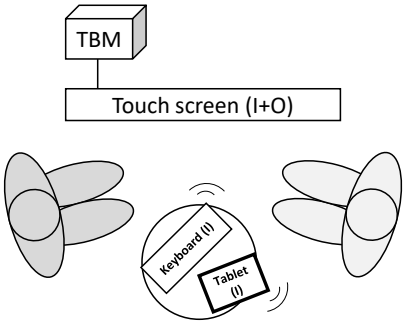
The dyadic interaction between therapist and patient poses special requirements for the user-centered design of an information system. The needs of both therapists and patients are a crucial basis for the development of a collaborative documentation system like TBM. When user experiences are designed for dyads instead of single users, the concept of primary and secondary users should be considered (see Alsos and Svanæs, 2011). Therapists are primary users, because they are frequent hands-on users of the TBM system. They have personal user accounts and possess credentials to log into the system. Patients are considered secondary users, because they are influenced by the therapists' system experience and rely on them to obtain information from the system. Patients can access the software system together with their therapist during the sessions – but so far not remotely on their own.

Figure 4.1: In the traditional scenario of a therapist-patient session, the therapist takes notes which are not visible to the patient.

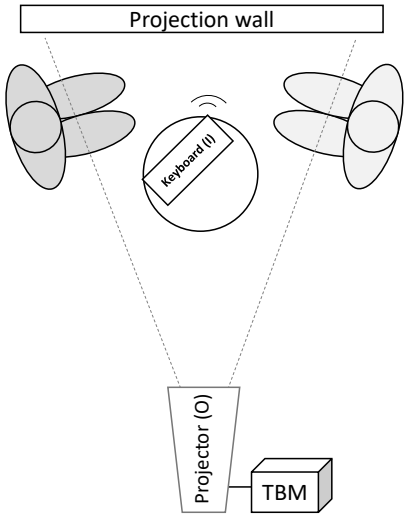
Figure 4.2: In the Tele-Board MED user scenario, the therapist and patient work on the digital therapy notes together. An interactive whiteboard allows for displaying and operating the documentation panels via touch gestures. A wireless keyboard serves as an input device for note-taking.

4.1.2 User Scenarios and Spatial Arrangements

A typical spatial arrangement in talk-based healthcare allows the therapist and patient to sit opposite one another. Often, therapists hold a pen and paper on their laps to take notes during the conversation. A side table and flipchart may stand nearby. When introducing technology for collaborative note-taking, there are several options for the setup of technical devices. The spatial arrangement should allow both therapist and patient to view the documentation panel and to reach input devices to navigate and enter notes in the system. We tested several options for spatial arrangements. In the outpatient clinic study (see Section 5.1.3) and the user experience study (see Section 5.1.7), a digital whiteboard with an optional keyboard and/or tablet computer was used (see Figure 4.3a). While the digital whiteboard shows the documentation panel, the keyboard serves for typing input and the tablet serves for input via the sticky pad app (see Section 3.1). Another setup includes a wall projection from a laptop and a keyboard with a touchpad as the input device (see Figure 4.3b). This setup was tested in the hospital case study (see Section 5.1.4). Table 4.1 lists different web servers and client devices. There are many more arrangements possible. For example, a tabletop touch screen on a movable base with an appropriate size and good lateral visibility could allow the therapist and patient to stay seated when navigating the documentation system.



(a) Patient and therapist sit in front of a touch screen (e.g. digital whiteboard) and use a keyboard for typing input or a tablet for handwriting recognition input.



(b) Patient and therapist sit in front of a wall with a projection of the whiteboard panel and use a keyboard with trackpad for navigation and input.

Figure 4.3: Spatial arrangements in sessions supported with Tele-Board MED (TBM) involving different input (I) and output (O) devices. The *TBM* box represents an internet-ready device such as a laptop or mini PC through which access to the TBM system is established.

Table 4.1: Possible implementations of web servers, client devices that can be used to connect to the server, and additional input and output devices.

Web servers	Client devices	Input (I) and output (O) devices
- virtual machine in a server network - virtual machine on a mobile laptop - physical application server located in clinic network	- laptop - desktop PC - mini PC - tablet computer	- digital whiteboard (I/O) - wireless keyboard with trackpad (I) - projector (O) - printer (O)

4.1.3 Features

In the course of developing the TBM system, certain features were adapted or removed, and new features were added (see Table 4.2). Several features of the Tele-Board web portal were deactivated for reasons of data privacy or simplicity of the user interface, e.g. the features regarding the sharing of projects and panels, as well as the news feed and notifications. In TBM, patient files are represented as projects, which contain all panels belonging to a certain patient.

The TBM system contains several features which were developed specifically for the healthcare context:

- **Documentation Templates for Medical Use Cases:** In order to support collaborative note-taking in psychotherapeutic treatment sessions, whiteboard panel templates were created to support therapeutic exercises and patient education, for instance. Details about the documentation templates can be found in Section 4.4.
- **Medical Report Generation Feature:** The medical report generation feature allows users to create clinical documents semi-automatically out of the digital notes taken during the session. This feature is the main technical contribution of this thesis and is described in great detail in Section 4.5.
- **Session Summary Feature:** This feature tracks the whiteboard panels used in a patient session and generates a summary. This feature has been described previously (see Perlich and Meinel, 2015; von Thienen et al., 2016) and is thus rather briefly presented in Section 4.6.
- **Handwriting and Speech Recognition Features:** As an alternative to typing notes with a keyboard, users can create notes by dictating or writing with a digital pen. These features have been described by Wenzel et al. (2019) and are thus only briefly presented in Section 4.7.

Table 4.2: Features of Tele-Board and Tele-Board MED. Features in the left column have been disabled and features in the right column have been implemented in the Tele-Board MED system.

	Tele-Board Features	**Shared Features**	**Tele-Board MED Features**
Whiteboard Client	- video conferencing mode with transparent overlay of whiteboard panel (Gericke et al., 2011)	- create, move, remove, cluster elements - sticky notes: voting dots, pin to background, duplicate, change color, connect to mind map - scribbles - upload pictures - whiteboard: zoom, pan, grid - timer	- overlay of section assignment grid for report generation
Web Portal	- sharing panels and projects with other users - meeting scheduling - email notifications - panel export (ppt, csv) - news feed (Gumienny, Gericke, Dreseler, Meyer and Meinel, 2011)	- manage panels and projects (in TBM, a project is considered patient record) - panels: create copy, create template, export (doc, jpg) - history browser (Gericke et al., 2010)	- whiteboard templates for medical use cases - medical report generation feature - visual session summary feature
Sticky Pad App		- write sticky notes (scribble, type) - take pictures - send notes and pictures to whiteboard client	- handwriting recognition - speech recognition

4.2 System Architecture

The general software architecture of Tele-Board MED and Tele-Board is very similar. Figure 4.4 shows a block diagram of the TBM system in which system adaptations, such as added or changed components, are highlighted. Initially, the Tele-Board whiteboard client, sticky pad app, as well as the web portal frontend and backend were developed by Gumienny, Gericke, Quasthoff, Willems and Meinel (2011). The

whiteboard client was redeveloped by Wenzel et al. (2013). The core functionalities are used in TBM and have been adapted to some extent (see Table 4.2). The TBM software architecture contains two additional elements: a server for handwriting recognition and a connection to a speech recognition service via the sticky pad app (Wenzel et al., 2019). The medical report generation feature was integrated in the web portal and the whiteboard client.

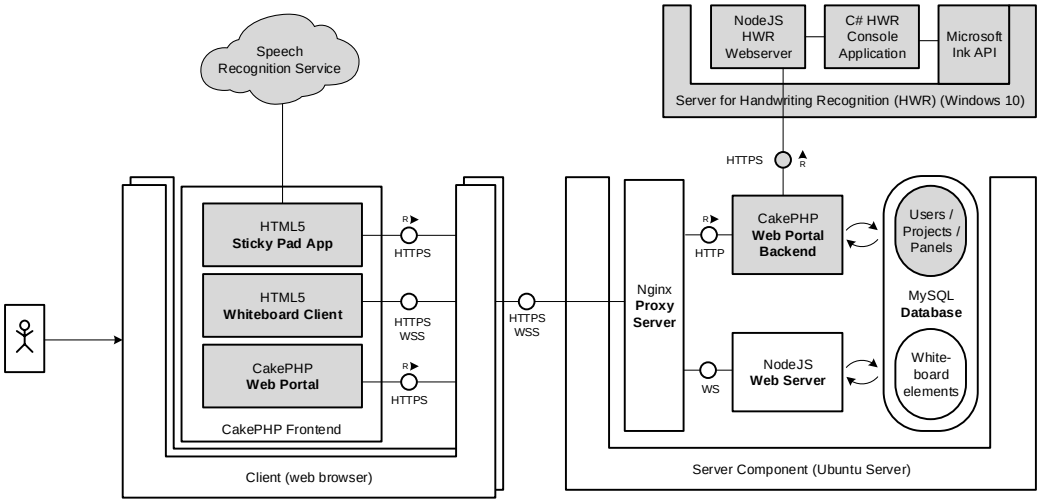


Figure 4.4: Block diagram of the Tele-Board MED system. The adaptations of the Tele-Board MED system as compared to the Tele-Board system are highlighted.

4.3 Data Format

The data format is optimized for the efficient storage and retrieval of digital whiteboard data, such as sticky notes, scribbles and other elements (see Gericke et al., 2010). Patient information is not stored in the form of attributes and values (e.g. `"year of birth":1985`), but simply as free texts on sticky notes. Similar to the data format in Tele-Board, text information is stored as a string on the sticky note, represented schematically as a descriptive attribute. For example, as shown in Figure 4.5, the descriptive attribute `"tx"` in JSON format stores the string `"born in 1985."`

4.4 Documentation Templates

With TBM, therapists and patients can use blank whiteboard panels or work with panel templates for specific topics, activities or treatment approaches. They can use prepared templates or create their own. Whiteboard panels can be saved as templates and reused.

A number of templates to support the diagnostics and treatment procedures in talk-based mental healthcare have been designed by von Thienen (2019). The

Figure 4.5: Tele-Board / Tele-Board MED data format. The JSON string (right) contains the position, size, color, and text of a sticky note, as well as a link to a possible background picture and an attribute selecting whether the note is pinned to the whiteboard.

templates are based on e.g. work sheets, models and interview guidelines. They contain elements such as headlines, icons and organized space for information entry, and can be modified in the course of patient conversations. The following sections describe a selection of templates used in the evaluation studies.

4.4.1 Templates for Cognitive Behavioral Therapy

Some key aspects in cognitive behavioral psychotherapy are the anamnesis and an analysis of behaviors the patient would like to change.

- The **anamnesis** template serves as a guidance for anamnesis interviews and helps to capture information, which is recorded most frequently during anamnesis sessions. The template contains headlines and icons for the patient's concerns, life story, family status, therapy experience, personal plans, medical issues, emotions, thoughts, energy level and self-endangerment (see Figure 4.6). This template was used in the therapist feedback study (see Section 5.1.1) and the technology acceptance study (see Section 5.1.6).
- The **behavior analysis** template is used to analyze behaviors patients would like to change. The behavior analysis template is based on the *SORC* (stimulus-organism-reaction-consequence) model introduced by Kanfer and Saslow (1965), which helps to analyze the patient's reaction to a concrete situation in his or her life and the consequences of this reaction (see Figure 4.7). This template was used in the expert rating study (see Section 5.1.5).

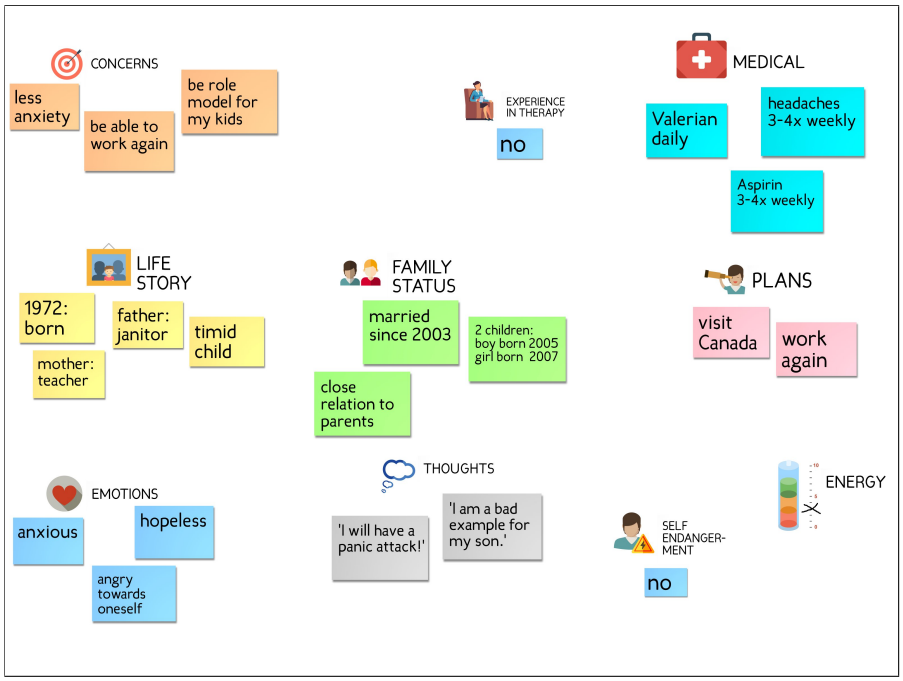


Figure 4.6: Anamnesis panel with headlines for certain topics (e.g. concerns, emotions, family status) and patient information on sticky notes.

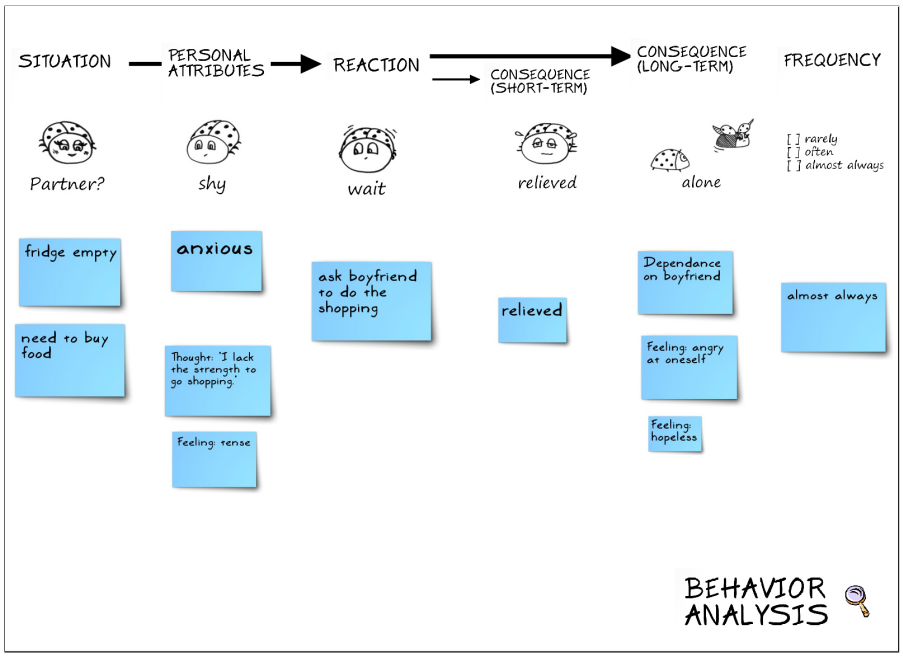


Figure 4.7: Behavior analysis panel filled with patient information on sticky notes.

4.4.2 Templates for Diagnostics in Psychiatry

We created templates to assess the following mental health problems that were common in patients at the psychiatric hospital ward (see Section 5.2.3): borderline personality disorder, compulsive disorder, depression, post-traumatic stress disorder, panic disorder, and phobia. The templates were used for patient diagnostics in the hospital case study (see Section 5.1.4). In psychotherapy, lists of criteria help determine the correct diagnosis. Thus, the templates are inspired by the diagnostic criteria of the DSM (Diagnostic and Statistical Manual of Mental Disorders) classification system (see Section 2.2.3). Figure 4.8 shows a template for the diagnostic procedure in patients where compulsive disorder was suspected. It shows one criterion per sticky note. The patient and therapist can capture which criteria apply to the patient by highlighting the note. The template design is aimed at making the diagnostic procedure transparent to the patient and thereby supporting the patient's understanding and acceptance of the diagnosis.

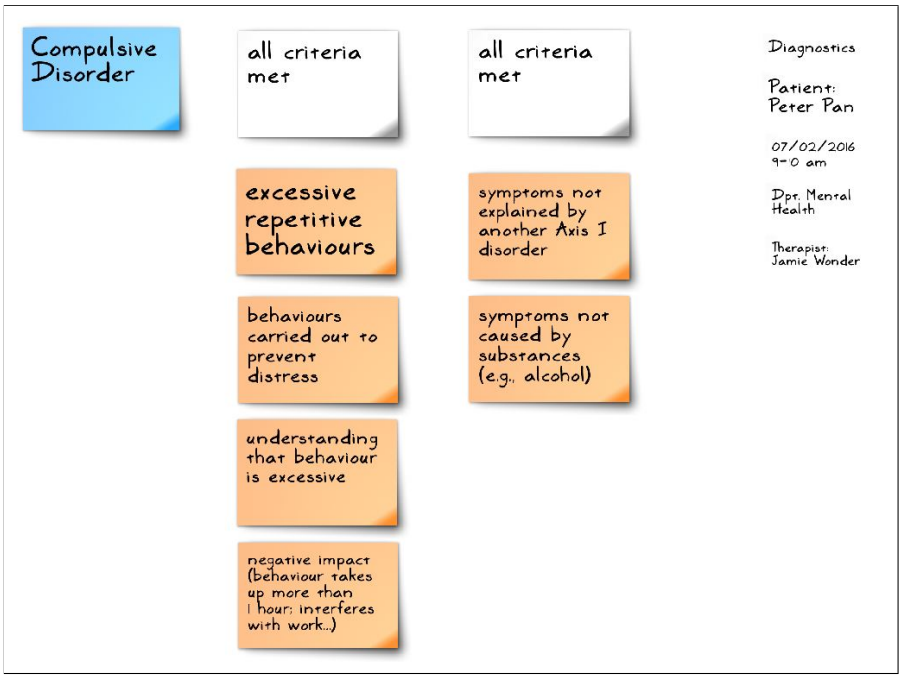


Figure 4.8: Diagnostics template used with patients when compulsive disorder was suspected. Compulsive disorder is diagnosed if all criteria in the first list and all criteria in the second list are met.

4.4.3 Templates for Psychotherapeutic Anamnesis

For psychotherapy anamnesis, a set of seven panel templates was created to reflect prominent topics in early patient interviews and, at the same time, cover all relevant information for the case report (see Section 2.2.2). These templates were tested in the user experience study (see Section 5.1.7), where they served for note-taking during the simulated anamnesis session and medical report generation. Figures of the templates in the German language are shown in Appendix A.1.

- The **concerns and symptoms** template is used in the beginning of the anamnesis session to discuss the patient's goals and the severity and course of symptoms (see Figure A.1).
- The **patient history** template covers the patient's family of origin, childhood, training and job, earlier therapy experiences and current life situation (see Figure A.2).
- The **behavior analysis** template is used to analyze behaviors that patients would like to change (see Figure A.3). It is similar to the template described in Section 4.4.1.
- The **psychological finding** template covers aspects like patient self-endangerment, impaired consciousness and memory (see Figure A.4).
- The **somatic finding** template covers psychopharmacological medication and drug consumption (see Figure A.5).
- The **therapy plan** template helps the therapist and patient to set goals together for the therapy. For each goal, they can set the priorities and agree on interventions (see Figure A.6).
- The **diagnosis** template is filled with diagnosis titles, codes (see Section 2.2.3) and the confidences (see Figure A.7).

4.5 Medical Report Generation Feature

This section describes the medical report generation feature, which creates clinical documents out of the TBM whiteboard notes. This feature is the technical core contribution of this thesis. The development of the medical report generation feature was motivated by the finding that fulfilling administrative documentation tasks is a highly time-consuming and undesirable activity for therapists (see study results in Section 6.1.3). In standard medical practice, when therapists create official clinical documents such as case reports or hospital discharge letters they transfer their handwritten notes into a digital format. TBM treatment notes are digital right from the start and thus can be automatically reused for the creation of official documents.

4.5.1 Conceptual Considerations

In order to reuse the content of the TBM session notes for clinical documents in an automated way, the central challenge is to bridge the gap between two documentation formats. The digital notes on TBM documentation panels are captured in the form of short sentences or key points in colloquial language and in a patient-centered, flexible and visually enhanced structure. Administrative clinical documents, on the other side, are paragraphs of running text written in a language of mental healthcare professionals using technical terms and the subjunctive tense. When approaching this challenge, we considered semantic technologies for natural language processing and natural language generation. However, we soon realized that these technologies are currently not suitable to turn the data from TBM sticky notes into fluent medical expert text in the German language. An all-automatic information extraction is challenging for several reasons. Firstly, there is hardly any textual context around the key points on TBM notes – as opposed to written narratives, where crucial information is embedded in surrounding text. Secondly, the meaningful information is not necessarily represented by specific textual entities but can lie in subtle cues, such as the spatial arrangement, visuals, color coding, headline or panel title. Thirdly, when writing this thesis, there were no suitable annotated (medical) text corpora in the German language or ontologies needed for terminology extraction. Thus, the implemented report generation feature leverages the spatial arrangement of information on the whiteboard panels and the structure of clinical documents. It allows the automated sorting of TBM session notes into paragraphs of a clinical document (see Figure 4.9).

4.5.2 Testing and Iteration

We started the development of the medical report generation feature with the creation of paper prototypes in order to envision, test and iterate the graphical user interface. This helped answer central questions such as: 1) How should the whiteboard client be redesigned to support associations between whiteboard content and report sections? 2) Given the time constraints of therapists, which implementation allows for the least number of additional clicks? 3) How should the feature be integrated in the web portal to allow for the editing of whiteboard and document templates? Finally, 4) Which form should the report document template have in order to be both computer-processible and meaningful for therapists? Paper prototypes of the whiteboard client interface, web portal interface, and report document template were tested with a psychotherapist in several iterations.

4.5.3 Input Data

The medical report generation feature accepts two types of input information: a text document in *Microsoft Word* format and a set of whiteboard panel templates. Either content format is compliant with the medical report generation feature and can easily be adapted to any text document schemes, e.g. hospital discharge letters

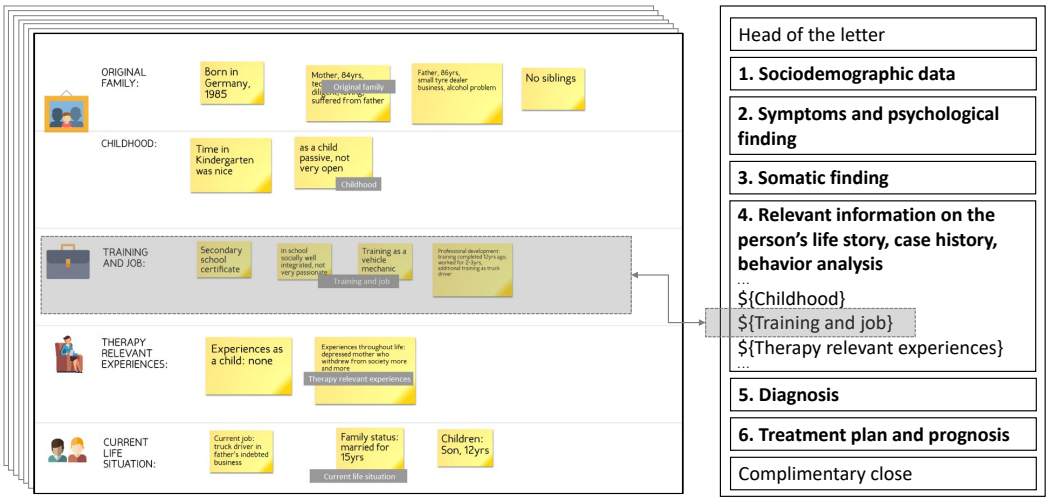


Figure 4.9: Illustration of the basic functionality of the report generation feature. Based on their spatial positions, the whiteboard panel content (left) is sorted automatically into the sections of a text file (basic structure of a report template on the right). As an example, the light grey rectangles indicate that the text on sticky notes positioned in the central whiteboard portion will appear in the section "Training and job" of the created case report (adapted from Perlich and Meinel (2018)).

or reports. In the following, the psychotherapy case report (see Section 2.2.2) is used as an illustration of the medical report generation feature. The Word document contains static text sections such as header, section headings and footer, as well as placeholders (characterized by a dollar sign and curly brackets e.g. '${Therapy goals}') which will be replaced by case-related information (see report template in Appendix A.2). The placeholders are used for linking whiteboard panel areas to report sections as described in Section 4.4.3. A set of templates was prepared which reflects prominent topics of psychotherapy anamnesis interviews and, at the same time, covers all relevant information for the case report (see figures in Appendix A.1).

4.5.4 Functionality

The medical report generation feature offers a set of interactions users can carry out, e.g. the creation of documentation templates, the assignment of documentation template sections to panels, and the generation of report documents (see Figure 4.10). We distinguish between non-administrative users (e.g. therapists) and administrative users (e.g. heads of the clinic, technical administrators), because creating, editing and deleting text documentation templates is reserved for admin users. Once text templates have been created, non-admin users can make use of them.

As a first step in the creation of a documentation template, the admin user uploads a Word document (in .doc or .docx format) to the TBM web portal. Once a documentation template with detected sections is available in the TBM system, it

can be accessed by all users. They can assign the template sections to whiteboard panel areas. This association is carried out via the sections editor shown in Appendix A.3. The editor is integrated in the panel editing view and contains three elements: 1) a list of available sections, 2) drop-down boxes to determine the grid structure, and 3) a section assignment grid. The grid structure can be modified in size: The number for columns and rows can be set between one and five. Each grid cell can be assigned to a section of the documentation template. Via drag and drop, the user can pick a section from the list and assign it to an empty grid cell.

In the whiteboard client, users can hide and show the section assignment grid with labeled cells as a second layer on top of the whiteboard panel. The labels indicate the connection to the report sections. Thus, creating sticky notes and moving them to certain areas on the documentation panel already prepares the report. After the patient consultation, the therapist simply needs to click a button and the report is created automatically. There is also a preview feature, which displays the generated document as a PDF file embedded in the web portal's project view.

Admin users can edit documentation templates by changing the title and description. The template structure itself can be changed by uploading a new Word file. In this case, the old file is replaced. If the new document contains placeholders which are identical to placeholders of earlier versions, the document sections remain unchanged. Thus, previously constructed connections between document sections and whiteboard panel areas are preserved. Admin users can delete a template and it will no longer be available.

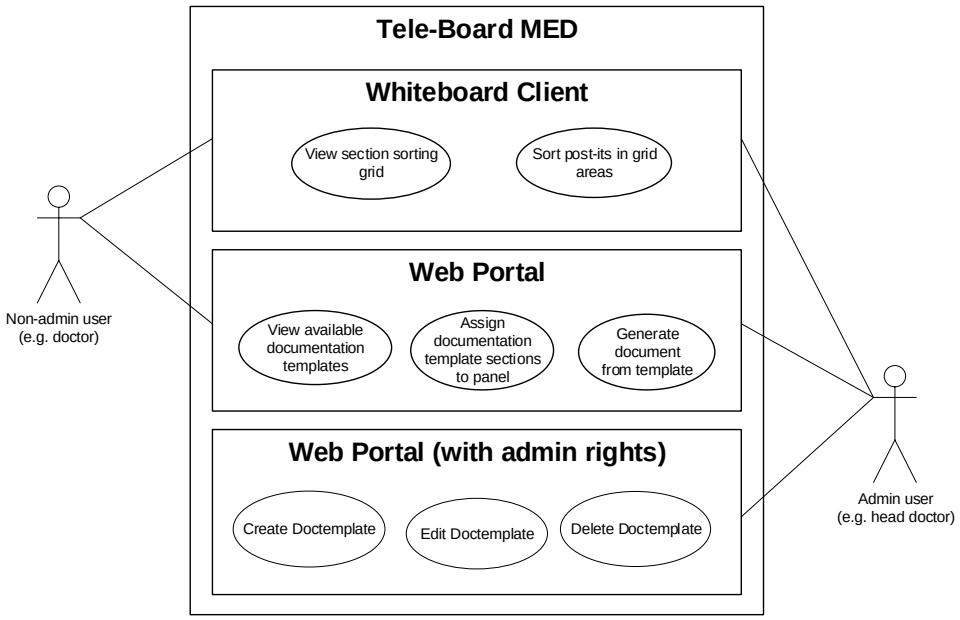


Figure 4.10: Use case diagram of the medical report generation feature. The use cases are integrated in the components of the whiteboard client and web portal.

4.5.5 Architecture

The medical report generation feature follows the *model-view-controller* (MVC) software architecture. Figure 4.11 shows the classes that were created for the controller, models and views. The controller comes into play whenever a user requests a web page or resource by entering an application URL or by clicking a button on the graphical interface. The controller communicates with the model layer to retrieve or store data from the database (see table structure in Appendix A.4). Afterwards, the controller delegates the task of generating an output to the respective view. The generated output is rendered to the user, e.g. in the form of a web page.

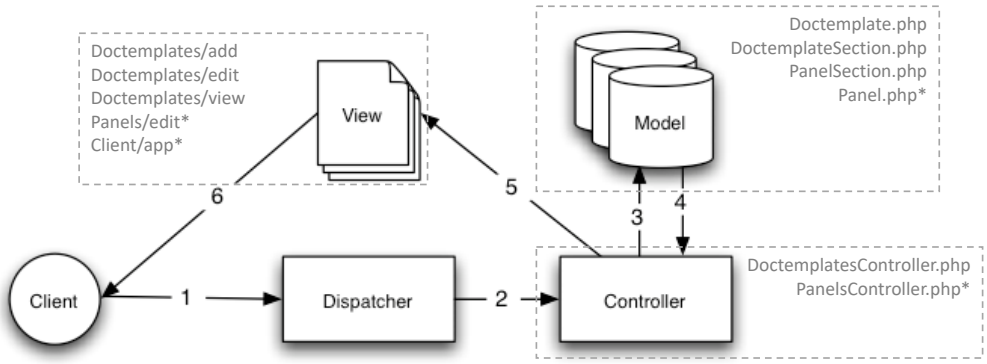


Figure 4.11: Classes implemented for the medical report generation feature shown in the context of the CakePHP request cycle (adapted from CakePHP (2011)). The classes marked with a * stem from the Tele-Board system and have been adapted.

4.5.6 Implementation

The implementation of the medical report generation feature builds upon the existing Tele-Board software code (see Chapter 3) based on the open-source web framework *CakePHP* (version 2.9.9). The software library *PhpOffice*[1] was used for processing Word files, detecting placeholders and generating Word files. PhpOffice requires the library *Zendframework*.[2] Both libraries were integrated with the help of the CakePHP plugin *Composer*.[3] The controller `DoctemplatesController.php` including the methods `add`, `edit`, `view`, `remove` and `downloadGeneratedDocument` was implemented in PHP. The methods are documented with flowcharts in Appendix A.5. The method `downloadGeneratedDocument` is responsible for generating a text document based on the text template and the whiteboard panels' text sticky notes. The three views (`add`, `edit`, `view`) were implemented in *PHP* and *HTML* and correspond to the three controller methods (see Figure 4.11). The model layer was

[1] https://github.com/PHPOffice

[2] https://framework.zend.com/

[3] https://getcomposer.org/ Composer is a dependency manager for PHP, which declares the libraries the program depends on and manages their installation. PHP libraries, which are installable with Composer, are collected in the PHP package repository *Packagist* (https://packagist.org/).

implemented with three PHP files (`Doctemplate.php`, `DoctemplateSection.php`, `PanelSection.php`) which represent database tables shown in Appendix A.4. The function `assignSectionsToPanel` for assigning documentation template sections to panel areas (see Figure A.17) was implemented in the already existing controller `PanelsController.php` and view `Panels/edit`.

The function `viewSectionSortingGrid` for viewing the section sorting grid in the whiteboard client (see Figure A.18) was implemented in the already existing view `Client/app`.

4.6 Visual Session Summary Feature

In behavior psychotherapy, short session protocols are used to name the most important interventions and outcomes of therapy sessions. While medical reports summarize the content of several treatment sessions for administrative purposes, the visual summary illustrates the course of one session. The TBM session summary feature generates visual session protocols automatically. The protocol shows all the whiteboard panels that were worked on during the session. It contains selected sticky notes that were identified as important or particularly memorable during the session. It can be exported as an image file and handed to the patient to take home after a session. More details about the session summary feature can be found in von Thienen et al. (2016).

4.6.1 Conceptual Considerations

Similar to the other TBM whiteboard templates, the session summary is visual and structured in a way that is easily understandable for both therapist and patient. Technically, a generated session summary is a normal whiteboard panel. Figure 4.12 shows an example of the visual session summary created automatically with TBM. The summary structure was tested and refined in more than 30 therapy sessions, taking into account the feedback of psychotherapists (see von Thienen et al., 2016). The summary contains a header with the date and time of the treatment session as well as a patient identifier. It contains whiteboard panels that were worked on during the treatment session and selected whiteboard elements.

4.6.2 Functionality

The visual session outline is created based on the whiteboard panels used throughout a session. Before the treatment session starts, the therapist selects a patient file in the web portal and clicks on a button to start the session. Once the treatment session mode is active, a clock starts running, indicating the elapsed session time. During the session, TBM tracks the whiteboard panels that the therapist and patient are working on. At the end of a session, the therapist presses a button to exit the treatment session mode. This triggers the automatic generation of the session summary based on the default settings. The session summary can be viewed directly

in the whiteboard client. Thus, at the end of the session, a summary is readily available and can be used to wrap up the session together. The settings for the summary generation can be adapted manually and the summary can be created anew. Therapists can configure whether or not their protocols should include a title, the patient identifier, and the start and end time of the session. Furthermore, they can select which of the panels used shall be taken into account and what type of sticky notes to include based on their characteristics, e.g. whether they have been (un)pinned to the whiteboard background or marked with a voting dot (see whiteboard client functionality described in Section 3.1). While editing the settings for summary generation, a preview helps to instantly see which elements will be included in the summary.

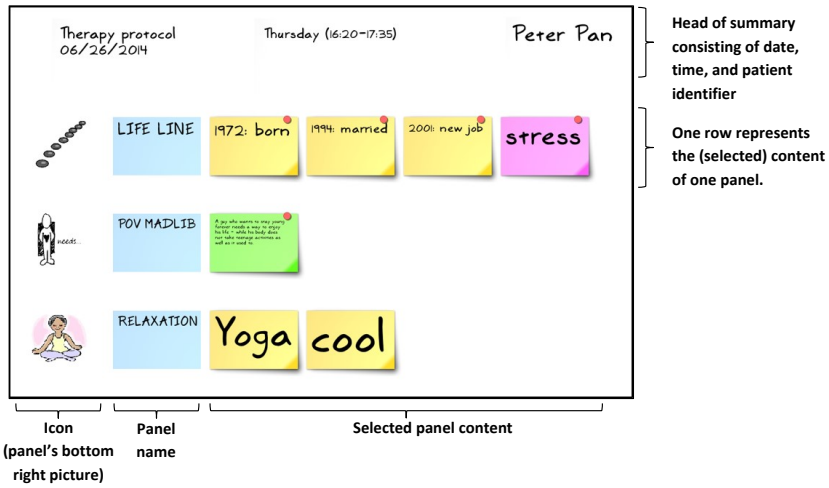


Figure 4.12: Example of a session summary with annotations about the general structure. In this session, the therapist and patient used three different whiteboard panels. In the beginning of the session, they worked on the patient's life line, where four sticky notes were considered especially important (adapted from Perlich and Meinel (2015)).

4.7 Note-Taking Input Modes

The sticky pad app for note-taking (see Section 3.1) was extended for Tele-Board MED. In medical documentation, it is important that captured digital information can be reused for other purposes, e.g. the automated generation of clinical documents. Because digital handwritten scribbles do not fulfill this requirement, the sticky pad app was extended by handwriting recognition and speech recognition features by Wenzel et al. (2019). An earlier feature in the Tele-Board system for handwriting recognition on a digital whiteboard panel was developed by Gericke, Wenzel, Gumienny, Willems and Meinel (2012). Figure 4.13 shows the three modes of capturing notes in the TBM sticky pad app: Information can be typed via the

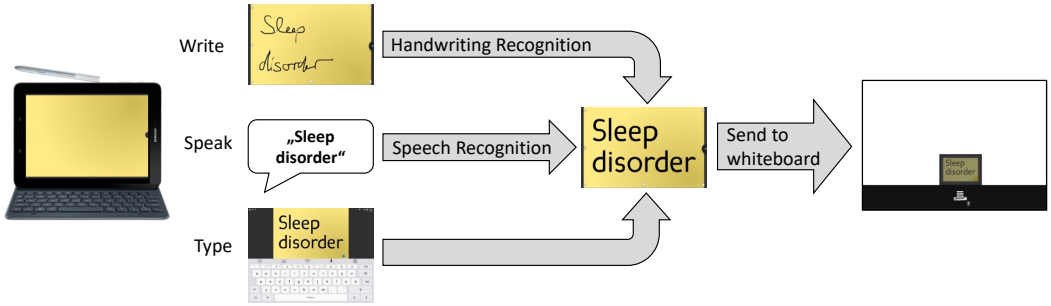


Figure 4.13: Three possibilities of capturing textual notes with the sticky pad app.

on-screen keyboard or a connected hardware keyboard, and can be entered via handwriting and speech. When the sticky note is submitted, it pops up at the bottom area of the whiteboard client and can be dragged to the whiteboard surface.

4.7.1 Handwriting Recognition

Handwritten notes can be taken using a digital pen or the finger tip on a mobile device. With the press of a button, the handwritten text is converted to the corresponding computer text representation. The main TBM web server provides *REST* endpoints for handling the handwriting recognition requests. When the user presses the handwriting recognition button in the sticky pad app, the scribble (represented by vector data in *JSON* format) is sent to the server. It is then handled by the *REST* endpoint and passed on to the handwriting recognition server. Here, a *C#* console application is executed, which uses the *Microsoft Ink API* for handwriting recognition. In order to make use of this API, a *Windows 10* server was set up that runs a *NodeJS* web server. Once the recognition is finished, a string with the computer text representation of the scribble is sent back to the TBM server, which in turn sends it to the sticky pad app. The user can send the text sticky note to the whiteboard client.

4.7.2 Speech Recognition

The speech recognition feature relies on the built-in microphone of the hardware device. In order to capture spoken words, the user presses the recording button in the sticky pad app running in the *Google Chrome*[4] browser. Once the button is pressed again, the audio recording ends and the speech recognition starts. The recognition is handled by *SpeechRecognition API*[5] provided through the browser. This service is located on a server which lies outside of the controlled scope of the TBM system. Therefore, the current implementation of speech recognition only serves proof-of-concept and test purposes and is not intended to be used with personal patient data.

[4] https://www.google.com/intl/de_de/chrome/
[5] https://w3c.github.io/speech-api/#speechreco-section

4.8 Information Security in Medical Documentation

In order to test TBM with patients in clinical institutions, such as outpatient practices or hospitals, the system needs to be integrated into the institutions' infrastructure. The application of an information system in the appropriate environment involves its secure integration in the context of people, organization and technology (see also Section 1.2). Actors involved in the clinical integration of a digital note-taking system are not only therapists and patients, but also clinic managers, technical administrators and researchers. During the evaluation phase, both TBM researchers and clinic administrators were jointly responsible for the information security. When dealing with personal data in healthcare organizations, the legal conditions and data security regulations are especially strict.

4.8.1 System Integration into a Clinical Environment

For the use of TBM with patients in an outpatient clinic (see Section 5.2.2), a dedicated server was set up and integrated into the clinic network (see Figure 4.14). This machine is located on the clinic's premises and is not publicly available via the internet. It runs the TBM server component, including the database. A network-attached storage (NAS) is connected to the TBM server for daily data backups. In order to control the connections, the TBM hardware components are located in a dedicated subnet. In order to protect the clinic network's security, connections initiated by the TBM server are blocked using a router with a firewall. The router only allows connections from the clinic network to the TBM server. Thus, therapists can log into the TBM application via desktop computers and laptops connected to the clinic network. When the technical administration of the TBM server is done by external parties (in our case us university researchers), a connection for remote maintenance can be set up. We used a password-protected *VPN* (Virtual Private Network) connection to the TBM subnet based on the *SSH* (Secure Shell) protocol, which allows for encrypted connections. The *VPN* connection can only be established from a specific range of IP addresses. Remote maintenance is carried out via a dedicated computer. The implemented measures are in line with the recommendations by the German Medical Association and National Association of Statutory Health Insurance Physicians[6] about data privacy and data processing in the doctor's office, which are based on legal regulations (see also Section 2.2.4).

4.8.2 Information Security Objectives

We pursued the following information security objectives for web-based healthcare applications suggested by Roehrig and Knorr (2000): confidentiality, integrity, availability, and accountability. Confidentiality, integrity, and availability are the so-called *CIA* requirements for communication security. Accountability is the fourth

[6] Bundesärztekammer und Kassenärztliche Bundesvereinigung, Hinweise und Empfehlungen zur ärztlichen Schweigepflicht, Datenschutz und Datenverarbeitung in der Arztpraxis – Technische Anlage: https://www.kbv.de/media/sp/Technische_Anlage_Datenschutz.pdf

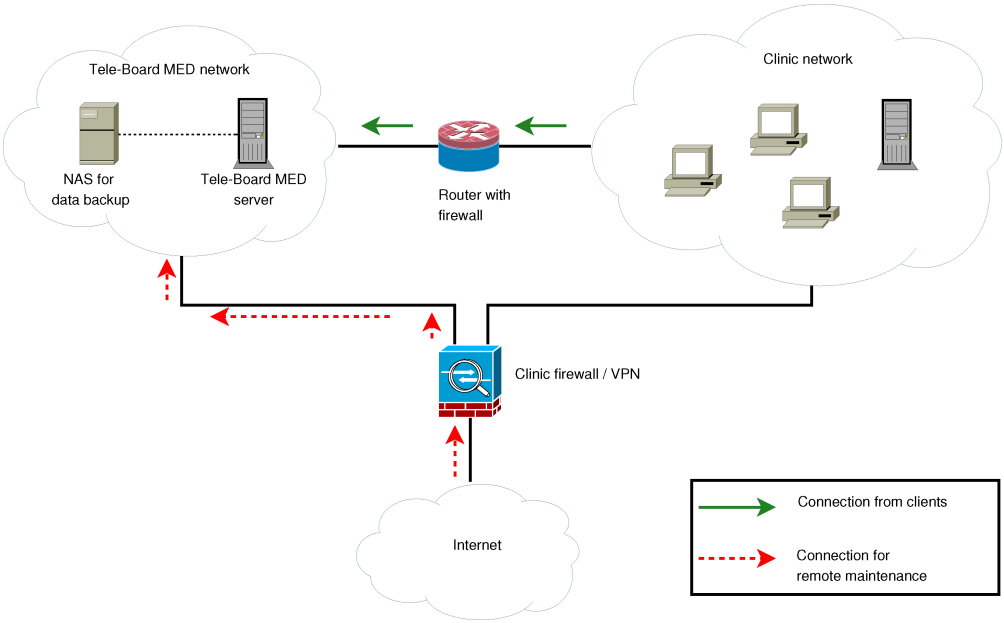


Figure 4.14: Integration of the Tele-Board MED server into the clinic network (adapted from Perlich et al. (2015)).

major security objective for information systems in healthcare. The following paragraphs describe how these objectives were met by implementing security measures for the use of TBM with patients (see also Perlich et al., 2015). The described measures offer only a minimal level of data security. For a long-term operation of TBM in a clinical context, a higher security level is recommended. The security can be further enhanced by e.g. two-factor authentication, database integrity checks, chip cards for storing cryptographic keys, continuous monitoring of the critical services, client certificates and automated security scans.

Confidentiality Keeping data confidential means protecting it from unauthorized disclosure. In healthcare, where highly sensitive data is handled, confidentiality is considered the most important security objective. Data confidentiality measures have been implemented to prevent unauthorized access to the TBM system. The dedicated TBM server is only accessible within the clinic network by entering a specific URL in the browser. For the system login, TBM uses a form-based authentication mechanism that requires user name and password. User accounts are given out to therapists after a personal introduction. In the TBM evaluation phase, researchers were in charge of the user account management, and later on administrators would take on this responsibility. In order to ensure a secure data transfer between the TBM server and the user's browser, TBM only allows encrypted connections via *HTTPS*. The encrypted transmission is based on public-key cryptography with *RSA*[7] and the Secure Hash Algorithm *SHA2*. In order to prevent physical

[7] Cryptosystem named by the authors Rivest, Shamir, Adleman

access to the data, the server's hard disk holding the patient data is encrypted. Furthermore, as an organizational confidentiality measure, third parties having access to the data (e.g. researchers, external administrators) sign the non-disclosure agreement of the cooperating clinic.

Integrity Integrity implies the assurance that data is not tampered with and is in the state it is supposed to be. In healthcare, compromised data integrity can lead to e.g. medical malpractice. Integrity measures have been implemented to prevent unauthorized data manipulation through the TBM application or at the database level. The TBM server and the database are protected with long, complex passwords. Each interaction with the TBM whiteboard interface triggers a transaction with the TBM database. Deleted whiteboard elements are not completely erased from the database, but only tagged as deleted and thus no longer shown on the whiteboard panel. Whiteboard data can be recovered with the history browser that can load former whiteboard states (see Gericke et al., 2010). Upon the request of patient and therapist, the whiteboard data is permanently erased.

Availability An information system's availability implies that the required services and data are delivered within an acceptable period of time. Therapeutic or vital interventions can be delayed when a computerized system takes too long to respond, e.g., due to collapse or overload. The physical TBM application server is a high-performance machine which allows the handling of many user requests at once, e.g. when a high number of therapists simultaneously require access to the application. A restricted firewall was set up in order to prevent the server from being attacked. It is configured such that only the ports for *HTTPS* (for encrypted communication via the web browser) and *SSH* (for remote maintenance) are opened. In the case of hard disk failure, the redundant data storage is used based on the *RAID* (Redundant Array of Independent Disks) system. In this case, the server automatically uses the mirrored hard disk until the failed one has been replaced. In order to be prepared for a possible data loss on the server, database backups are created automatically. On a daily basis, a backup script archives, encrypts and stores the data on a network-attached storage (NAS).

Accountability An information system's accountability confirms the identity of every actor in a communication (e.g., a person or machine). In the context of healthcare, it is crucial to know who performed which service and when in order to hold stakeholders responsible for their actions. The TBM server holds an *X.509* certificate, which is used to verify the server's identity and allow for encrypted data transmission to the client (via *HTTPS*). The *X.509-v3* certificate uses the *SHA-256* hashing algorithm and the 2048-bit *RSA* signature algorithm. This certificate was issued by the University of Potsdam as certificate authority (CA), which is approved by the German National Research and Education Network.[8]

[8]German: Deutsches Forschungsnetz (DFN)

Chapter 5

Research Design

We conducted seven evaluation studies to address the research questions introduced in Section 1.1. This chapter describes how the research was conducted following the information systems research approach (see Section 1.2). The first section provides an overview of the evaluation studies conducted. Second, the clinical evaluation environments in which Tele-Board MED (TBM) was tested are described. The third section is dedicated to the TBM artifacts that were built, such as videos and functional prototypes. Afterwards, the applied empirical research methods are illustrated. The final section addresses ethical considerations.

5.1 Evaluation Studies

The conducted studies were part of an iterative process of building and evaluating and can be classified according to the four kinds of evaluation studies proposed by Sonnenberg and vom Brocke (2012) (see Figure 5.1). *EVAL1* and *EVALs* cover "ex ante" evaluations which are conducted prior to artifact construction. *EVAL3* and *EVAL4* cover "ex post" evaluations which are conducted after the artifact construction. Table 5.1 shows an overview of the studies.

- *EVAL1* covers the evaluation of the research problem identified in order to ensure that it is important and relevant for practice and suitable for a novel research project.
  - **Therapist feedback study** delivered justification of the research questions and objectives of TBM.
- *EVAL2* covers the evaluation of design decisions in order to show that an artifact design (expressed by e.g. design specifications) evolves into a solution to the stated research problem.
  - **Therapist demonstration study** delivered justification of the TBM tool for taking notes on a digital whiteboard.
  - **Technology acceptance study** evaluated TBM's suitability in the field of addiction counselling.

- *EVAL3* covers the evaluation of constructed artifacts in an artificial or partially real context in order to make early inferences about the artifacts' utility. The context can be described according to the "three-realities" paradigm, according to which evaluation studies may involve a subset of real tasks, real users, and real systems (Sun and Kantor, 2006).
  - **Expert rating study** led to the evaluation of a functional TBM artifact in an artificial setting.
  - **User experience study** evaluated TBM's ease of use, and the effectiveness and efficiency of the TBM report generation feature.
- *EVAL4* covers the evaluation of the use of an artifact in a naturalistic setting in order to show that it is both applicable and useful in practice. Such naturalistic evaluations include all of the complexities of human practice in the organizational context which are affected by the adoption of the new technology.
  - **Outpatient clinic study** involved a real system, real users, and real tasks – however, it did not deliver the expected outcome.
  - **Hospital case study** proved the effectiveness and usefulness of TBM in real treatment sessions and assessed the effects on the patients and the therapist-patient relationships.

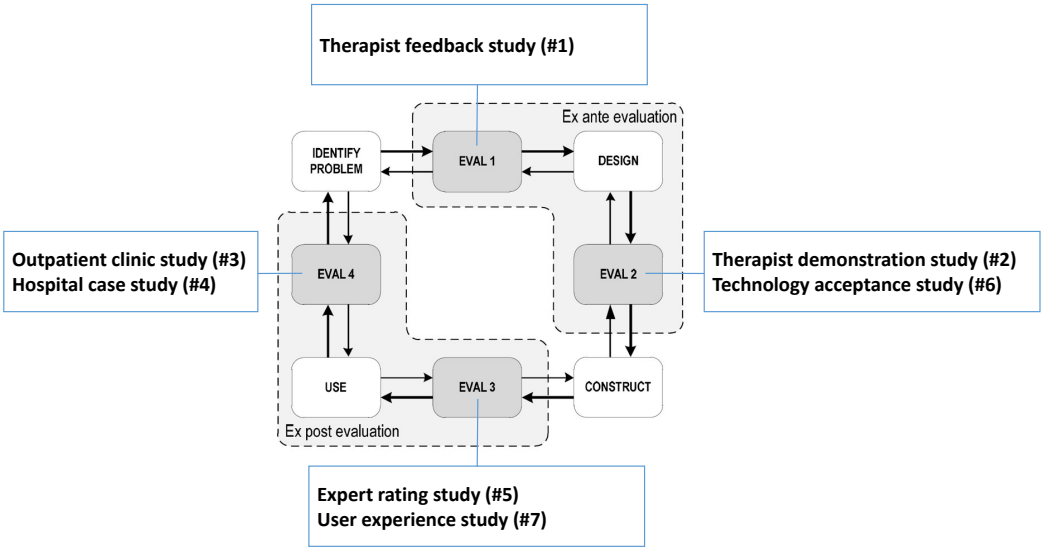


Figure 5.1: Evaluation activities framework (adapted from Sonnenberg and vom Brocke (2012)) and classification of our seven studies.

Study	1) Therapist feedback study: Assessment case report creation habits, attitude towards TBM	2) Therapist demo study: Assessment note taking habits, attitude towards summary feature	3) Outpatient clinic study: Field experiment with TBM	4) Hospital case study: Evaluation of TBM in the field	5) Expert rating study: Rating of therapeutic relationship with and without TBM	6) Technology acceptance study: Evaluation of TBM technology acceptance	7) User experience study: Evaluation of TBM user experience
Context	Psychotherapeutic outpatient clinic	Psychotherapeutic outpatient clinic	Psychotherapeutic outpatient clinic	Psychiatric hospital ward	Treatment roleplay simulation	Addiction counselling center	Anamnesis session simulation
Participants	34 therapists	10 therapists (age: 27-57yrs, avg. 38.2)	0 therapists	1 therapists, 10 patients (diagnostics), 9 pat. (treatment), total n=17)	8 eHealth experts, 28 human-centered design experts, total n=36	13 therap. (age: 33-56yrs, avg. 46), 33 pat. (age: 27-69yrs, avg. 48)	4 therapists (age: 26-32 yrs, avg. 28)
Artifacts	Intro video	Func. prototype	Func. prototype	Func. prototype	Func. prototype	Roleplay video	Func. prototype
Format	remote, unmoderated	in-person, moderated, 120min	-	in-person, unmoderated	in-person, moderated, 15min	in-person, moderated, 70min / 15min	in-person, (un)moderated
Methods	Questionnaire	Questionnaire	Action research	Action research	Roleplay, questionnaire	Questionnaire, focus group	Self-confront., UXcurve, simul.
References	Perlich et al. (2014); von Thienen et al. (2015)	Perlich and Meinel (2015); von Thienen et al. (2016)	Perlich et al. (2015); Perlich, von Thienen, Wenzel and Meinel (2018)	Perlich and Meinel (2016); Perlich, von Thienen, Wenzel and Meinel (2017)	Perlich, von Thienen and Meinel (2017)	Perlich, Meinel and Zeis (2018)	Perlich and Meinel (2018); Perlich et al. (2020)

Table 5.1: Overview of evaluation studies.

5.1.1 Therapist Feedback Study

The therapist feedback study (Study 1) was an early study with psychotherapists at an outpatient clinic (see Figure 5.2) (see also von Thienen et al., 2015; Perlich et al., 2014). This study entailed a preparatory literature review and observations of therapists in counselling sessions. Based on the introduction video for therapists described in Section 5.3.1, we conducted a digital survey with 34 therapists. A questionnaire was used to assess their case report creation habits, their attitude towards the patients' rights law requesting record transparency and their attitude towards the TBM system for digital, collaborative note-taking in patient sessions. The questionnaire items can be found in von Thienen et al. (2015). As such, we justified the problem statement on therapists' daily documentation work (see also Section 2.2). Furthermore, we found an existing gap in tools that address the problems of administrative documentation and patient record transparency (see also related work in Section 2.5). By evaluating the suitability of TBM to meet the current problems, we strengthened the objective of adapting the Tele-Board system described in Chapter 3 to the field of talk-based healthcare.

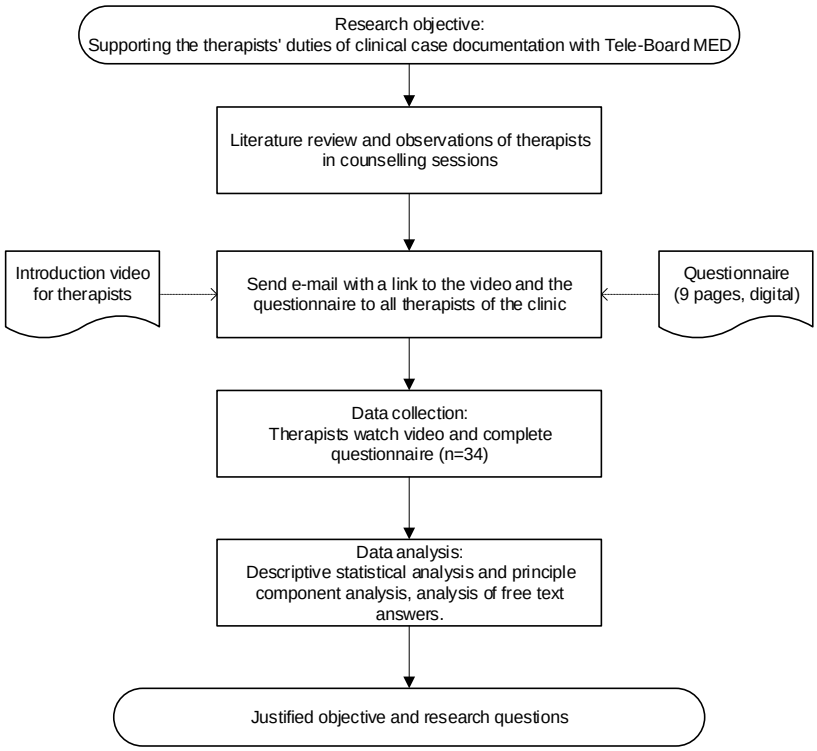


Figure 5.2: Procedure of therapist feedback study (Study 1).

5.1.2 Therapist Demonstration Study

The therapist demonstration study (Study 2) was conducted in cooperation with the same outpatient clinic as Study 1 and assessed therapists' note-taking habits and attitudes towards TBM and its session summary feature (see Figure 5.3) (see also Perlich and Meinel, 2015; von Thienen et al., 2016). We started with an initial survey on note-taking habits and patient session summaries. Afterwards, we gave a demonstration of a functional TBM prototype (described in Section 5.3.2.1) including the session summary feature to 10 psychotherapists by acting out a therapist-patient interview with collaborative note-taking on digital whiteboard panels. A digital whiteboard, a tablet computer and a wireless keyboard with touchpad were used (see also Section 4.1.2). After the demo, the therapists were invited to take on the role of the patient and improvise a therapy session situation with TBM. Furthermore, the therapists were able to freely experiment with the system and create some notes and drawings. Afterwards, in a second survey, we collected data on their perceptions of the TBM session summary feature. Details about the questionnaire can be found in von Thienen et al. (2016).

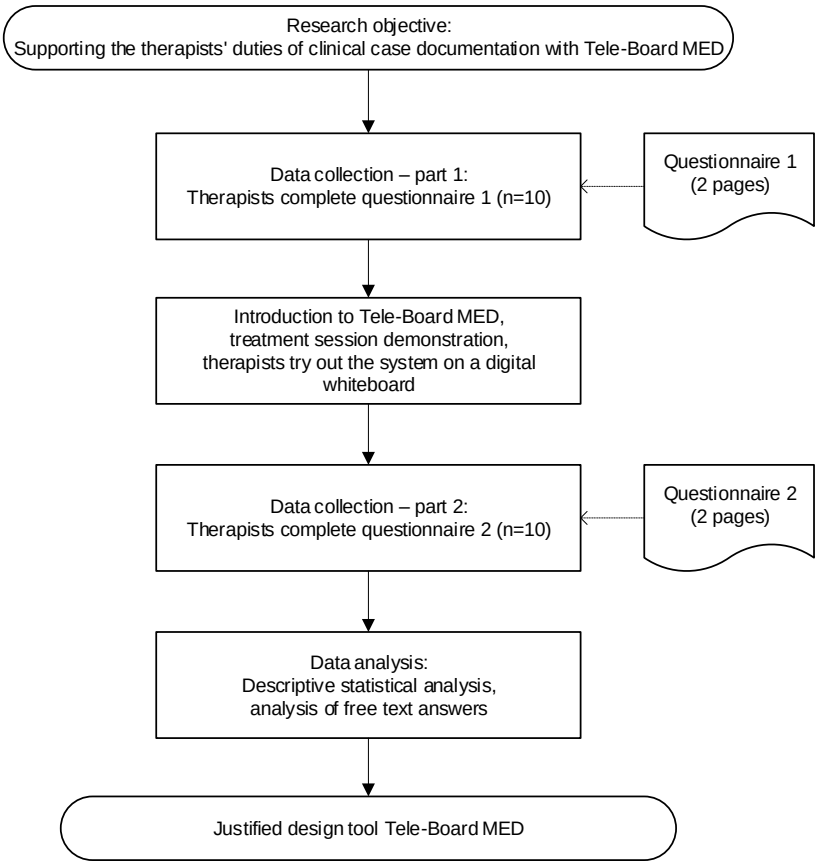


Figure 5.3: Procedure of therapist demonstration study (Study 2).

5.1.3 Outpatient Clinic Study

Based on the positive therapist feedback collected in Studies 1 and 2, we conducted a field experiment with a functional prototype (see Figure 5.4) (see also Perlich et al., 2015; Perlich and Meinel, 2018). We investigated how TBM could be included in the clinic workflows and facilities. TBM was set up at the outpatient clinic, including the integration into hardware and network infrastructures. Afterwards, we conducted a 3-hour training event with eight clinical therapists on how to use the system. However, the study did not deliver the expected outcome of validating TBM in a naturalistic setting, because we failed to gain therapists as participants for our planned long-term study. One reason was that the study design was too strict and expected an experimental group of therapists using TBM and a control group using traditional documentation approaches. We learned that in the clinical context it is not realistic to expect therapists to use TBM in all of their sessions with a certain patient. This is because they choose their interventions and tools (whether a worksheet, a practical exercise or a system like TBM) in patient sessions very carefully depending on the specific case and session content.

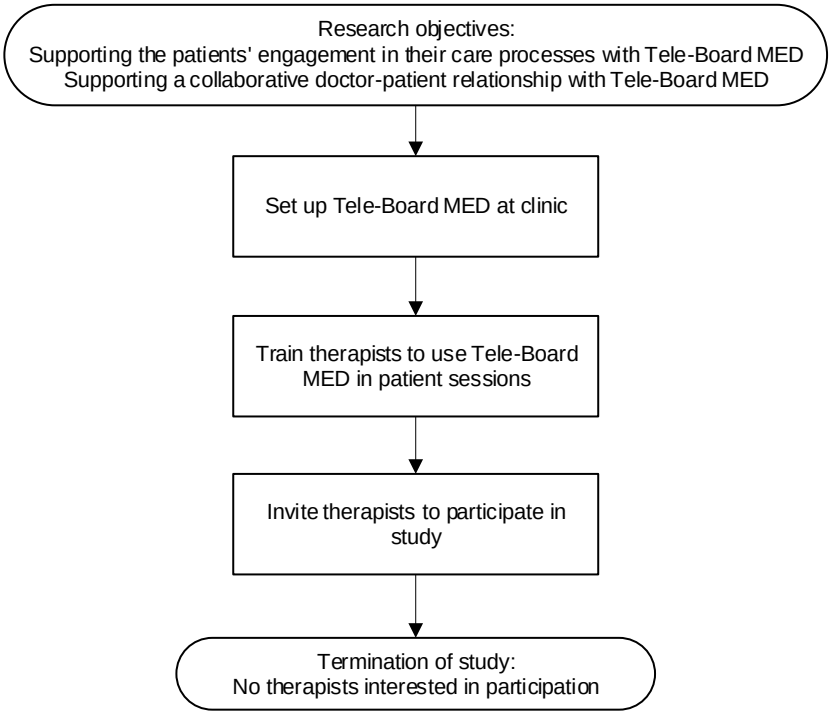


Figure 5.4: Procedure of outpatient clinic study (Study 3).

5.1.4 Hospital Case Study

We conducted a hospital case study (Study 4) where TBM was used with patients at a psychiatric hospital ward (see Figure 5.5) (see also Perlich and Meinel, 2016; Perlich, von Thienen, Wenzel and Meinel, 2017). We used the method of action research described in Section 5.4.2 to evaluate the use of TBM in a naturalistic setting. A member of the research team who is a trained psychotherapist worked at the ward and observed workflows, patients' daily routines and staff responsibilities (see also Section 5.2.3). A functional TBM prototype including a mobile trolley on wheels containing a laptop, a projector and a wireless keyboard (see also Section 5.3.2.3) was integrated in the ward's organizational processes. TBM whiteboard panels for psychiatric diagnostics (see also Section 4.4.2) were used and tested with patients in one-to-one sessions. The therapist used the TBM system with 10 patients in diagnostic sessions and with 9 patients in therapeutic treatment sessions. In total, 17 patients experienced the TBM system over a period of one year. The therapist used the system when suitable and collected observations of TBM's practical consequences for the patients and the treatment session atmosphere. To evaluate the effects, the observations were mapped to the dimensions of patient-provider relationship and patient empowerment (see Sections 2.1.2 and 2.1.3).

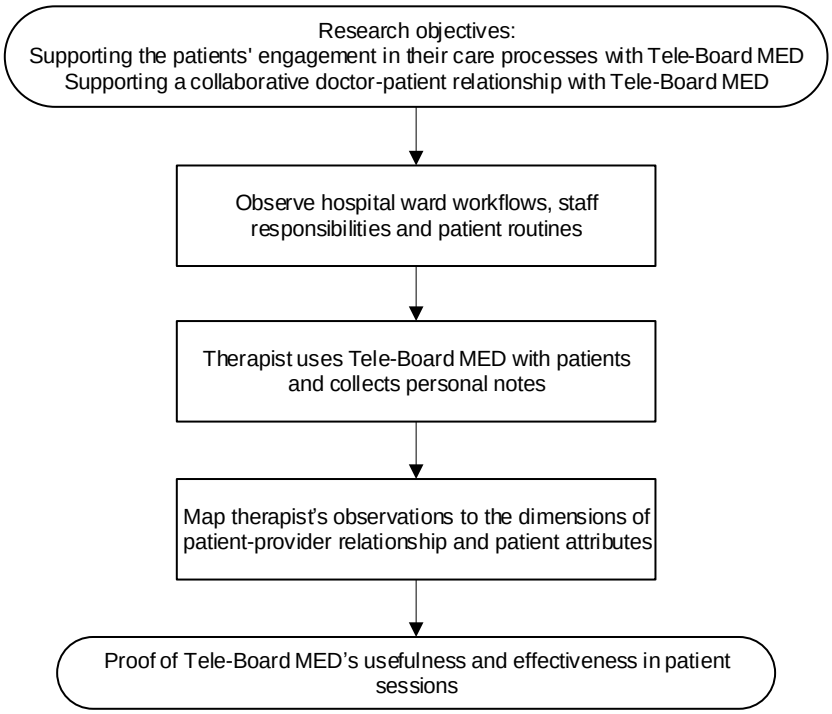


Figure 5.5: Procedure of hospital case study (Study 4).

5.1.5 Expert Rating Study

The expert rating study (Study 5) involved a roleplaying simulation of a treatment session scenario (see Figure 5.6) (see also Perlich, von Thienen and Meinel, 2017). Together with eHealth experts and human-centered design experts as observers and proxy patients, we evaluated the use of TBM in a simulated way (see methods in Section 5.4.6). The functional TBM prototype described in Section 5.3.2.1 was tested during a close-to-life conversation between a member of the research team who is a trained psychotherapist and a volunteer from the audience who played the patient role and spontaneously shared a personal problem on stage. Following a quasi-experimental research design with two conditions (traditional note-taking vs. TBM), the first half of the conversation was conducted with traditional documentation approaches and the second half was conducted using TBM. The experts assessed both conversations regarding the effect on the therapeutic relationship. Here, two questionnaires for pre-post comparison were used to collect quantitative rater data (see Appendix B.1). This study was conducted twice; the first one in Germany with 8 eHealth experts and the second one in the USA with 28 human-centered design experts.

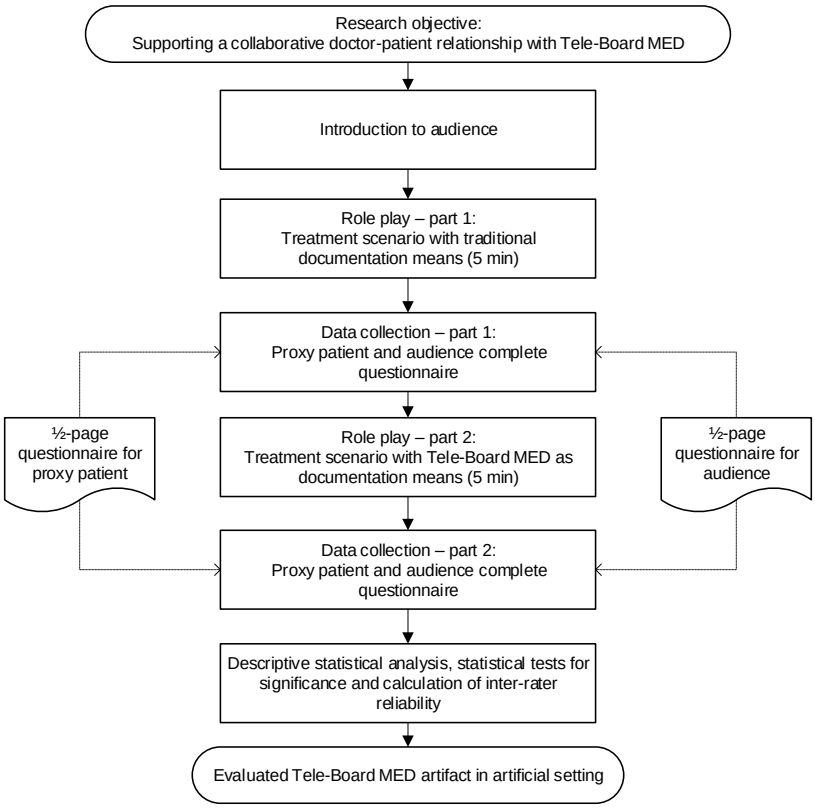


Figure 5.6: Procedure of expert rating study (Study 5).

5.1.6 Technology Acceptance Study

The technology acceptance study (Study 6) addressed the evaluation of the technology acceptance of TBM at an addiction counselling center described in Section 5.2.4 with 13 addiction therapists and 33 patients (clients) (see Figure 5.7) (see also Perlich, Meinel and Zeis, 2018). They watched a video showing the TBM system used in a roleplay of a psychotherapy treatment session (see also Section 5.3.1.3) and completed questionnaires. Both questionnaires for therapists and patients can be found in Appendix B.2. The patient questionnaire focused on the possible effects of TBM. Therapists were asked to rate items representing the UTAUT constructs (see Section 2.6) on a *Likert*-type scale. *Performance expectancy* was represented by items which constitute the goals of TBM, namely support in case documentation, patient engagement and the doctor-patient relationship. *Effort expectancy* was represented by items describing the interaction with TBM's software and hardware features. *Social influence* was covered by items relating to people who are important to the therapists and who influence their professional work. *Facilitating conditions* were represented by items describing TBM's integrability into existing work routines, as well as the fit of TBM to the therapists' personal attitude towards therapy and the counselling center's mission. The *intentions to use* was assessed by asking whether they would use TBM if provided at their clinic. We looked for interrelationships between the variables and calculated pairwise correlations among the predictors and the intention to use. In addition, we conducted a focus group with the therapists.

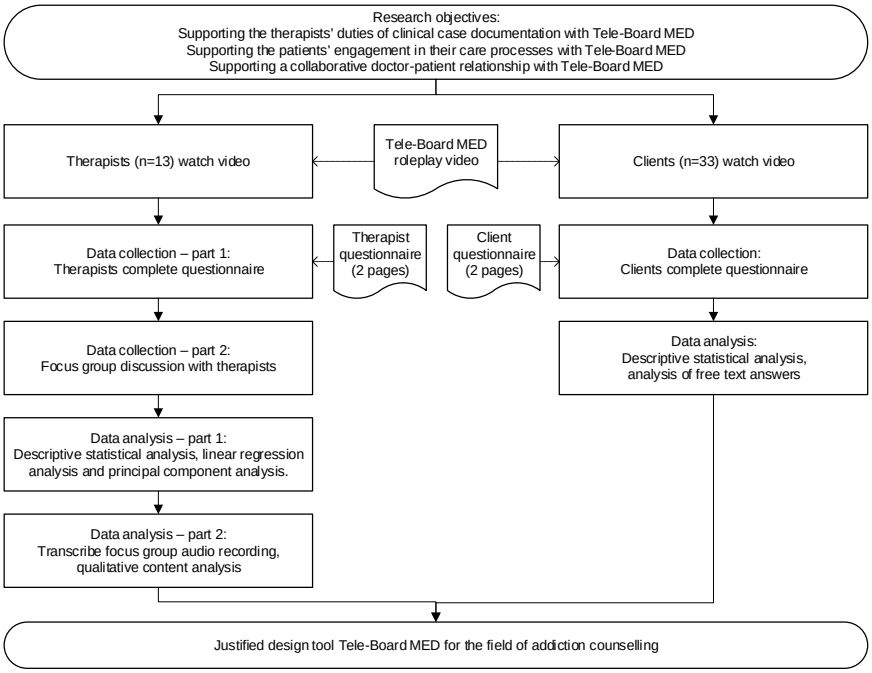


Figure 5.7: Procedure of technology acceptance study (Study 6).

5.1.7 User Experience Study

The user experience study (Study 7) was conducted with 4 behavioral therapists who were given the task of conducting a full-length anamnesis session of 50 minutes with simulated patients using a functional TBM prototype (see Figure 5.8) (see also Perlich and Meinel, 2018). The therapists were prepared in individual, 2-hour introductory sessions to try out the TBM whiteboard interface and the prepared documentation templates. Volunteers who acted as patients were asked to memorize a clinical psychology case (see methods described in Section 5.4.6). Therapists and volunteers simulated an anamnesis session conversation which was video-recorded. During the interview, the functional TBM prototype described in Section 5.3.2.1 and a set of prepared whiteboard templates illustrated in Section 4.4.3 were used for digital note-taking. Directly after the session, we applied the method of self-confrontation as described in Section 5.4.4. Afterwards, the therapists were asked to draw and annotate a user experience curve (see also Section 5.4.5). In the next step, they created a case report using TBM. The therapists generated a case report using the TBM report generation feature and revised it to be suitable to submit for health insurance purposes. We recorded the time needed to turn the generated file into a revised document. The therapists were asked to fill out a short questionnaire on demographic data and the report generation. The material used in this study can be found in Appendix B.3.

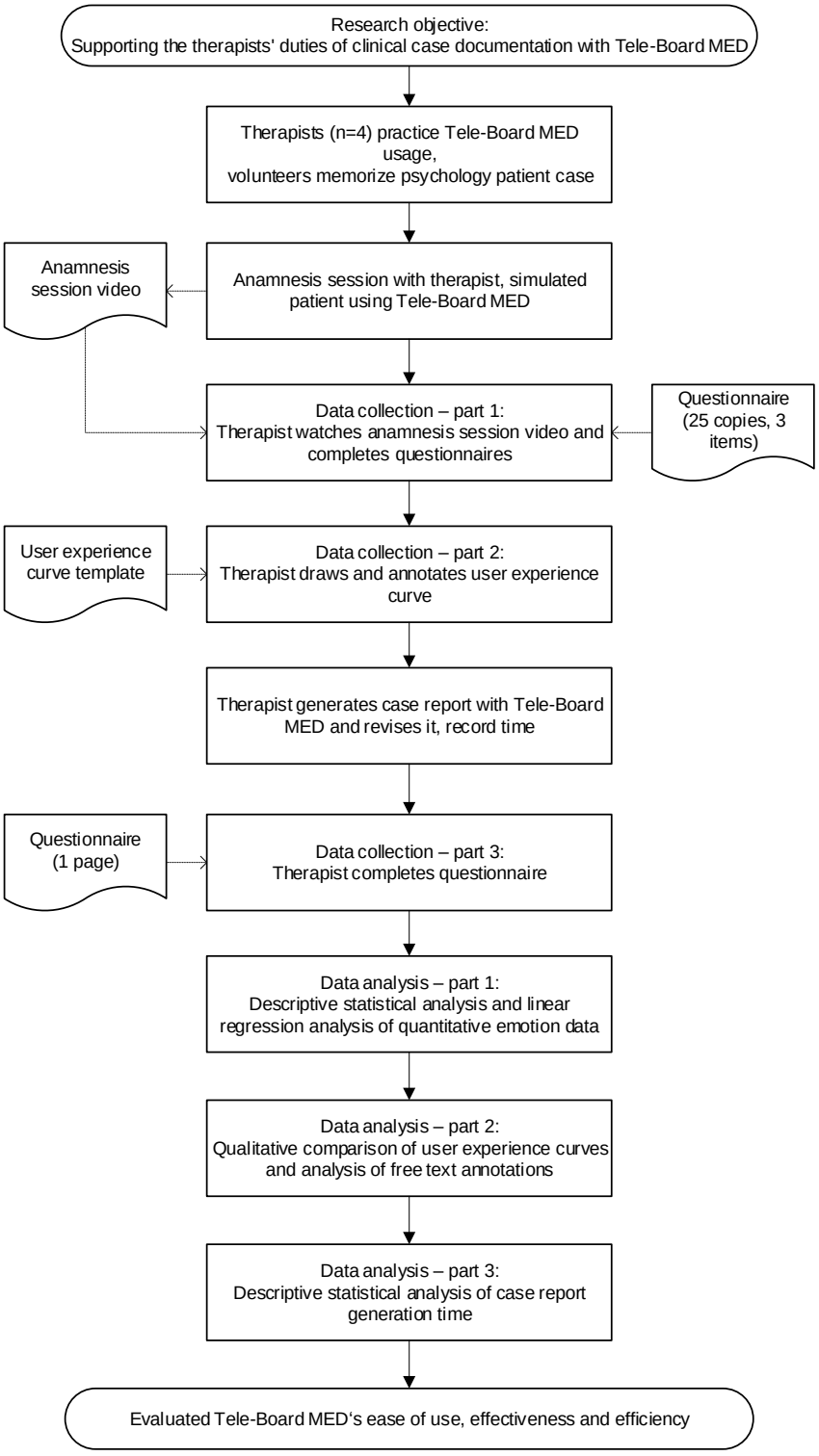


Figure 5.8: Procedure of user experience study (Study 7).

5.2 Evaluation Environments

TBM was tested in multiple therapeutic consultation environments in Germany, namely a classic psychotherapeutic practice, a psychotherapeutic outpatient clinic, a psychiatric hospital ward and an addiction counselling center. This section describes the environments with regard to the people involved, the organizational facilities, care processes and administrative processes, as well as the technology on site.

5.2.1 Psychotherapeutic Practice

The idea of TBM was initially tested with analogue artifacts in a small psychotherapeutic practice in Berlin. The practice is run by two therapists who follow the approach of cognitive behavioral therapy. At this practice, all kinds of mental health problems with diverse degrees of severity are treated. Patients see their therapist about once per week for one-to-one sessions. In this practice, the feel of collaborative documentation in patient sessions was explored with analogue flipcharts, pens and sticky notes by the research team member who is a trained psychotherapist. Early versions of TBM documentation panels were tested in the form of paper sheets in both sketched and printed versions.

5.2.2 Psychotherapeutic Outpatient Clinic

TBM was developed in collaboration with a major psychotherapeutic outpatient clinic in Berlin, which is managed by two directors and two technical administrators. About 100 therapists work at this clinic and over 200 are being trained to become approbated psychotherapists. The therapist training takes about 3 to 4 years and contains theoretical lessons as well as practical training. In the second half of their training period, the trainees start seeing patients. The patient and therapist meet about once per week for a 50-minute session. In certain cases, this can last for up to two years.

At this clinic, all kinds of moderate mental illnesses are treated, such as phobia or addictions. Patients come with a referral from their general practitioner if any mental health issue is suspected. When the patient and therapist decide on a treatment agreement after up to five probatory sessions, the therapist writes a case report to the health insurance company in order to request funding (see also Section 2.2.2). If the application is accepted, a short-term therapy of up to 24 sessions can start. The treatment can be extended to a long-term therapy of up to 80 sessions.

The clinic has a main office and three field offices, which comprise treatment rooms for one-to-one and group sessions. The room booking is managed via an online system. A patient administration system is used for billing and reporting purposes. TBM was installed and integrated in the clinic network as described in Section 4.8.1. Data security measures were implemented and one treatment room in the main office (with a total of 10 rooms) was equipped with an interactive whiteboard screen and tablet computers (see setup in Section 4.1.2).

5.2.3 Psychiatric Hospital Ward

TBM was used in patient sessions at a psychiatric hospital ward of a major university hospital in Berlin. The mental health professionals at the ward comprise a head of department, two employed psychotherapists and five therapists in training. The hospital ward offers inpatient treatments for a clientele with rather severe mental illnesses, such as post-traumatic stress disorder and borderline personality disorder. Patients stay at the clinic between 2 and 12 weeks. Each patient is treated by several individuals between day and night shifts. There is a main therapist for single sessions, a co-therapist, therapists for group sessions, one physician in charge, one senior physician and nursing staff. All these people share information with each other on a daily basis regarding each patient's case. A number of different therapists are involved in diagnostic and treatment interventions for each patient. Each day, there is a specific treatment program with sessions of 50 minutes. Before therapists see their patients in an available treatment room, they prepare for the encounter in the staff room. When the treatment session is over, the room is left for the next people. The facilities comprise rooms for one-to-one and group therapy sessions next to the patient bedrooms. A core component of the hospital IT infrastructure is the patient administration system, which supports e.g. the handling of discharge letters. Documentation related to the treatment process, e.g. session notes, are captured by therapists in a paper-based fashion (see also Section 2.2.1). A simple technical setup of a functional TBM prototype independent from the clinic network and the public internet (as described in Section 5.3.2.3) allowed for a prompt and secure usage of TBM with patients.

5.2.4 Addiction Counselling Center

TBM was introduced to therapists and patients at an outpatient addiction counselling center in Potsdam. This center offers counselling and therapy for multiple types of addiction, such as alcohol, drugs, gambling and media. Weekly treatment is offered in one-to-one and group sessions of 50 minutes following behavioral psychotherapeutic approaches (see also Section 2.1.1). Initial counselling is done in several one-to-one sessions. Furthermore, drug-specific group sessions and group sessions for e.g. relapse prevention and self-regulation training are offered. Group sessions with 6-12 participants are held around topics such as motivation, rehabilitation or follow-up care. The treatment is funded by the German pension insurance. The center has two sites. The staff comprise 13 therapists and a four-person leadership team including a medical director, a technical administrator and two senior therapists. A patient administration system is used for the management of clients, appointment scheduling, report creation and accounting.

5.3 Testable Tele-Board MED Artifacts

This section describes artifacts which were built for the evaluation of the TBM concept and system in the domains of psychotherapy and addiction care. In the context of information systems design research (see also Section 1.2), artifacts are "innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, and use of information systems can be effectively and efficiently accomplished" (Hevner et al., 2004, p. 76). We developed TBM videos and functional prototypes that were tested in the evaluation studies.

5.3.1 Videos

Three types of videos were created for different purposes.

5.3.1.1 Introduction Video for Therapists

One of the first artifacts was a 15-minute video in the German language aimed at the audience of cognitive behavioral psychotherapists. The video consists of two parts.[1] In the first part, the legal and administrative requirements for psychotherapists are illustrated. The video summarizes the patient's rights law and the therapists' administrative duty to create case reports (see also Sections 2.2.5 and 2.2.2). The second part of the video introduces TBM as a possible solution to the requirements for psychotherapists and explains the concept, aims and functionalities of the system. The system setup, patient session use cases, software features, documentation templates and hardware options are illustrated. The video consists of presentation slides and an audio track with spoken explanations (see Figure 5.9). This video was used in the therapist feedback study described in Section 5.1.1.

5.3.1.2 Roleplay Video (English)

In order to communicate the idea behind TBM to a broad, international audience, a video was recorded in the English language.[2] The 7-minute video contains a short introduction of the TBM research team, an identification and comparison of therapist and patient needs (see Figure 5.10), a roleplay of a psychotherapy session with and without TBM, the research goals and a glimpse into empirical research findings of the therapist feedback study, the hospital case study and the expert rating study.

[1] First part available at https://www.youtube.com/watch?v=1O0nyp0eks8 (German video "Tele-Board MED - Der Bedarf"). Second part available at https://www.youtube.com/watch?v=p-XaLmmQabY (German video "Tele-Board MED - Der Lösungsansatz").

[2] Available at https://hpi.de/meinel/knowledge-tech/innovation-research/tele-board-med.html

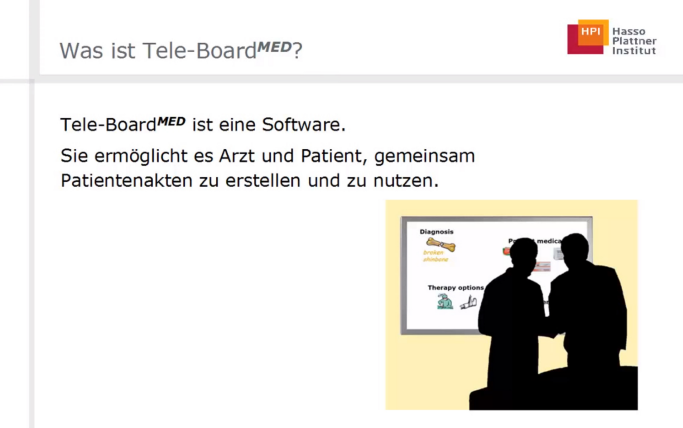


Figure 5.9: Screenshot of the introduction video for psychotherapists.

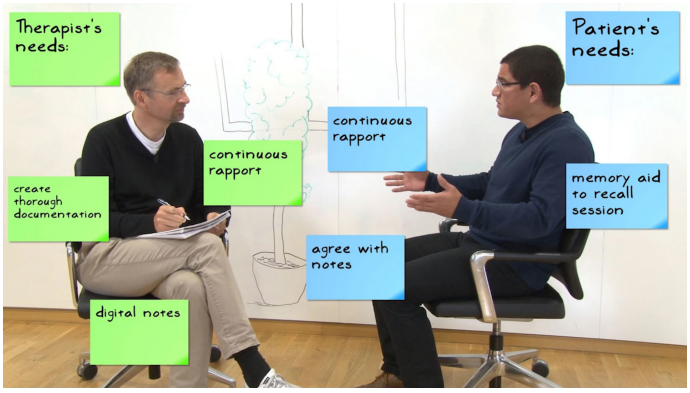


Figure 5.10: Screenshot of the English video showing a therapist-patient roleplay and a comparison of their needs.

5.3.1.3 Roleplay Video (German)

A video was recorded in order to convey the idea behind TBM to collaborating institutions in Germany.[3] The video shows a roleplay of a psychotherapy session with and without TBM. It shows a collection of whiteboard templates, explains possible hardware devices, and presents the handwriting recognition feature. Building on the administrative task of case report writing, the TBM medical report generation feature is also introduced. Furthermore, the video briefly explains the German patients' rights law, the implemented data security measures, as well as findings on the effect of TBM on the patient-therapist relationship (expert rating study, see Section 5.1.5). This video was used in the technology acceptance study in the addiction counselling center described in Section 5.1.6. In this study, therapists watched the full 7-minute video. Addiction clients were introduced to the TBM concept with a 3-minute extract of the video showing the treatment session roleplay only. A video screenshot is shown in Figure 4.2.

[3] Available at https://owncloud.hpi.de/index.php/s/E4YuY0iOkvM3tTm

5.3.2 Functional Prototypes

Several functional prototypes have been developed for early simulations as well as for real-life implementations in clinical routines.

5.3.2.1 Prototype for Demonstration Purposes

A functional prototype of the TBM software system is available on the public internet.[4] This prototype is suitable for demonstration purposes, roleplays and to experience tangible, hands-on interaction with TBM. A functional prototype of the TBM system including the session summary feature was evaluated in the therapist demonstration study (see also Section 5.1.2). In the expert rating study described in Section 5.1.5, the functional prototype was tested using the whiteboard template for behavior analysis (see Section 4.4.1). In the user experience study described in Section 5.1.7, a functional prototype was used including the medical report generation feature and a collection of templates that cover all the relevant psychotherapy anamnesis interview information (see also Sections 4.5 and 4.4.3).

5.3.2.2 Prototype for Testing at an Outpatient Clinic

The TBM system was integrated in the technical and organizational infrastructures of the psychotherapeutic outpatient clinic introduced in Section 5.2.2. The transition from a functional prototype for demonstration purposes to a system implementation dedicated for clinical use with patients was highly complex. We considered relevant policies, clinic processes and staff responsibilities, as well as existing technological infrastructures. In order to comply with the data security requirements, a dedicated TBM server was set up and integrated in the clinic environment (see also Section 4.8.1). The server machine was located in the clinic's premises, connected to the local clinic network and was not publicly available via the internet. The treatment room dedicated to TBM usage was equipped with a digital whiteboard, keyboards and tablet computers (see Figure 5.11). Furthermore, we set up a lockable cabinet to store technical accessories, such as tablet computers, keyboards and charging cables. This functional prototype was part of the outpatient clinic study described in Section 5.1.3.

5.3.2.3 Prototype for Testing at a Hospital Ward

A functional TBM prototype was installed at the psychiatric hospital ward, introduced in Section 5.2.3, as part of the hospital case study (see also Section 5.1.4). The initial hardware equipment consisted of a laptop holding a virtual TBM server, a projector and a wireless keyboard with touchpad (see Figure 5.12 and Section 4.1.2). This simple technical setup independent of the clinic network and the public internet allowed for a prompt and secure testing with patients. However, the devices needed to be carried manually to the treatment rooms. This approach was

[4] Available at `https://med.tele-board.de`

Figure 5.11: Tele-Board MED setup at a psychotherapeutic outpatient clinic including an interactive whiteboard, tablet computers and keyboards.

Figure 5.12: Tele-Board MED setup at a hospital ward. In the initial setup (left), a laptop and projector were installed in the treatment room positioned on chairs. In order to improve the mobility, a trolley was built to store and quickly move the devices (right).

unpractical, and it always took a few minutes from the valuable patient time to set up the equipment. To overcome this problem, we created a trolley on wheels with several shelves (see Figure 5.12). The devices were connected to a multisocket, such that only one electricity plug connection was needed. Furthermore, a mobile printer was added in order to provide print-outs for the patients to take home. With the equipment in the trolley, the therapist was able to flexibly move around the hospital floor. She could set up and dismantle the system instantly in the treatment rooms.

In comparison to the setup with the interactive whiteboard screen, this mobile setup yielded time savings regarding the system start-up and shut-down. The therapist was able to prepare the TBM documentation panels (see also Section 4.4) before the session in any available room at the ward. Shortly before the patient session started, the trolley was moved in the treatment room, computer and projector cables were plugged in, the TBM whiteboard surface was projected onto a wall and the session could begin.

5.4 Evaluation Methods

This section describes the empirical research methods applied in the evaluation studies. Following a mixed-method approach, both qualitative and quantitative methods and both explorative and conclusive methods were used. The methods were selected in consideration of the evaluation environments and the TBM artifacts. Methodological weaknesses are discussed in Section 6.8.

5.4.1 Questionnaire

A questionnaire is a written form of a survey to collect data systematically, e.g. about people's demographic background, their preferences and their behaviors. In our studies, we frequently used questionnaires for collecting both quantitative and qualitative data. For the studies carried out in-person, we used printed copies to be completed by the participants.

In the therapist feedback study, in which feedback was gathered from participants remotely, we used a digital questionnaire sent out via e-mail (see also Section 5.1.1). Questionnaires were used in conjunction with a focus group in the technology acceptance study (see also Section 5.1.6) and as part of self-confrontation in the user experience study (see also Section 5.1.7). The original questionnaires used in the evaluation studies can be found in Appendix B.

5.4.1.1 Questionnaire Content

Central questionnaire items used in all studies cover participant's sociodemographic data (e.g. gender, age) and their attitude towards technology (on a five-point scale: hostile, sceptic, neutral, friendly, enthusiastic). In studies with therapists as the target audience, an item on therapy experience (in years) was included. Depending on the specific study and the tested TBM artifact, we included further items on e.g. therapists' roles, activities and beliefs, their note-taking habits, digital case documentation, case report writing, as well as their attitude towards the TBM system and its features. When building on existing models of, e.g. technology acceptance (see Section 2.6) or patient-provider relationship (see Section 2.1.2), the questionnaire items were derived from the model's constructs.

5.4.1.2 Questionnaire Items

The surveys used combine check-box, scale and free text items. Discrete scales were used frequently, where one out of several possible answers should be chosen. We often used *Likert*-type scales to rate the participant's position towards a statement. For example, the statement "Tele-Board MED supports the communication with patients" was rated on a five-point *Likert*-type scale with the possible answers [-2] disagree, [-1] rather disagree, [0] uncertain, [1] rather agree, and [2] agree. Furthermore, we used semantic differential items in which participants placed an 'x' in a range between two extremes. For data interpretation, the handwritten 'x' was converted to a numerical value in a value range. To collect qualitative data in written surveys, we used free text items. In the therapist feedback study described in Section 5.1.1, we classified and counted the qualitative answers. In questionnaire series, in order to relate answers from different questionnaires to the same person, we used anonymized identifiers.

5.4.1.3 Statistical Analysis of Quantitative Questionnaire Data

The statistical analysis of the quantitative survey data was conducted with the software *SPSS* versions 22-25. Depending on the variables' measurement scales, we conducted descriptive statistics. We calculated the frequency distribution, tendency values (median, mean), dispersion values (minimum, maximum, standard deviation) and percentile values (quartiles) to describe our samples.

In the expert rating study described in Section 5.1.5, in order to determine the degree of agreement among the audience raters, we calculated intra-class correlation coefficients for single measures and *Cronbach's alpha* for average measures. We used correlation coefficients of *Pearson*, *Spearman's rho* and *Kendall's tau-b* to measure pairwise correlation among two raters. In order to show the correlation's level of statistical significance, we used dependent t-tests for paired samples with two-sided p-values. Furthermore, we calculated *Cohen's d* to estimate the effect size of the TBM intervention.

In the technology acceptance study described in Section 5.1.6, the *Pearson* coefficient was calculated in order to assess the correlation between variables of the UTAUT model (see Section 2.6), e.g. the therapist's attitude towards technology vs. the intention to use TBM. In this study and the user experience study described in Section 5.1.7, we applied inferential statistics and performed linear regression analyses in order to estimate the relationships among variables, e.g. between usage time and the therapist's feelings.

In the therapist feedback study described in Section 5.1.1 and the technology acceptance study, we applied a principal component analysis in order to discern different user groups among therapists.

5.4.2 Action Research

Action research is used in studies around social and workplace issues in environments which allow for little or no controlled conditions. In action research, some form of intervention is done in the particular environment and its effects are studied by means of participant observation. According to Cole et al. (2005), the approaches of action research and design research introduced in Section 1.2 show great similarities: Both are proactive in the sense that they intervene in an environment rather than studying a phenomenon after the fact. In the context of technology and human-computer interaction, action research is the "study of how technology is applied in the real world and the practical consequences of technology-enabled action" (Kock, 2015, p. 1). In this thesis, design research is considered the overarching research paradigm, and action research is considered a method implying a concrete intervention occurring within an organization.

Action research was used as an evaluation method in the outpatient clinic study described in Section 5.2.2 and the hospital case study described in Section 5.1.4.

5.4.3 Focus Group

A focus group is a qualitative research method conducted with a small group of people. In a moderated discussion, the participants are asked to articulate their attitudes, opinions and perceptions about a topic of interest. Focus groups can be used as a meaningful complement to questionnaires yielding additional, unexpected insights (Wolff et al., 1993).

In order to collect in-depth, qualitative data, we conducted a focus group discussion in the technology acceptance study described in Section 5.1.6. The discussion was based on the roleplay video in the German language (see Section 5.3.1.3). The focus group with addiction therapists was moderated and guided with open questions inspired by the dimensions of the UTAUT technology acceptance model (see also Section 2.6). The conversation was audio recorded, transcribed verbatim and analyzed with *MAXQDA 12*. We took a deductive approach to the qualitative content analysis and used the five UTAUT constructs as a predefined coding scheme.

5.4.4 Self-Confrontation

Self-confrontation is a video-supported self-report method. Participants are filmed while interacting with an artifact and asked to report about their experience while watching the film of the interaction immediately afterwards (Laurans et al., 2009).

In the therapist user experience study described in Section 5.1.7 we combined the methods of self-confrontation and questionnaire. The therapists were asked to watch the video, which was paused every two minutes. In each pause, the therapists completed a short questionnaire on their feelings and where their attention was directed at that moment (patient vs. TBM). The feelings of pleasantness and calmness were assessed. These dimensions of pleasant vs. unpleasant and calm vs. excited are commonly used for self-reporting the emotional response to human-computer

interaction (Laurans et al., 2009; Agarwal and Meyer, 2009). In order to assess whether the experience improved or worsened throughout a treatment session, we computed a linear regression model predicting the therapists' perceived pleasantness based on the time. The independent variable ranged between [1] the first assessment after 2 minutes and [25] the last assessment after 50 minutes. The dependent variable ranged between [-1] unpleasant and [1] pleasant. Furthermore, we did a statistical analysis on how the three variables related to each other. We combined self-confrontation with the user experience curve method described below.

5.4.5 User Experience Curve

The user experience (UX) curve is a method to collect qualitative data about a user's experience over time. The UX curve template proposed by Kujala et al. (2011) contains two parts: The first part provides space dedicated to accommodate a hand-drawn curve with a horizontal time axis and a vertical experience axis ranging from a negative to a positive feeling. The second part is an area for descriptions about the course of the curve.

In the user experience study described in Section 5.1.7, we asked the therapists to draw and annotate a curve of their feelings over time. We collected hand-drawn curves of four therapists and did a qualitative comparison in a composite diagram (see Figure 6.4). The free text annotations regarding the curve's rise and fall were transferred to computer text and analyzed and translated from German to English. As a hybrid of user experience research methods, UX curves were used in combination with the self-confrontation described above in order to collect both quantitative and qualitative data in the same study.

5.4.6 Patient Session Simulation

Simulated patients can be utilized when functionality and usability of health information systems should be studied without involving real patients. In design processes, a *proxy* assumes a role that is normally filled by a user (Boyd-Graber et al., 2006). A *simulated patient* is a trained layperson who plays the role of a patient in a testing encounter (Pheister et al., 2017).

In the expert rating study described in Section 5.1.5, TBM was introduced in an impromptu roleplay of a short, true-to-life therapy session with a proxy patient.

In the user experience study described in Section 5.1.7, a full-length anamnesis session was simulated in order to evaluate the therapists' user experience. Here, the patient volunteers were asked to memorize a case stemming from an educational book on clinical psychology (Reinecker, 1999), e.g. a case describing a 27-year old man suffering from obsessive-compulsive disorder. The description contained biographical information, a mental health problem including symptoms and unpleasant situations the person had experienced. To keep the interview as authentic as possible, the therapists were familiar neither with the actors nor with the case they would present.

5.5 Ethical Considerations

In all evaluation studies conducted, ethical aspects were carefully considered, such as maintaining the anonymity and confidentiality of the collected data. The study participants received information about the purpose of the research and the data collection procedure. Informed consent was obtained from the participants. In the conducted surveys, the data was collected anonymously and the completed questionnaires were put away safely. Digital data such as audio and video recordings were stored safely. In order to ensure confidentiality, the names of the participants were not revealed in the presentation of the results. An ethical approval for using TBM in counselling and therapy sessions was obtained from the ethics committee at the University of Potsdam (26/2018).

Chapter 6

Results

This chapter presents the results of the Tele-Board MED (TBM) evaluation studies. The findings are structured according to the subquestions of the three research questions introduced in Section 1.1:

RQ1. Can digital collaborative documentation support therapists in fulfilling their duties of clinical case documentation?
RQ2. Can digital collaborative documentation support patient engagement in care processes?
RQ3. Can digital collaborative documentation support a collaborative doctor-patient relationship?

6.1 Therapists' Documentation Activities (RQ1a)

We looked at the therapists' documentation activities regarding session note-taking, the creation of session summaries and the writing of case reports.

6.1.1 Note-Taking

In the therapist demonstration study described in Section 5.1.2 (n=10), we found that handwriting with pen and paper is the most common documentation approach both during and after patient sessions (see Table 6.1). During the session, 80% of therapists take notes, none of which are taken digitally. Therapists write an average of between one-quarter and one-half of an A4-page per session. Furthermore, 70% of therapists add notes after the patient session, 20% of which are taken digitally. On average, therapists take more notes during the session than afterwards, in order not to forget important things. Taking notes after the patient session allows therapists to give their full attention to the patient, even though it causes them extra hours and important aspects might be forgotten.

6.1.2 Session Summary Creation

In the therapist demonstration study described in Section 5.1.2, we found that therapists go over their notes again in order to create proper session summaries, because session notes are rather unstructured. More than 20% do not create structured summaries on a regular basis. However, 44% do create session summaries for more than 90% of their sessions. We asked the therapists about the time it takes them to create session summaries. Only 10% of them manage to do this in up to five minutes, but

Table 6.1: Percentage of therapists who take session notes.

	Handwritten notes	Digital notes	Notes (total)
During sessions	80%	0%	80%
After sessions	50%	20%	70%

for the vast majority it takes up to two hours. Considering that treatment sessions have a length of 50 minutes, this means that, on average, writing a proper session summary takes about half as long as the therapy session itself. Besides the legal documentation obligation (see also Section 2.2), there are other reasons for therapists to write session summaries. Mainly, they use summaries to keep an overview of the patient's treatment, to remember the case for the next meeting or to follow up and reflect on a session (see Figure 6.1, light grey bars). Handing out session documentation to patients is the least important reason for writing summaries. In line with this finding, 70% of therapists state that they have never handed out session summaries to patients. 30% of therapists have handed out summaries to patients in individual cases.

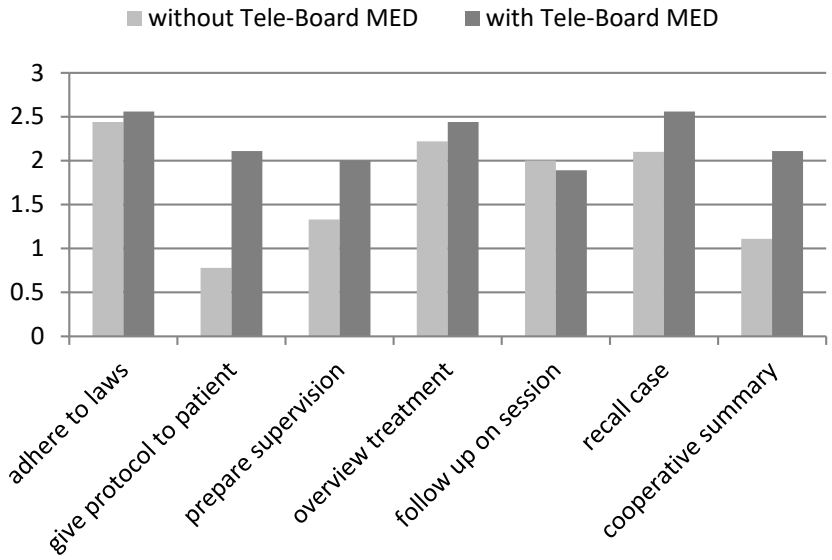


Figure 6.1: Therapists rated the purposes for creating session summaries on a scale from [0] not so important to [3] very important. The light bars show the ratings for manually created summaries and the dark bars show the ratings for summaries created automatically with Tele-Board MED (adapted from Perlich and Meinel (2015)).

6.1.3 Case Report Writing

In the therapist feedback study described in Section 5.1.1 (n=34) we found that the writing of case reports for therapy funding is regarded as an undesirable, time-consuming necessity. More than two-thirds of therapists need at least 5 hours to write one case report. All of them occasionally or often need one week or longer to finish one report. Thus, very often reports are not written in one sitting. When using data from patient questionnaires, more than one-third of therapists in every fifth case cannot read theirs patients' handwriting. Therapists develop pragmatic strategies to cope with the cumbersome task of writing case reports. We found that more than two-thirds of them often copy paragraphs from existing reports, and more than one-third often copy entire case reports.

6.2 Therapists' Acceptance Factors (RQ1b)

The following paragraphs describe the TBM acceptance factors found in the therapist feedback study, the therapist demonstration study, the user experience study and the technology acceptance study (see description of studies in Section 5.1).

6.2.1 Behavioral Psychotherapists

When we introduced the TBM system to therapists (n=34) in the therapist feedback study, 88% stated they could imagine using TBM with their patients. They thought that digital collaborative documentation would be helpful to fulfill their documentation duty of writing case reports (see also Section 2.2.2) and the legal requirement of record transparency (see also Section 2.2.5). They saw personal benefits in saving time for documentation tasks and in avoiding redundancy in note-taking. They stated that with the help of TBM and the reuse of digital session notes, they would on average save one-third of their time for creating case reports.

6.2.1.1 Session Summary Creation with TBM

When we introduced the TBM visual session summary feature (see Section 4.6) to therapists (n=10) in the therapist demonstration study, all of them thought they would work with the automatically generated session summaries. They valued this feature as an intervention to summarize the treatment session together with the patient. Furthermore, with TBM, therapists are likely to hand out automatically created session summaries to patients often or very often. They expect that their patients will be enabled to better recap the meetings and work on their case by themselves between sessions. Furthermore, the therapists see advantages of greater transparency enabling patients to read and understand the notes, as opposed to facing illegible handwriting. The ratings of purposes for creating session summaries with TBM are shown by the dark grey bars in Figure 6.1.

6.2.1.2 Case Report Creation with TBM

At the end of the user experience study, the therapists created a case report with the help of the TBM report generation feature (see Section 4.5). It took them two clicks and a few seconds waiting time until the initial version of the case report was generated. The therapists edited the generated Word file by formulating sentences, paraphrasing notes, changing the inflection of words, formatting text, removing text, and adding text, which was not noted down in the session. Sometimes information was complemented, e.g. when the therapists' perception differed from the patient's statements. Moreover, the therapists highlighted certain text passages that would still need supplementary information. Three out of four therapists stated they wrote parts of the case report after each patient encounter and followed up on open questions in the next session. For all therapists, the time needed for case report creation with TBM was below the time they usually need (see Table 6.2). For example, therapist 2, who usually needs on average 150 minutes to write a report, used 30 minutes to turn the generated document into an intermediate draft. After these 30 minutes, she estimated the additional time needed to finish the report as another 30 minutes. On average, the report creation time was reduced by 60%, even when the therapists used TBM for the first time with a new patient.

Table 6.2: Characteristics of the behavioral psychotherapists who participated in the user experience study.

Therapist number	1	2	3	4
Gender	male	female	female	female
Age	26	32	27	27
Therapy experience	therapist in training, year 2	practicing therapist, over 2 years	therapist in training, year 1	therapist in training, year 2
Number of written case reports	>= 20	>= 20	6-10	11-20
Average time per case report (min)	270	150	240	270
Report creation with TBM: Time needed for revision (min)	40	30	42	33
Report creation with TBM: Estimated further time needed (min)	60	30	50	90

6.2.2 Addiction Therapists

The technology acceptance study with addiction therapists (n=13) revealed further factors of perceived usefulness of a digital collaborative documentation system like TBM.

6.2.2.1 Focus Group Results

In the focus group discussion, therapists brought up the potential for the facilitation of a patient conversation. One addiction therapist (AT) stated:
"I think technology could add structure and maybe there's a way to avoid the constant search for worksheets, instead to just give a keyword, like 'relapse model', and the sheet appears immediately." (AT1)
Currently, worksheets are paper-based and sometimes not readily available. We found that there is a consensus among therapists that TBM should be put into operation whenever it seems useful for the session content and the client:
"Our work lives from relationship building. Therefore, what matters most is to utilize technology in order to connect with the client and create a win-win situation." (AT2)
Thus, a key factor for therapists' acceptance of TBM is the support of a good therapeutic relationship and its effects on their clients. One therapist stated:
"For me getting a client's feedback is critical, to hear the client's opinion about whether something is disruptive or helpful. This assessment will strongly influence my final judgement." (AT3)
The addiction therapists suggested using TBM in group sessions, where flip charts or whiteboards are used on a regular basis. TBM would allow all the participants of the group to take home a readable copy of the notes. Furthermore, data security concerns are less pronounced in group sessions than in single sessions, because the data cannot be directly related to an individual client:
"While the issue of trust also plays an important role in the group, not everything is officially put on paper and printed." (AT4)
In addiction care, therapists' interest in using TBM for the efficient creation of case-related documents seems less pronounced than for psychotherapists. However, addiction therapists see great benefits in TBM to provide a conversation framework, quick access to worksheets and thus support for facilitating and structuring the session.

6.2.2.2 Survey Results

In addition to the focus group, we collected data via a written survey about the therapists' acceptance of TBM. Based on the UTAUT model (see Section 2.6), we assessed the factors of performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC) and the intention to use (IU) the TBM system (see Figure 6.2). The *Pearson* coefficient r was used to measure pairwise correlation among the predictor variables (PE, EE, SI, FC), and the intention to use (IU). The values show moderate ($0.3 < r < 0.5$) to high ($r > 0.5$), but not signif-

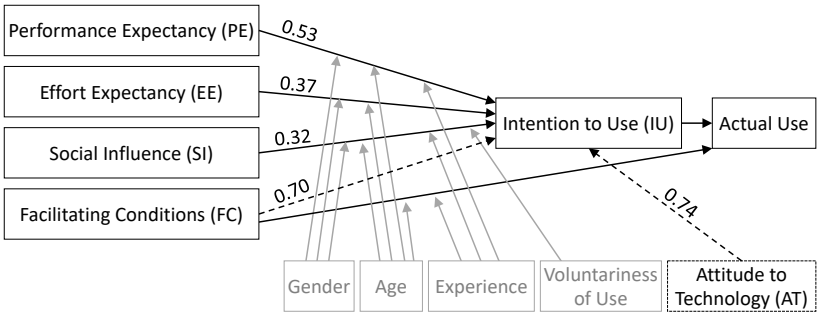


Figure 6.2: UTAUT model with the main constructs in black, moderators in grey (adapted from Venkatesh et al. (2003)). The dotted lines were added for the technology acceptance study. The numbers represent *Pearson* correlation coefficients (copied from Perlich, Meinel and Zeis (2018)).

icant, correlations (see values in Figure 6.2). In addition to items representing the UTAUT variables, our questionnaire also contained one item on the attitude towards technology (AT), which in fact appears to be the strongest predictor of the intention to use (0.74). Surprisingly, this factor is explicitly excluded from the UTAUT model (Venkatesh et al., 2003). The UTAUT model may have shortcomings when a secondary user (see also Section 4.1.1), and thereby a more dynamic user scenario, is involved. However, adding variables to information technology acceptance models is common in research (see Holden and Karsh, 2010).

A regression analysis shows that the four predictor variables (PE, EE, SI, FC) account for up to 50% of the variance in the acceptance (intention to use, IU) ($R^2 = 0.49$, adjusted $R^2 = 0.16$). However, a regression with the attitude towards technology (AT) as an additional variable explains 92% of the variance in the acceptance ($R^2 = 0.92$). Remarkably, a regression analysis with AT as a single item allows for a better prediction of the acceptance ($R^2 = 0.55$, adjusted $R^2 = 0.51$) than the four UTAUT factors together, which already integrate 20 questionnaire items in total.

A principal component analysis yields two components (user groups) in the sample of respondents, who agree on system usage. Group one expects support in documentation tasks by allowing errors to be reduced and creating reports faster. Group two sees TBM's greatest potential in fostering the therapeutic encounter itself regarding the counselling process, the communication, and client engagement.

6.3 Therapists' Rejection Factors (RQ1c)

There are diverse factors that may lead to a therapist's rejection of digital collaborative documentation like TBM. In the therapist feedback study (see Section 5.1.1) and the therapist demonstration study (see Section 5.1.2), we encountered skepticism regarding full patient file transparency, possible negative effects of technology usage on the patient-therapist relationship and data privacy issues.

Full record transparency as requested by the patients' rights law is debated actively (see also Section 2.2.5). A question that came up repeatedly was how to handle notes that therapists do not want to share with the patient because they concern delicate information. Some observations therapists make might offend the patient when spoken out loud. Once the session notes become open and collaboratively supported with TBM, it can be difficult to separate private notes. In this regard, one therapist saw the threat of self-censorship or incompleteness in note-taking. Important aspects might be forgotten when they are not noted down directly but only in a private moment after the session.

Furthermore, some therapists expressed fears that the use of technology might disturb the therapeutic contact and processes. Therapists were afraid that difficulties in using the technology might impair the patients' trust in the therapists' professionalism.

Moreover, therapists cared about data privacy issues and wondered whether the data in the TBM system was stored securely. Unexpectedly, we observed in the focus group discussion at the addiction counselling center that some therapists did not see the core benefit in supporting case-specific documentation. One addiction therapist (AT) even stated:
"We try to put as few private details as possible in therapeutic reports because any insurance employee might read it, and such sensitive data is none of their business." (AT5)
The skepticism regarding data privacy issues was overcome by the implementation of data security measures described in Section 4.8.

6.4 Therapists' User Experience (RQ1d)

In the user experience study described in Section 5.1.7, we evaluated the therapist user experience with TBM and the automatic creation of case reports.

6.4.1 Emotion Sampling

The note-taking experience was assessed via self-confrontation and self-reported emotion samples (see methods in Section 5.4.4). We computed a linear regression model, which predicts the therapists' perceived pleasantness based on the time. When we permitted the calculation of a regression constant, a constant was suggested which did not achieve statistical significance. Thus, the final regression model represented in Formula 6.1 and visualized in Figure 6.3 was computed without permitting a constant. The regression model is statistically highly significant at a level of $p <= 0.01$ and explains 55% of the overall data variance ($R = 0.741$). The regression coefficient b amounts to 0.025, which indicates that the therapists' feelings became increasingly positive over time. In addition to the pleasantness, linear regressions for the other two outcome variables of attention ([-1] TBM to [1] patient) and calmness ([-1] excited to [1] calm) were computed as well. The results are very

similar, as the regression coefficient b amounts to 0.023 for both attention and calmness. These results show that time has a highly positive effect on the therapists' feelings when they take notes with TBM in patient sessions. Moreover, with time, the focus of attention increasingly turns towards the patient instead of the system's operation. This suggests that positive therapist emotions are a matter of practice and one can expect that in follow-up sessions with the same therapists, their feelings will be in the positive range from early moments on.

$$pleasantness = b * time = 0.025 * time \tag{6.1}$$

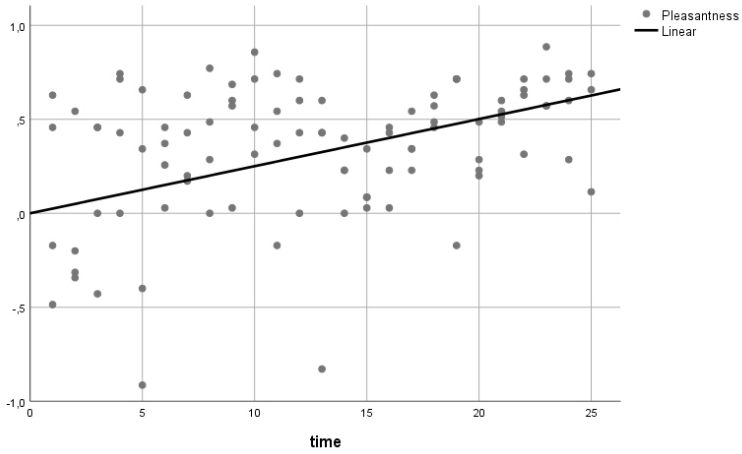


Figure 6.3: The regression model illustrates the relationship between time (y-axis, 25 samples in 50 minutes) and pleasantness (x-axis, -1 to 1). Per time point there are four samples from the four therapists (copied from Perlich and Meinel (2018)).

We also did a statistical analysis on how the three variables (pleasantness, calmness, attention) relate to one another. We filtered the emotion samples according to the lower and upper quartiles of one variable and calculated the statistical means for the other two variables. This analysis shows that if the therapists do not feel good (all time points where pleasantness is below the lower quartile of 0.200), they are moderately excited (average calmness -0.113) and have their attention on the TBM system (average attention -0.312). If the therapists feel good (all time points where pleasantness is above the upper quartile of 0.600), they can pay close attention to their patient while the system interaction just happens along the way (average attention 0.641), and they are calm (average calmness 0.593).

6.4.2 Perceived Experience

In addition to the emotion samples, we assessed the therapists' note-taking experience with TBM via hand-drawn user experience curves as described in Section

5.4.5. The user experience curves of all four therapists (T1 to T4) were combined in one diagram, shown in Figure 6.4. The comparison of curves suggests a pattern: During the first quarter, the curves of all four therapists start in the area of negative or neutral feelings. During the middle part of roughly 25 minutes, the curves of therapists T1, T2 and T4 oscillate around the zero line back and forth, indicating shifts between slight satisfaction and slight dissatisfaction. In the final quarter of the treatment session, the curves of all therapists rise in the positive emotion range to a medium or high level. Therapist T1 comments that at the start he had "difficulties with technology (key combination for a line break on sticky note)." In the middle, his feeling "got better as soon as technology problem was solved," after which it "got worse through uncertainty of which symptoms are illness-related and relevant to note." Eventually, "after the many diagnostic questions, [his] feeling got better because the attention was largely on the patient." Therapist T2 explains that she was "insecure in the beginning and often looked at the whiteboard." Her feeling started to increasingly improve. In the middle of the conversation, when she typed text on sticky notes, there was "confusion between adding a line break (keys Shift + Enter) and closing the sticky note editing view (key Enter)." In the middle of the conversation, the therapist and patient jumped frequently between topics, accompanied by some switches between whiteboard panels. The therapist had a "secure feeling when working on one documentation panel at a time" (e.g., the patient's life history). Towards the end of the session, her feeling of "security and control increased when [she] could wrap up the session using the collected notes" together with the patient.

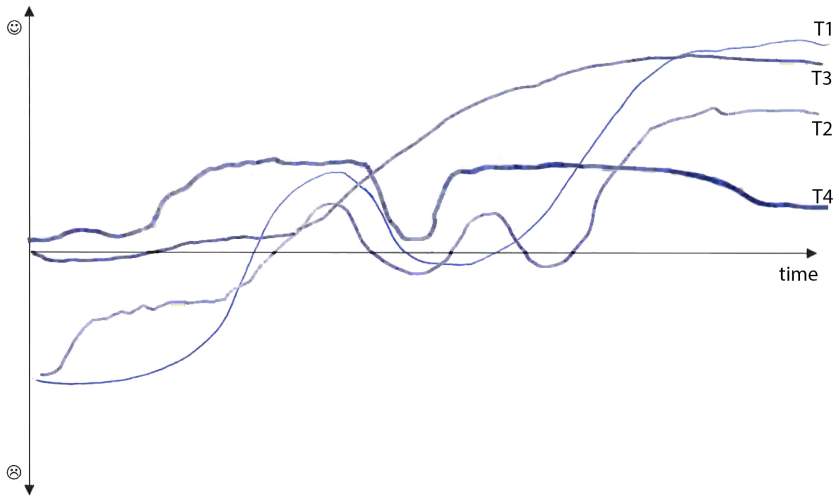


Figure 6.4: Comparison of the user experience curves drawn by the four therapists (T1-T4) (copied from Perlich and Meinel (2018)).

6.4.3 Choice of Devices

The choice of input and navigation devices in the user experience study differed from therapist to therapist. Therapists T1, T2 and T3 chose the keyboard as their preferred input device, and T4, by contrast, favored the tablet with digital pen and handwriting recognition. Only when the conversation shifted to the patient's life history did therapist T4 turn towards the keyboard to fill in the prepared sticky notes of the patient history template (see Figure A.2), because the handwriting recognition feature does not work when text on filled sticky notes is extended. While she describes a solid positive feeling when working with the tablet computer, she describes the slight drop towards the end of the curve as follows:
"I became nervous when I realized I had only little time left. Thus, I sent notes to the wrong panel and lost even more time by fixing stuff. When the whiteboard panel changed, I had to adapt this in the settings of the sticky pad app." (T4)
To navigate the whiteboard screens or move sticky notes around, therapists T1 and T2 used the integrated trackpad mouse of the wireless keyboard. For T2, possible constraints raised were that the handling of two devices might be confusing and that reaching towards or standing up at the whiteboard might cause restlessness in the session. Therapists T3 and T4 decided to use the interactive whiteboard touch feature for navigation between documentation panels and moving sticky notes. In this case, we observed that the double click on the whiteboard screen was defective, which led to difficulties starting the sticky note editing mode. The therapists frequently required multiple attempts with finger tapping before they could finally enter text:
"I felt greater insecurity in the beginning, especially due to the missing response of finger tapping. Later on, I felt more and more secure and was able to manage better when something did not work immediately." (T3)

6.5 Patients' Acceptance Factors (RQ2a)

In the technology acceptance study described in Section 5.1.6 we evaluated the technology acceptance of TBM with patients (n=33) in an addiction counselling center, who deal with alcohol, gambling, drug and medicine addiction. On average, they perceived TBM as beneficial in all the dimensions we assessed (see Figure 6.5). Patients saw opportunities especially in supporting communication with the therapist and in correcting documentation errors themselves. Furthermore, they liked the idea of getting copies of session notes, especially to recall the discussed topics later on.

The qualitative feedback in the form of written comments showed that it was important for patients to better understand, follow and reconstruct the conversations with therapists. TBM fulfills this wish by allowing for a clear visual presentation of session content. One patient liked that the "content is presented graphically as an overview" and "thus can be better memorized." Another person liked the "traceability of the conversation by picking up earlier thoughts and possibly expanding

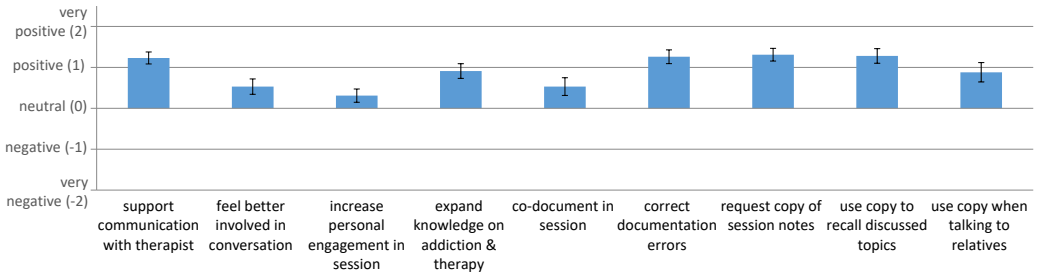


Figure 6.5: All average patient ratings (n=33) fall within the positive realm (std. deviation +− std. error of the means) (adapted from Perlich, Meinel and Zeis (2018)).

them in follow-up conversations." Yet another patient liked the "collection of notes to take away."

We found that the more therapy sessions patients had already experienced, the more they liked TBM. There were no significant response differences related to the addiction background. The acceptance in both one-to-one and group sessions was positive and fairly balanced. However, the addiction patients saw slightly more advantages of TBM in single sessions than in group sessions. This was also reflected by the qualitative feedback collected on situations the patients would find suitable for TBM usage. In one-to-one sessions, they would like to use TBM in contexts such as biography work and in root cause analysis, where relationships between incidents, reactions and results are analyzed. Furthermore, one patient saw opportunities in "bringing together own approaches and those of the therapist." In the context of group sessions, one client expected that TBM could help "to clearly show the distribution of opinions" among participants.

6.6 Patients' Rejection Factors (RQ2b)

In the technology acceptance study described in Section 5.1.6, we also asked addiction patients (n=33) what they disliked about TBM and what they wished were different. One patient wondered whether there could be a risk of distraction because the therapist has to conduct supplementary activities. Some patients thought that treatment situations which rely on trust and relationship building are less suitable for using TBM. One person did not want to use TBM at the beginning of therapy, when "personal contact at eye level is crucial." Another patient would refuse to use TBM when "something very personal" was to be discussed. One patient stood out, rating all but two items shown in Figure 6.5 as very negative. The patient declined to use TBM but provided no explanation for the decision.

6.7 Influences on Patient Empowerment (RQ2c) and the Doctor-Patient Relationship (RQ3)

The findings regarding the influence of digital collaborative documentation with TBM on patient empowerment and the therapist-patient relationship are closely interlinked and thus presented together in this section.

6.7.1 Observations of Patient Behavior

In the hospital case study described in Section 5.1.4, psychiatry patients (n=17) experienced TBM with a therapist. The therapist's observations were mapped to the dimension of patient empowerment, namely the patient attributes (knowledge, autonomy, values, described in Section 2.1.3) and the dimensions of the patient-provider relationship (collaboration, integration, empowerment, communication, described in Section 2.1.2). When TBM was used, no indicators of patient rejection or patient-therapist conflict were observed. There was no explicit refusal to use TBM. Furthermore, there were neither unexcused absences of patients in scheduled sessions nor a complete therapy drop-out. Quite to the contrary, patients showed considerable and uncommon teamwork behavior. Almost every patient helped to arrange the room after three or fewer sessions with TBM, such as adjusting the light, closing the door, or carrying equipment. Furthermore, the German language has two ways of addressing other people and thereby a built-in 'relationship detector.' Patients and doctors normally address each other with the official form ("Sie"). Close acquaintances, though, use the familiar form ("du"). In sessions where TBM was used, every second patient accidentally addressed the therapist with "du" at least once and immediately excused her or himself. The observations that patients helped the therapist to arrange the treatment room and used the unofficial form of address strongly indicate a team feeling and thus a manifestation of a positive *integration* and *communication* process.

Moreover, we noted that every third patient spontaneously expressed the wish to take home a complete copy of the notes. This was not observed in sessions without TBM and can be seen as increased *patient autonomy*. Furthermore, when TBM was used, we observed more focused conversations during therapy sessions. In particular, patients found it easier to stay on topic when the treatment conversation was supported with TBM. One patient had been taken over for a couple of sessions with the observation among therapists that he tends to talk at cross purposes – a behavior which might hinder the therapeutic process. During the sessions with TBM, however, there was no indication of such behavior and the patient always answered to the point. This case illustrates a positive effect on the *communication* process. Another patient complained that he had been receiving an incorrect diagnosis for years. He felt that he was physically ill, not psychologically. After completing the diagnostic sessions with TBM, he defended his psychological diagnosis against a skeptical doctor. Yet another patient had been treated under one diagnosis for more than ten years. He expressed thankfulness towards the therapist,

because he understood for the first time why he had received this diagnosis. The patient cases of better understanding diagnoses and concordance with therapeutic treatments show an increased *patient knowledge*, a higher consideration of *patient values* as well as an improvement of the *collaboration* process. The acceptance of diagnoses is an important predictor for therapy concordance and therapy success.

6.7.2 Ratings on Therapeutic Alliance

In the expert rating study described in Section 5.1.5 with eHealth experts (n=8) and human-centered design experts (n=28), we assessed the therapeutic alliance as an ideal form of the patient-provider relationship (see also Section 2.1.2). The audience and the volunteering patient rated the patient-therapist interaction based on a short therapy session that was launched on stage both with and without TBM. The feedback on aspects like collaboration, empowerment, communication and relationship was given twice: after the first half-session in which traditional documentation approaches with pen and paper were used, and then again after the second half-session in which TBM was used. The questionnaire items representing several aspects of relevance for patient-doctor collaboration are shown in Table 6.3.[1] Furthermore, Table 6.3 shows the arithmetic means in a range from 2 to -2 of the ratings for the traditional and the TBM scenario pertaining to the audience and the volunteering proxy patients ([2] clearly so, [1] seems so, [0] I don't know, [-1] doesn't seem so, and [-2] clearly not). N specifies the number of valid answers per item. Due to some missing replies and three items not being included in either study, N varies across the comparisons. For the audience ratings, dependent t-tests for paired samples with two-tailed tests of significance (p-values) show the level of statistical significance. These tests were chosen because each participant provided ratings for the traditional and TBM settings, and because there was no a priori knowledge about which scenario would receive better ratings.

There is a strongly significant effect in favor of TBM in eight out of nine items (low p-values below 0.05 and even 0.001). Statistically, a p-value below 0.05 is generally considered significant and hence would be sufficient to support the hypothesis that TBM makes a difference (see Table 6.3). The significant effects are likewise reflected by *Cohen's d*, which estimates the effect size of the intervention.[2] Here, the traditional setting is interpreted as the control condition and the TBM setting is considered the experimental condition, so that positive d-values indicate a positive effect of TBM. The questionnaire data does not only indicate a large positive effect on almost all scales (large *Cohen's d* above 0.8 in seven out of nine items – despite the relatively small sample size). There are even shifts from a negative average rating without TBM to a positive rating with TBM. The only variable for which the

[1] The items are phrased from the patient perspective, and for the audience questionnaire the syntax was adapted (e.g. item 2 reads "I feel my therapist listens to me" for the patient questionnaire and "The therapist listens to the patient" for the audience questionnaire).

[2] Values of 0.2 to 0.5 are considered a small effect, values of 0.5 to 0.8 indicate a medium effect and values above 0.8 indicate a large effect (Cohen, 1988).

Table 6.3: Questionnaire items used to assess patient-therapist cooperation with their average ratings for a traditional therapy setting (Trad.) versus a session with Tele-Board MED (TBM). The ratings are listed separately for audience members and volunteering patients. N specifies the number of comparisons. A two-sided p-value (p) indicates the level of statistical significance. *Cohen's d* (d) indicates the effect size (adapted from Perlich, von Thienen and Meinel (2017)).

		AUDIENCE					VOLUNTEER		
	Item	**Trad.**	**TBM**	**N**	**p**	**d**	**Trad.**	**TBM**	**N**
Collaboration	My therapist and I have the same therapeutic goals.	0.06	0.97	32	<0.001	1.25	0.5	0.5	2
Integration	I feel my therapist listens to me.	1.24	1.15	33	.572	-0.12	1.5	2	2
Empowerment	I am allowed in the decision-making process.	-0.58	1.42	31	<0.001	2.62	-0.5	1.5	2
Communication	It is easy to understand my therapist's instructions.	0.42	1.23	31	<0.001	1.03	2	2	2
	My therapist and I work well together.	0.86	1.57	7	0.008	1.15	1	2	1
Relationship	My therapist and I collaborate at eye-level.	0.03	0.81	32	0.010	0.77	-0.5	2	2
Documentation	It is possible for me to recognize documentation errors.	-1.64	1.64	33	<0.001	5.44	-1.5	1.5	2
Shared Knowledge	My therapist and I develop joint knowledge that we can build on in the next session.	-0.44	1.28	25	<0.001	2.13	0	1	1
	My therapist and I have a common understanding of the treatment procedure.	-0.52	0.60	25	<0.001	1.46	-1	0	1

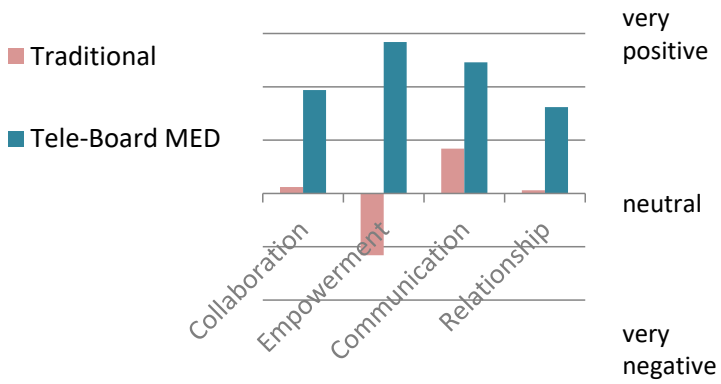


Figure 6.6: Expert ratings (n=36) on patient-doctor cooperation indicate substantial benefits of Tele-Board MED compared to traditional documentation approaches (copied from Perlich, von Thienen and Meinel (2017)).

audience does not see a clear positive effect of TBM is item 2 ("The therapist listens to the patient"). However, the members of the audience who volunteered to take on the patient role do indicate that they experience a positive effect of TBM on this item as well (see Table 6.3 right part). Figure 6.6 displays a chart with the expert ratings regarding the comparison of the traditional versus TBM scenario based on the numbers from Table 6.3 relating to the four items and the respective constructs of collaboration, empowerment, communication and relationship. The sessions with TBM obtain much better relationship ratings than sessions with traditional documentation with paper and pen (see Figure 6.6).

This finding seems very robust, because the inter-rater reliability both within and across studies is very high. For the ratings by the audience members, intra-class correlation coefficients for single measures and *Cronbach's alpha* for average measures were calculated. In the first study with audience ratings of eHealth experts (n=7), the intra-class correlation coefficient, calculated with a two-way random model and consistency analysis, amounts to 0.69 for single measures (i.e. regarding single items). On a level of $p < 0.001$, this is statistically significant. In terms of average measures (i.e. regarding the total number of survey items), *Cronbach's alpha* is 0.94, where 1 would be the maximum possible. When this analysis is carried out with audience ratings of human-centered design experts (n=27), the intra-class correlation yields a coefficient of 0.870 for single measures, which is also significant on a level of $p < 0.001$. Here, *Cronbach's alpha* for average measures is 0.995. Considering the audience raters of both studies together (n=34) and only those 12 items (2x6) which were handed out to both expert groups, the intra-class correlation coefficient amounts to 0.873 for single measures, which is again significant on a level of $p < 0.001$. In terms of average measures, a *Cronbach's alpha* of 0.996 is obtained. The ratings show high intra-class correlations both within and across studies. Thus, participants observed positive effects of TBM with great agreement. To assess the inter-rater agreement of the two proxy patients, common correlation coefficients

were calculated. On metrics ranging from [1] a completely positive relationship to [0] neutral relationship and down to [-1] a completely negative relationship, all measures yield values above 0.8, which is statistically highly significant (*Spearman's rho*: 0.89 with $p < 0.001$, *Pearson*: 0.86 with $p < 0.001$, *Kendall's tau-b*: 0.81 with $p <= 0.002$). It is remarkable that the study participants show a striking agreement in their responses along all questionnaire items, given that the ratings stem from two different therapy sessions. The two substudies conducted in Germany (n=8) and the USA (n=28) involved different volunteering patients and raters who differ in their professional backgrounds. This shows that culture-specific or subjective viewpoints bear little influence on the ratings.

6.8 Limitations

This section discusses limitations and weaknesses of the conducted studies introduced in Section 5.1.

The **therapist feedback study** was very specific to the context of the German patients' rights law and the case report writing. Thus, the transferability of results to other cultures may be limited.

The number of participants in the **therapist demonstration study** was relatively small (n=10). Thus, the representativeness of this study is limited.

The **outpatient clinic study** did not deliver the expected outcome, because we failed to gain therapists as participants. Subsequently, we sent out a survey to the therapists in order to better understand the reasons why they did not use TBM. Out of the 24 therapists who had previously shown interest, we received only two responses.

There are clear limitations to the **hospital case study**, because it involved 17 patients but only one therapist. Thus, it cannot be empirically stated to what extent the patient reactions are caused by the system usage. A larger sample of therapists is needed to eliminate the effects of the therapist's personality traits and the therapeutic style. The collected data was limited to the observations of the therapist and did not include patient-reported information. Furthermore, it might be considered a weakness that the therapist was biased because she was part of the research team. However, when seeing patients, the therapist primarily acted as a psychotherapy professional and only used the TBM system when suitable for the session content and treatment situation.

The questionnaires in the **expert rating study** were rather short and the therapeutic alliance constructs were only presented by one or two items each. The small size of the questionnaire was chosen in order to keep the attention of the participants high. However, certain guidelines for survey design were neglected, e.g. the use of control items as a truth control for the answers or buffer items to mitigate spillover effects. The collection of self-reported data through questionnaires itself can be considered a weakness. As an alternative, one could assess changes in the

therapeutic relationship with more objective means, e.g. through video analysis.[3]

In the **technology acceptance study**, we found that the attitude towards technology in general appears to be the strongest predictor of therapists' intention to use the TBM system. Remarkably, this factor is not part of the UTAUT technology acceptance model (see Section 2.6), which was used in this study. It might be considered a weakness that this model was chosen, because its effectiveness may be limited when a dynamic user scenario involving a primary user (therapist) and a secondary user (patient) is studied. However, so far, there is no technology acceptance model designed for dyadic human-computer interaction.

The findings of the **user experience study** suggest that positive therapist emotions are a matter of practice, and it can be hypothesized that in follow-up sessions the therapists' feelings will be in the positive range from the early moments on. However, the study was limited to a singular session and involved a patient actor. A restriction is that there are more factors determining the therapist user experience, which can only be detected in a long-term study and with real patients. Regarding the generalizability of results, the relatively small number of four test users can be considered a weakness of this study. However, Nielsen (2000) found that this number is appropriate for finding the majority of usability problems. Furthermore, the non-anonymous testing scenario could add a social desirability bias. But, since the therapist test users have no relationship with or interest in the research team, this bias can be expected to be insignificant. The self-reported evaluation approaches with the help of emotion sample questionnaires and annotated user experience curves have the advantage of allowing unexpected observations. At the same time, emotions have a large unconscious component and they might be subject to bias.

6.9 Discussion of the Research Approach

The research described in this thesis is characterized by a trade-off between scientific rigor and practical relevance for therapists and patients. The domains of mental health and addiction care are characterized by sensitivity and stigma, which influence the feasibility of naturalistic evaluation studies. From a rigorous scientific perspective, an ideal study for evaluating TBM's effectiveness and efficiency would involve a sample group of therapists and patients who use TBM versus a control group where traditional documentation approaches are used. However, the treatment processes are too sensitive to constrain therapists to a continuous use of the novel technology regardless of patient feedback and session topics. Therapists choose their interventions depending on the patient characteristics, treatment phase and session atmosphere. Scientific rigor could also be improved with more extensive, continuous data collection, e.g. with treatment session video recordings. However, video recording or third-person observations are obtrusive and could influence the

[3] One could use the video analysis algorithm by Ramseyer and Tschacher (2011) to quantify nonverbal behavior in dyads in order to analyze the coordination of the patient's and therapist's movement as one aspect of therapeutic alliance.

therapist-patient interaction. Thus, excessively high standards for scientific rigor can result in conditions that are not acceptable for users. Experimental research designs with the comparison of a sample group (using novel technology) and a control group (using traditional tools) in real environments also poses challenges in terms of discerning the effects of many confounding variables. A project can only be done once with the same people and the same mindset, though.

Chapter 7

Conclusion

The aim of this thesis was to investigate how digital collaborative documentation can support patients and therapists in talk-based mental healthcare consultations. The development of the Tele-Board MED (TBM) system as a tool for joint documentation in face-to-face therapy and its evaluation were presented. This chapter summarizes the study findings on the three research questions and common insights. It furthermore provides design implications, implementation recommendations and finally an outlook on future work.

7.1 Summary of Findings

The study findings on the three research questions introduced in Section 1.1 can be summarized as follows.

RQ1. Can digital collaborative documentation support therapists in fulfilling their duties of clinical case documentation?

There are diverse factors that lead to therapists' acceptance of digital collaborative documentation in talk-based healthcare. In the therapist feedback study described in Section 5.1.1, we encountered willingness in psychotherapists to use TBM primarily driven by a practical interest in fulfilling administrative documentation duties and legal requirements (see results in Section 6.2.1). We encountered skepticism regarding technology use, patient file transparency and data privacy issues (see results in Section 6.3). In the therapist demonstration study described in Section 5.1.2, we found that with TBM, psychotherapists can well imagine summarizing important issues together with the patient at the end of a session and also handing out printed summaries to them (see results in Section 6.2.1.1). However, we encountered uncertainty over how to handle notes that are not intended to be shared with the patient (see results in Section 6.3). In the user experience study described in Section 5.1.7, we found that psychotherapists develop a positive feeling, come to feel comfortable and can concentrate on the patient even in the very first session with TBM (see results in Section 6.4). We found that therapists feel uncertain when it is unclear whether the information expressed by the patient is relevant to note or when it is contradictory to their personal perception. Therapists have an increased sense of confidence with TBM when giving explanations to the patients, such as summarizing the session content or introducing models and exercises (see results in Section

6.4.2). Regarding documentation duties, we found that with the TBM report generation feature therapists save 60% of the time they normally spend on writing case reports for health insurance companies even when TBM is used for the first time (see results in Section 6.2.1.2).

The addiction therapists involved in the technology acceptance study described in Section 5.1.6 saw a flexible and context-dependent usage as a basic condition for TBM acceptance (see results in Section 6.2.2.1). The greatest perceived benefits were the provision of a discussion framework and quick access to worksheets during treatment sessions. The strongest factor to influence TBM acceptance was the therapists' attitude towards technology in general (see results in Section 6.2.2.2).

In summary, when the following factors are met, digital collaborative documentation systems can support therapists in their duties of clinical documentation:

- **Flexible Usage:** Therapists appreciate tools that can be flexibly brought into treatment sessions depending on the individual patient case and treatment situation.
- **Efficient Reuse of Session Notes:** It is evident that the features for medical report generation and session summary creation strongly increase the therapists' acceptance of a collaborative note-taking system. With these features, redundancy in documentation can be avoided and thus time spent on administrative tasks can be saved.
- **Treatment Structuring:** Digital collaborative documentation systems can support the facilitating and structuring of treatment sessions.
- **Confidence:** Therapists need to feel confident using a documentation system together with their patients. Next to acquiring system operation skills, they also need to find their personal approach to harmonizing the activity of cooperative note-taking with the course of conversation.

RQ2. Can digital collaborative documentation support patient engagement in care processes?

In the hospital case study described in Section 5.1.4, we found that using TBM was very well received by patients. They liked the shared notes, visualization of diagnostics and treatment procedures, as well as the opportunity to take home a copy of their notes. Futhermore, we found that collaborative note-taking with TBM encouraged patients' engagement and increased their acceptance of the diagnosis, which in turn is an important predictor for therapy concordance and therapy success (see results in Section 6.7.1). In the technology acceptance study described in Section 5.1.6, we found that patients expected TBM to improve the communication with their therapist and the recall of discussed topics when taking a copy of their notes home after the sessions (see results in Section 6.5). Skepticism was expressed

regarding a possible distraction of the therapist and usage in situations where a relationship is being built (see results in Section 6.6).

In summary, digital collaborative documentation supports the following factors which in turn support patients' engagement in their care processes:

- **Integration:** Through collaborative documentation, patients feel more involved in treatment decisions.
- **Trust:** Transparent documentation creates trust in patients, because no information is withheld.
- **Education:** Collaborative documentation supports the patient's education about their health problem as well as the reflection on their personal situation and beliefs.
- **Accessible Notes:** Patients like to receive a copy of comprehensible session notes at the end of a session. Furthermore, patients can correct faulty information and prevent incorrect information from being written down.

RQ3. Can digital collaborative documentation support a collaborative doctor-patient relationship?

The research in this thesis showed that treatment documentation can be turned from a necessity taken care of by the doctor into an intervention which positively affects the patient-therapist relationship, and thus the treatment itself. In the hospital case study described in Section 5.1.4, we found that TBM encouraged a team feeling between patient and therapist (see results in Section 6.7.1). The findings about the therapeutic relationship are closely interlinked with the factors of patient engagement. The expert rating study described in Section 5.1.5 showed that TBM supports therapeutic alliance and shared knowledge between therapist and patient (see results in Section 6.7.2).

In summary, digital collaborative documentation supports the following factors which in turn support a collaborative doctor-patient relationship:

- **Communication:** Digital collaborative note-taking has a positive effect on the communication process, as shown by the increased team feeling between patient and therapist and the patient's higher acceptance of the diagnosis.
- **Mutual Goals:** Collaborative documentation fosters the alignment of patient and provider towards mutual therapy goals.
- **Power Balance:** Joint note-taking supports shifting the power from therapists to patients and thus promotes a collaboration at eye-level. The jointly taken notes are artifacts of an emancipated discussion and thus a strong signal that patients are being taken seriously and intellectually valued instead of feeling underestimated and patronized.

7.2 Common Insights

Besides the findings to the research questions, the evaluation studies led to insights regarding the suitability of certain therapeutic contexts, the resistance towards patient access to mental health records, and the therapists' confidence in operating a digital collaborative documentation system.

In which therapeutic context is digital collaborative note-taking (not) suitable?

The perceived benefits of digital collaborative note-taking in talk-based healthcare primarily depend on the therapist, their perception of patients, the patient him or herself, the treatment stage and the session situation. The question of whether there are treatment situations that are especially suitable or unsuitable for digital collaborative documentation cannot be answered generally. Based on the study results, it seems very suitable in phases in which treatment is planned, exercises are conducted, and treatment progress is reviewed or summed up. One patient said he liked that the "content is presented graphically as an overview" and "thus can be better memorized" (see results in Section 6.5). Opinions differ greatly about the very first treatment session. Patients and therapists agree that building trust is an essential aim in the first sessions. Here, some see a great danger and some see great potential in using a digital collaborative note-taking system. One patient expressed reluctance to use TBM at the beginning of therapy when "personal contact at eye level is crucial" (see results in Section 6.6). A therapist stated, "what matters most is to utilize technology in order to connect with the client and create a win-win situation" (see results in Section 6.2.2.1).

The general treatment context in cognitive behavioral therapy and addiction counselling plead for digital collaborative documentation because the consultation sessions are rather long and comprehensive, the patient is involved actively, and the amount of information reported verbally by the patient is high. However, patients might refuse digital collaborative note-taking for personal reasons, which should be respected. One patient said that he would refuse to use TBM when "something very personal" was to be discussed. Furthermore, patients might be afraid that their therapist will become distracted when using TBM (see results in Section 6.6).

How can the resistance towards patient access to mental health records be overcome with digital collaborative documentation?

Full record transparency in mental health and addiction care is a topic of great controversy and uncertainty. While full record transparency has been required in Germany by law since 2013, there is still a great insecurity in psychotherapists about how to put this requirement into practice. Fears of undesirable patient reactions and the wish to keep notes personal can be reasons for therapists to reject digital collaborative documentation systems (see results in Section 6.3).

The following list shows common arguments by care providers against patient access to mental health records (see also Fors and McWilliams (2016)), as well as arguments for how TBM helps to overcome this resistance:

- *Mental health patients are perceived as being fragile and lacking self-reflection.*
  → Patient's self-reflection seems to rise when they are made partly responsible for their case documentation and thus for their overall treatment (see results in Sections 6.5, 6.7.1).

- *Reading the record content may trigger undesirable patient reactions.*
  → No undesirable patient reactions were observed when TBM was used (see results in Section 6.7.1). If negative emotions were to arise in patients when reading or co-editing session notes, they could be welcomed as a trigger for direct discussions with the therapist.

- *Mental health records may include disrespectful, insensitive or harmful entries.*
  → In collaborative note-taking, the therapist and patient choose a documentation language which is not only informative but also acceptable for both. Mutual respect is fostered, because therapists are encouraged to find respectful words.

- *It is too difficult for the patients to read and understand their health record, because of the professional language and medical terms.*
  → By means of joint documentation, the patient and therapist develop a shared mental model. Notes are created in a language that is owned by both patient and therapist. Professional jargon may still be used in the documentation, however not without explaining the meaning to the patient.

- *Therapists are insecure about revealing their note-taking habits.*
  → With TBM, new note-taking habits are formed by making notes instantly visible on a screen or projection, e.g. via typing on a keyboard or digital handwriting recognition (see results in Section 6.4).

- *Access to mental health records puts the therapist-patient relationship at risk.*
  → Collaborative note-taking supports shifting the power from provider to patient and thus promotes a more balanced relationship (see results in Section 6.7).

- *Access to mental health records has negative effects on therapy success.*
  → When TBM was used with psychiatric patients, they showed an increased acceptance of their diagnosis, which is an important factor for therapy concordance and therapy success (see results in Section 6.7.1).

The following quotes illustrate why therapists appreciate the digital collaborative note-taking system TBM.

A medical doctor and psychotherapist specialized in psychodynamic and psychosomatic psychotherapy described her impression of TBM in the following way:
"I am really impressed by Tele-Board MED! It is an intuitive tool to put the requested record transparency with patients into practice and it saves me time when writing case reports. The design allows me to adapt the usage and the contents to my needs. What's great about Tele-Board MED is that I can use it in the conversation with my patients and that I can hand over print-outs of the notes directly at the end of the sessions. I want to use Tele-Board MED in initial diagnostics interview with ambulatory patients in particular. My patients will feel more valued, because we use a special technology that integrates with a facing conversation and on the other hand fits to the expected modern way of cooperative patient communication. My wish for the future is that such an interactive documentation will become standard at my ward."

A psychology student in a seminar on anamnesis interview, and case report writing stated the following:
"The automated report generation with Tele-Board MED is totally fascinating! This is great for anamnesis interviews, because you have got a raw version of the case report right after the session and the only thing you need to do is formulating sentences. I also think Tele-Board MED is a very helpful structuring aid for patient conversations. The anamnesis template provides a good basic structure with all important aspects, some of which I would have maybe forgotten to address. It is comparable to an interview guideline, but it is nice to look at together with the patient. I can imagine that it also helps patients to be more structured and to go along with the conversation. A patient who talks uninterruptedly and wanders off the point might be more focused."

What do therapists need in order to confidently use digital collaborative note-taking?

The requirements for a digital collaborative documentation system to be implemented in practice go beyond attractive functionality and good usability of software and hardware. Therapists need the courage and willingness to formulate notes collaboratively, which involves instant conversation paraphrasing and word choice to the satisfaction of both patient and therapist. The transformation of conversation snippets into meaningful written notes requires interpretation, rephrasing, summarizing, and connecting with already captured information. Furthermore, the language should be descriptive and nonjudgmental.

There might be situations where therapists want to take side notes (see results in Section 6.3), which are not part of the patient record but help them to structure and organize their treatment sessions, e.g. personal reminders to address a certain topic or prepare a work sheet for the next session. However, it was a conscious decision not to implement a feature for private therapist notes in TBM, because no consensus has been found in the German healthcare system yet on how to harmonize the legal requirements of full transparency and the practices of keeping personal notes next to the official patient record.

7.3 Design Implications

From the findings of the evaluation studies, the following design implications for the development of future digital collaborative documentation systems in (mental) healthcare can be derived.

Stakeholder-Centric Design A collaborative note-taking system should be designed to be suitable to both patients and therapists. A patient-centered interface should be designed in such a way that the structure, language and information representation are simple and understandable without medical knowledge. The system should allow for an image and text export of the jointly created documents to provide patients with a copy of their file to take home at the end of the session. Therapists decide whether or not to use a new technology with their patients. Therefore, it is crucial to support their documentation needs – both during the patient encounter and beyond.

Design for Interaction The user interface and the treatment room setup (including hardware devices and furniture) should support the interaction between patient, therapist and system. A system suitable for the collaborative view and collection of session notes should support eye-contact and facing of patient and therapist as well as an equal inspection and hands-on operation of the user interface. Non-verbal communication should be supported, i.e. facial expressions and gestures should be mutually visible. The system should allow conversation snippets to be captured in a written and visual way.

Note-Taking Templates The design of whiteboard templates should take into account both patient and therapist needs. In order to support patient engagement, the templates should allow the presentation of information, e.g. diagnostics and treatment procedures, in plain language and with the support of visual elements. The templates should also support the therapists' goals of structuring the treatment session as well as efficiently creating memory aids for the treatment overview and official clinical documents. Furthermore, a seamless preparation and follow-up editing of the digital notes is very important.

Content Flexibility The way digital notes are captured should be flexible and informal. It should be possible to freely collect notes without restrictions on e.g. data types or entry order. The organization and sorting of information should be supported through visual cues such as spatial arrangement, clustering, highlighting and coloring of elements. The system should support note-taking from scratch and from prepared documentation templates for diagnostics and treatment procedures.

Operation Flexibility The collaborative note-taking system should go flexibly into action whenever it seems suitable for the therapist, patient, treatment stage and session situation. It should support different usage scenarios and should offer flexible ways of displaying and organizing digital notes. It should allow for smooth transitions between analogue and computer-mediated interaction modes. A flexible system setup is beneficial, e.g. by using a trolley on wheels to quickly move the technical equipment.

Simplicity The user interface should make the process of capturing conversation notes as quick and easy as jotting down notes on a piece of paper or a flipchart. The whiteboard-inspired note-taking interface should allow users to capture short free texts, to create simple visual elements (e.g. hand-drawn scribbles or image files), and to structure the content in a basic way. Patients should understand the features of the documentation interface easily without any instructions, so that the focus can stay on the therapeutic content and not on the system's operation.

Hardware Independence The software system should be hardware-independent so that it can be used on any available and suitable device on the local premises of a clinic. A web-based system can be used on a variety of hardware devices – from stationary hardware such as an interactive whiteboard or desktop computer to mobile devices like a laptop or tablet computer.

Data Reusability The system should allow the multiple use of both general treatment information as well as patient data. Once created, whiteboard templates should allow for use with multiple patients. The creation of auxiliary case-related documents such as medical reports or session summaries should be based on the digital session notes.

Data Privacy When designing information technology for the healthcare domain, it is crucial to comply with the legal context regarding data protection and to follow information security recommendations.

These design implications confirm the design guidelines for mental health technologies by Doherty et al. (2010), who also emphasize the design for both patient and therapist users. They also suggest a design for patient engagement and consideration of the patient's background. Furthermore, their guidelines also stress the consideration of therapists' existing working methods, the responsibilities placed on therapists and the aspect of not putting burdensome time demands on them. We confirm their recommendation to consider the dynamic of patient and therapist together as well as the requirements of mental healthcare settings, e.g. to make it clear that data is secure. Our design implications are also consistent with their guidelines of making technology systems adaptable, sustainable and tangible, as well as providing flexibility in the delivery of support. Alsos and Svanæs (2011) suggest guidelines for information systems involving a secondary user, which can be confirmed by our design implications, wherein the patient is considered the secondary user. They suggest giving system feedback to the secondary user, supporting non-verbal communication, using the language and representation of the secondary user and providing a graphical user interface tailored for the secondary user. The design implications on flexibility, simplicity and hardware-independence correspond to the implications for digital whiteboard systems provided by Gumienny (2014).

7.4 Implementation Recommendations

The following recommendations for a successful implementation and adoption of digital collaborative documentation systems in clinical care can be derived.

Support of Clinic Management and Technical Administrators It is crucial for successful implementation to obtain the full support of the clinic management level. In order to foster the adoption of a digital collaborative note-taking system, the management should incentivize their therapist staff. Furthermore, the support of the clinic's technical administration is crucial in order to realize the setup of hardware devices and the compliance with data security regulations on site.

Customization to the Clinic The understanding of a clinic environment including therapists, patients, routines and premises is crucial. It is important to know the specialization in order to provide helpful documentation templates for therapists and patients, such as worksheets or treatment schemes. The local premises and routines determine how a system can be integrated in a clinic. Furthermore, the technical equipment of the clinic is crucial, including hardware devices and network infrastructure. Moreover, an understanding of the usage and reservations of treatment rooms is important.

Tangible Benefits for Therapists Only if therapists perceive a system as supportive for their work will they decide to give the technology a chance. The benefits of digital collaborative documentation should be made tangible for therapists. Moreover, one should also discuss the resistance towards patient access in mental health care (see also Section 7.2). Therapists should be encouraged to reflect on the integration of collaborative note-taking in their personal treatment approach.

Therapist Super User A super user is a therapist who is supporter and early adopter of the new system at a clinic. A super user can be a role model for other therapists and a trusted contact partner in the case of questions. Thus, other therapists can be encouraged to familiarize themselves with the system and to try it out with patients.

Incremental System Introduction A prerequisite for a successful practical implementation of a digital collaborative documentation system is that therapists feel competent with the activity of cooperative note-taking and the operation of the system. In order to experience the concept as such, therapists could practice collaborative note-taking in an analogue way, e.g., using sticky notes and/or templates on a flipchart together with their patients. Before using digital tools in patient sessions, therapists should practice on hardware devices they are familiar with, e.g. a desktop or laptop computer. Thus, the focus can be put on learning the new software first without being overwhelmed by new hardware devices such as a digital whiteboard. The individual learning phase should be accompanied by a facilitator who is knowledgeable about the system usage and healthcare context. In a next step, therapists should envision treatment scenarios with their patients and consider different hardware devices to use. They could practice the system usage in simulated treatment sessions with colleagues. Once therapists feel secure, they can use the system with real patients.

These implementation recommendations for the context of digital collaborative documentation systems in mental healthcare comply with general recommendations for the implementation of eHealth technologies by Ross et al. (2016). They suggest a careful selection of an appropriate eHealth system, taking into account the adaptability of the technology to the local context, the complexity of technology usage, and the compatibility with existing systems and work practices. Furthermore, they recommend including key stakeholders and champions (super users, i.e. individuals promoting the implementation process) as early as possible in the implementation process. They also emphasize training and education of all those involved with the implementation as a key success factor. Moreover, they point out that implementation does not stop when a technology 'goes live' – instead, there is a need for ongoing monitoring, evaluation and adaptation of systems to ensure that intended goals are being met.

7.5 Future Work

The research presented in this thesis is limited to digital collaborative note-taking in face-to-face treatment sessions in the domains of cognitive behavioral therapy and addiction care. In the future, the application areas can be extended to other medical domains and user scenarios. Moreover, future work can be done regarding the management of clinical knowledge in order to achieve interoperability with other documentation systems and thus a wider adoption of collaborative medical documentation.

Further Domains and Treatment Scenarios In future research, the approach of digital collaborative documentation can be evaluated in further domains of care. Elderly care, nutrition counselling and rehabilitation are suitable domains because the interaction and communication between care provider and recipient play a crucial role. Medical domains that are characterized by short patient-provider encounters (e.g. general practice) or by reliance on laboratory values and doctor-reported information (e.g. oncology, dermatology) could also profit from digital collaborative note-taking. Future research could also examine the potential of digital collaborative documentation with adolescent patients or with doctors and patients who face language barriers. While the work in this thesis was limited to face-to-face interactions, future research can be conducted in the context of remote care. One question worth addressing is how collaborative documentation could be used to support patient-therapist counselling over distances.

Clinical Knowledge Management An important issue to be addressed in future work is the question of how patient-centered collaborative documentation systems on the one hand, and data-centered electronic health records on the other hand, can fit together at the level of data formats. A question which should be addressed is how data models need to be designed in order to achieve both semantic interoperability with other documentation systems and patient-centricity. The data model design should consider terminology systems and ontologies for the respective domain of care as well as standards for electronic patient data. Thus, there could be a standardized computerized medial record as a backend connected to a collaborative interface as a frontend.

Our future vision is that digital collaborative documentation systems will be widely adopted in healthcare – not as an alternative but as an add-on to electronic health records.

Appendix A

Medical Report Generation Feature

A.1 Whiteboard Panel Templates for Psychotherapeutic Anamnesis

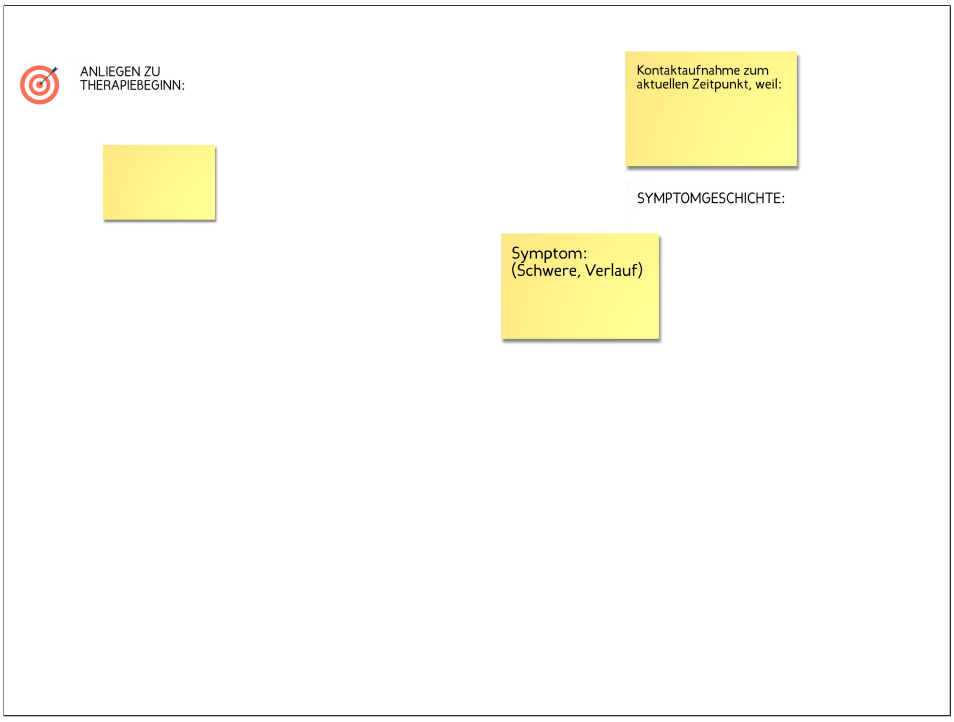


Figure A.1: Concerns and symptoms (German: Anliegen und Symptome)

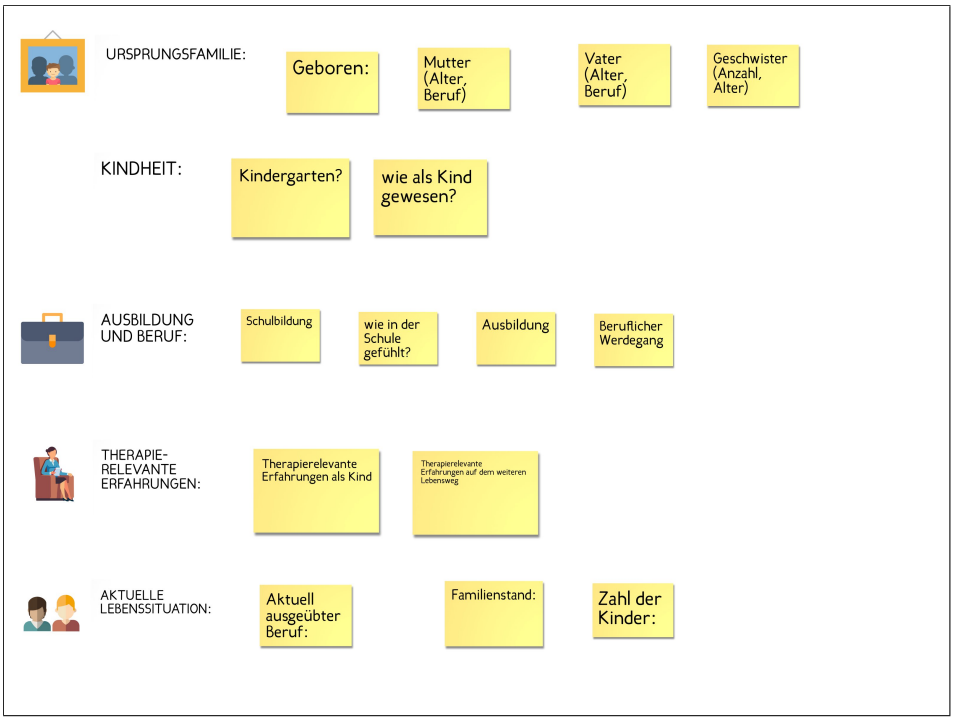


Figure A.2: Patient history (German: Vorgeschichte)

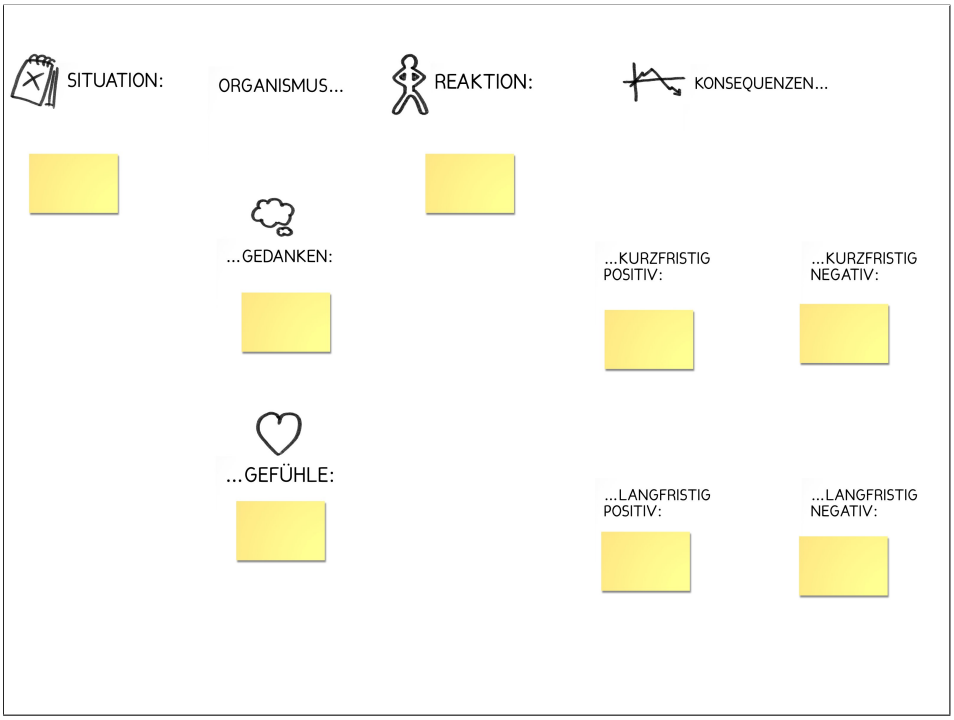


Figure A.3: Behavior analysis (German: Verhaltensanalyse)

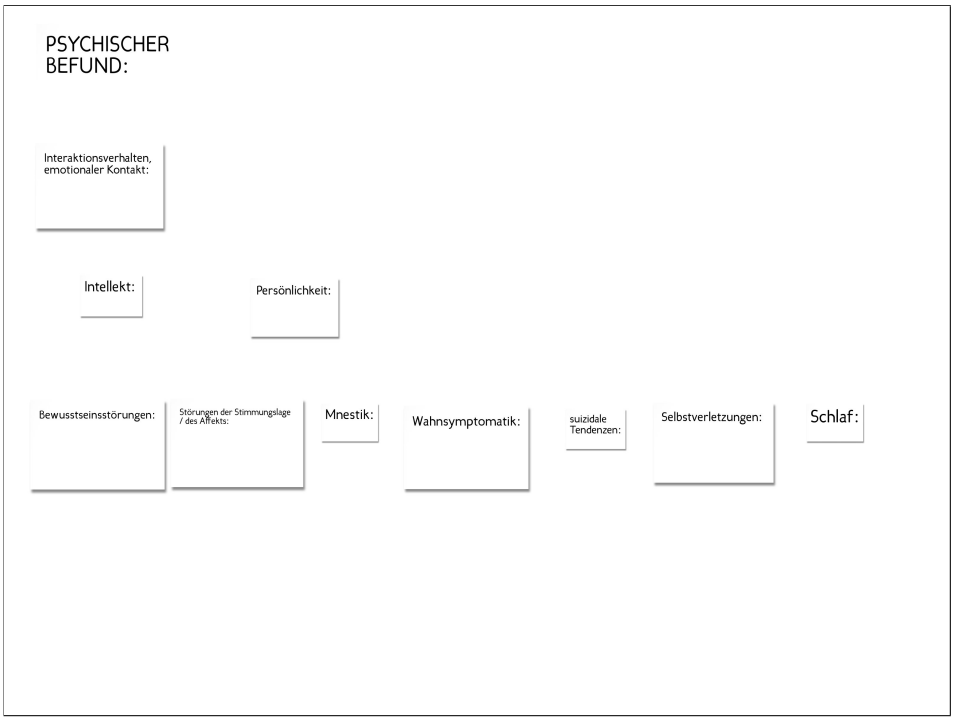


Figure A.4: Psychological finding (German: Psychischer Befund)

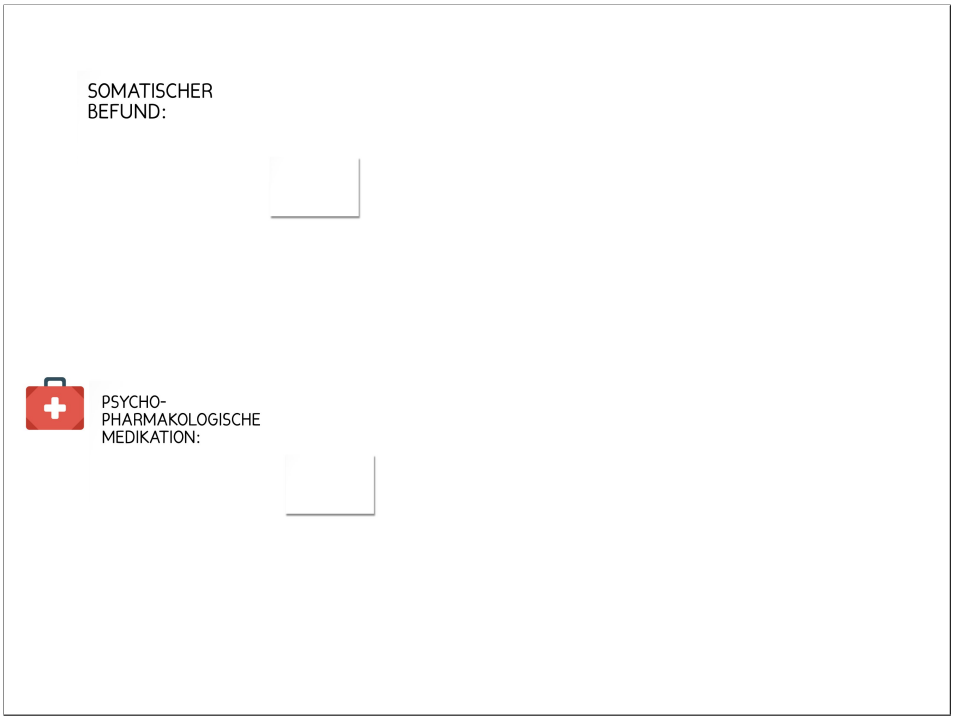


Figure A.5: Somatic finding (German: Somatischer Befund)

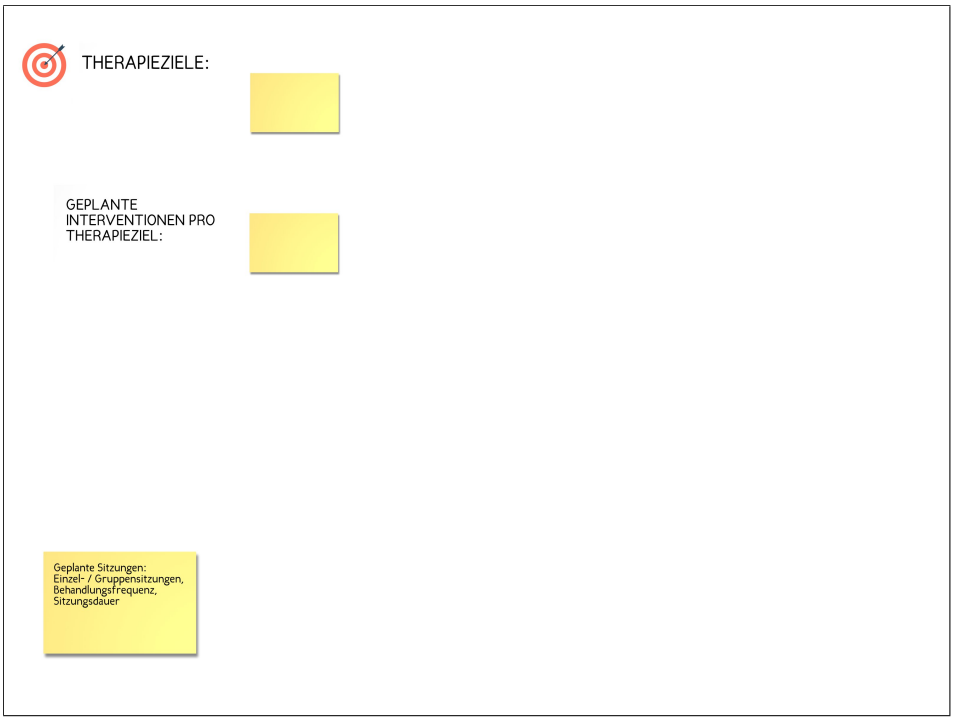


Figure A.6: Therapy plan (German: Therapieplan)

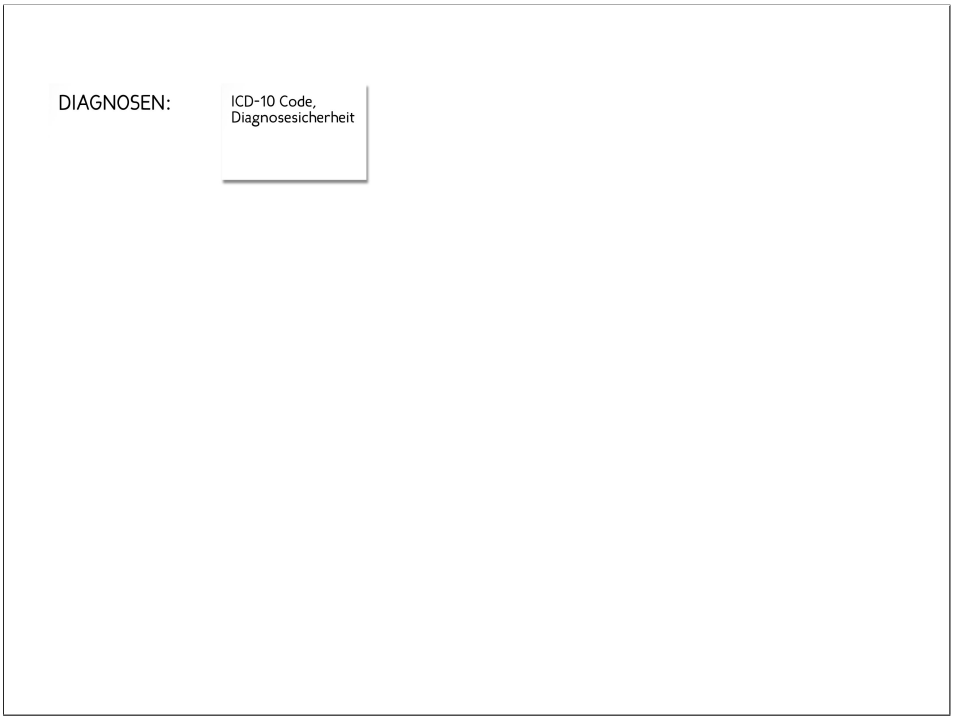


Figure A.7: Diagnosis (German: Diagnose)

A.2 Report Document Template

Therapiezentrum Heinrichsgrün | Lindenallee 60-80 | 14203 Berlin

Abteilung für Psychotherapie

Direktorin: Prof. Dr. Ursula Roger Muster

Unser Zeichen: XYZ
Tel.: 12345
Fax: 6789
https://psychotherapie.heinrichsgruen.de

An
Frau Dr. Muster Eins
Musterkasse
Musterstraße 11

12345 Musterstadt

${DATUM}

Antrag auf Therapie - Bericht an die Krankenkasse

Sehr geehrte Frau Kollegin, sehr geehrter Herr Kollege,

wir berichten Ihnen heute über
${PATIENT}
für den / die wir einen Erstantrag auf Kostenübernahme für psychotherapeutische Behandlung stellen.

1. Relevante soziodemographische Daten
${VG: aktuelle Lebenssituation}

2. Symptomatik und psychischer Befund
${Symptombildung}
${Psychischer Befund}

3. Somatischer Befund / Konsiliarbericht
${Somatischer Befund}
${Psychopharmakologische Medikation}

4. Behandlungsrelevante Angaben zur Lebensgeschichte
${VG: Ursprungsfamilie}
${VG: Kindheit}
${VG: Ausbildung + Beruf}
${VG: therapierelevante Erfahrung}
${Verhaltensanalyse BILD}
${VA: Situation}
${VA: Organismus}
${VA: Reaktion}
${VA: Kons. +kurz}
${VA: Kons. -kurz}
${VA: Kons. +lang}
${VA: Kons. -lang}

5. Diagnose zum Zeitpunkt der Antragstellung
${Diagnosen: ICD Codes}
${Diagnosen + Kriterien}

6. Behandlungsplan und Prognose
${Therapieziele}
${BP: Interventionen}
${BP: Sitzungen}
${Prognose}

Mit freundlichen kollegialen Grüßen,
${THERAPEUT}

A.3 Sections Editor in the Tele-Board MED Web Portal

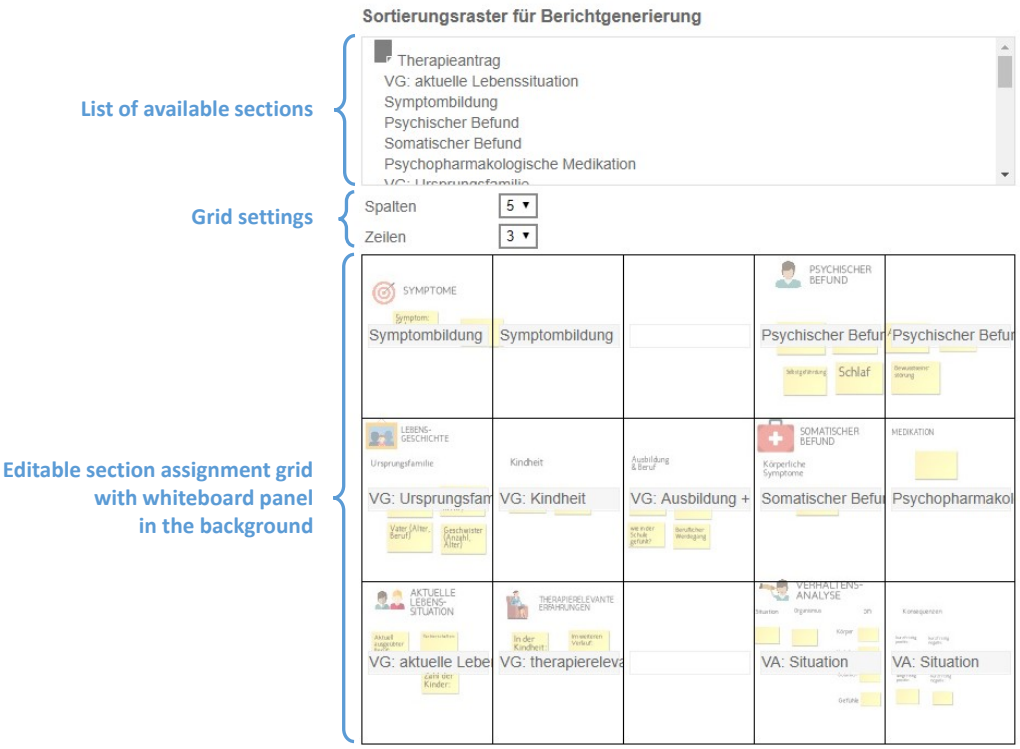


Figure A.8: Annotated screenshot of the panel sections editor in the web portal. The lower part shows the section assignment grid with the whiteboard panel in the background. The number of columns and rows can be changed in the grid settings. Here, the grid is of the size 5x3. Recognizable by the grey label bars, 13 of the 15 cells contain section associations. Two cells in the vertical middle have no associated sections. Via drag and drop, the sections can be picked from the list and assigned to the cells.

A.4 Entity-Relationship Diagram of Database Tables

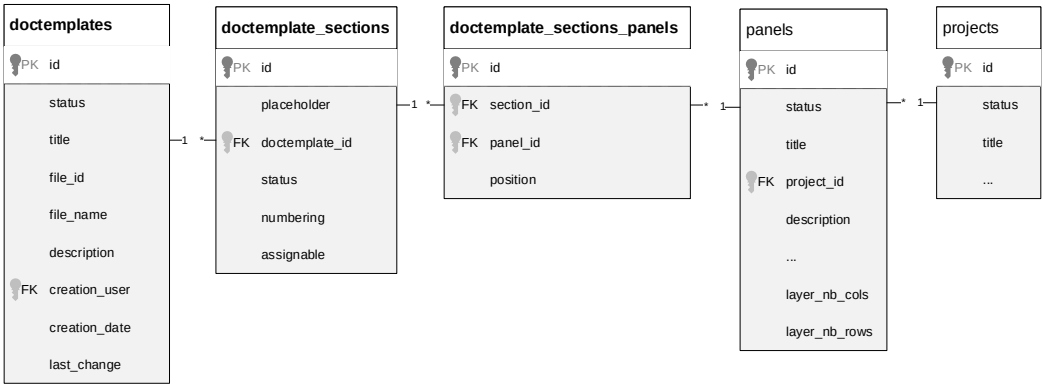


Figure A.9: Entity-Relationship (ER) Diagram of the database tables associated to the medical report generation feature. The three tables from the left have been created for the documentation templates, the documentation template sections and the association of sections to panels. The existing panels table was extended by two two columns which hold the number of columns and rows of the association grid.

A.5 Flowcharts of Implemented Functions

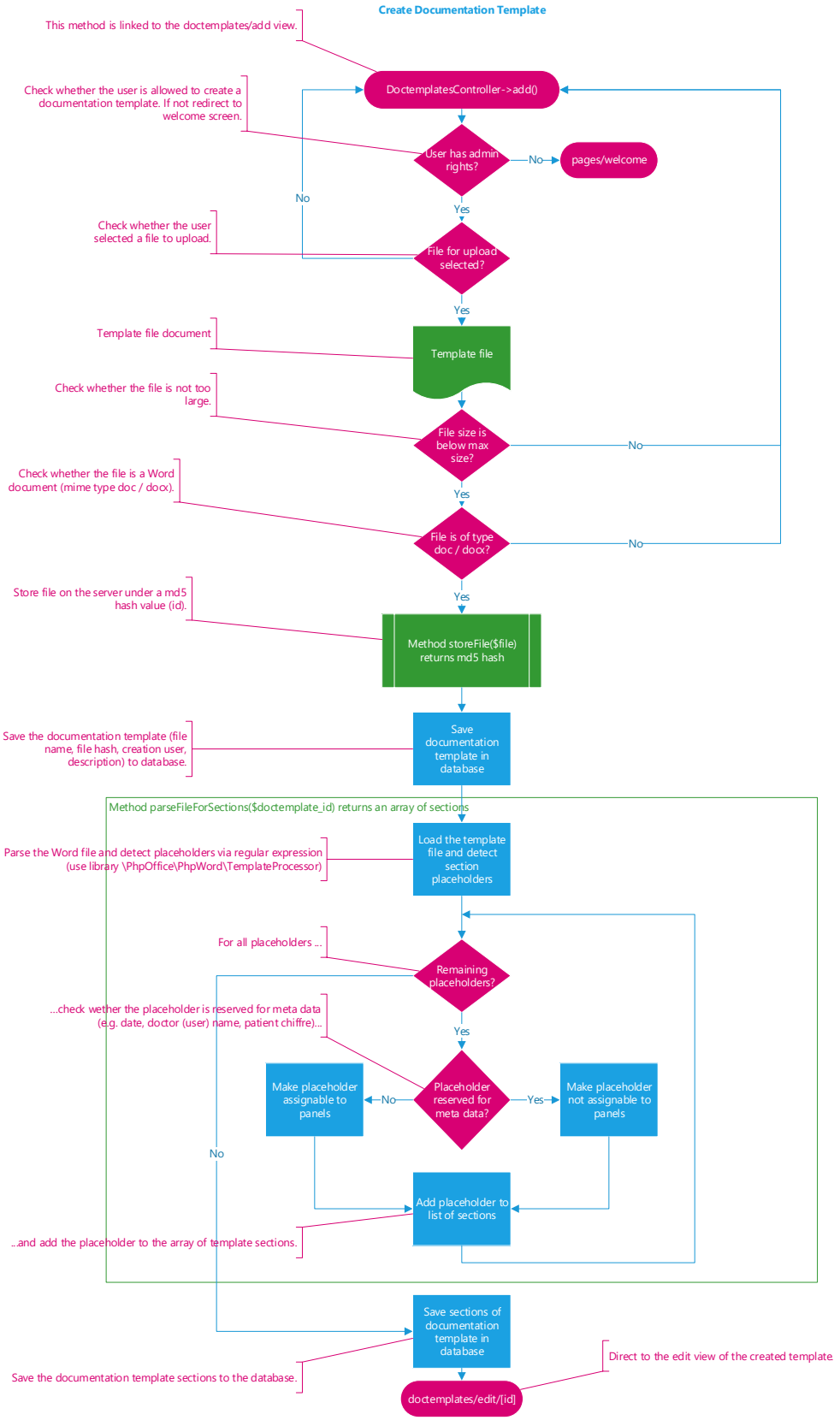


Figure A.10: Flowchart Doctemplates/add

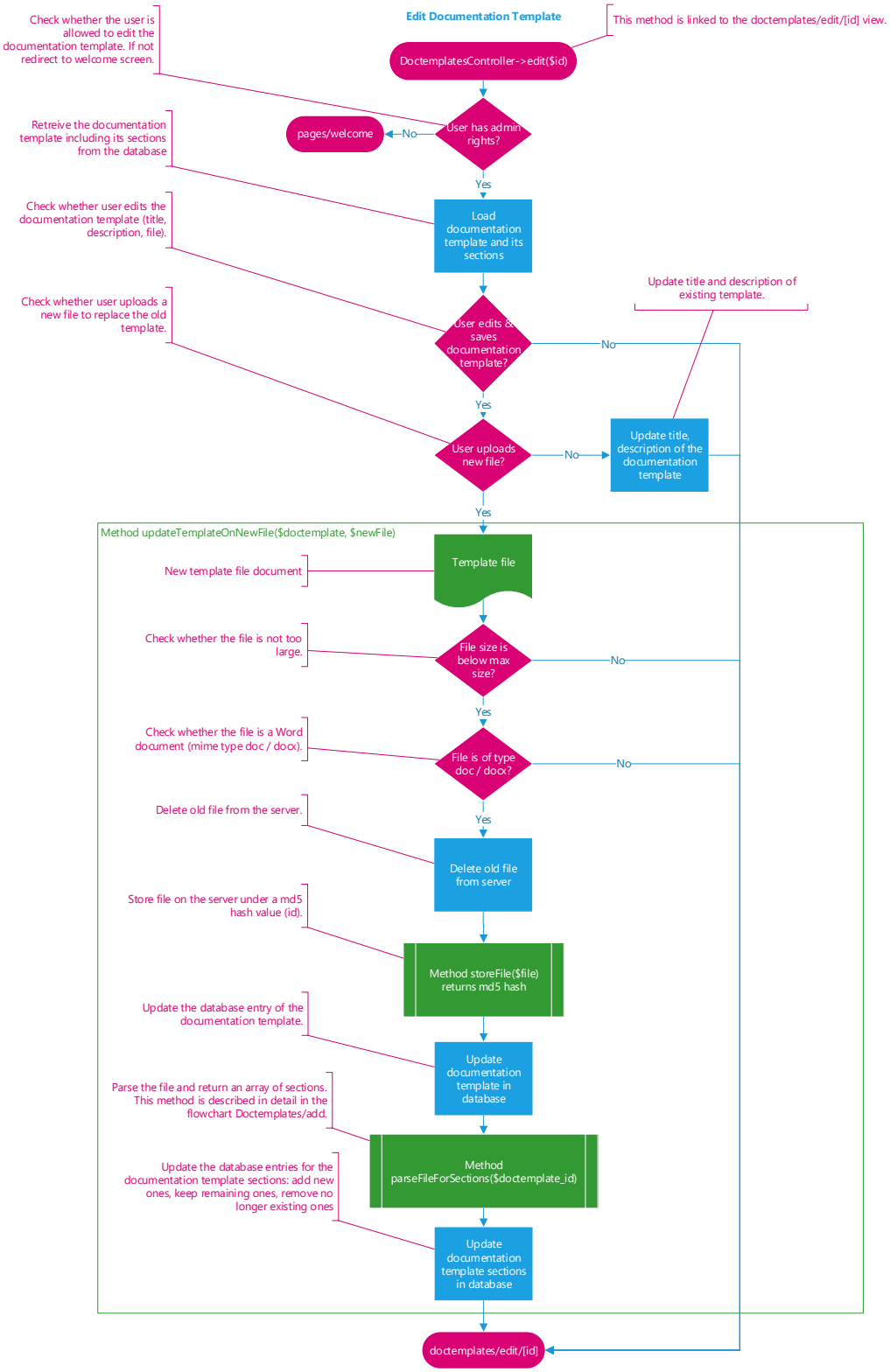


Figure A.11: Flowchart Doctemplates/edit

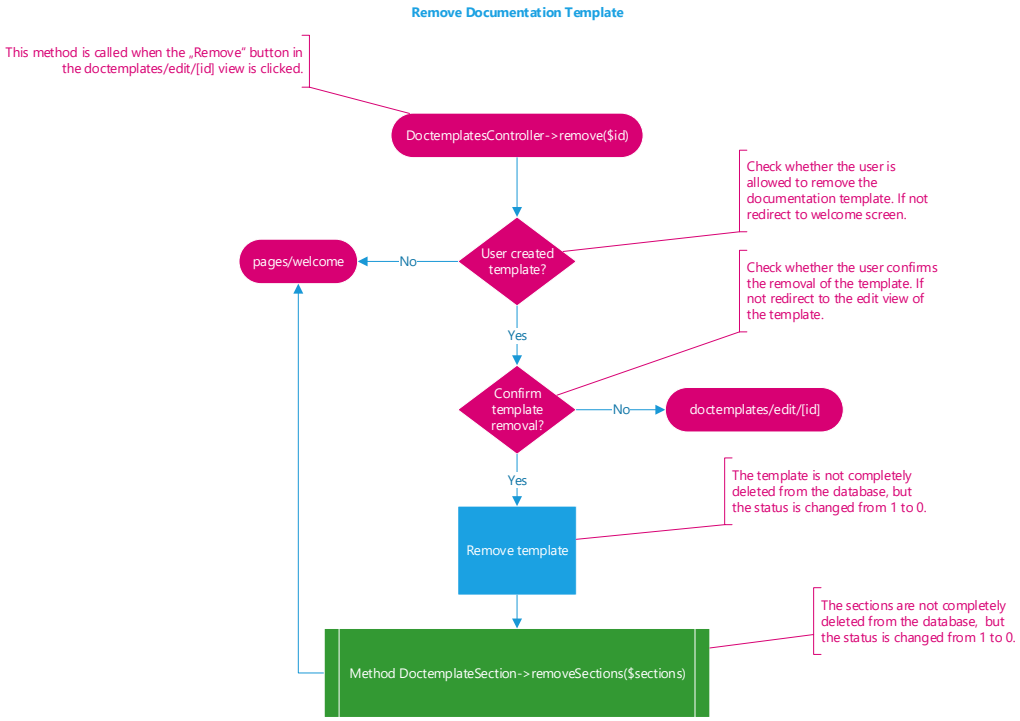


Figure A.12: Flowchart Doctemplates/remove

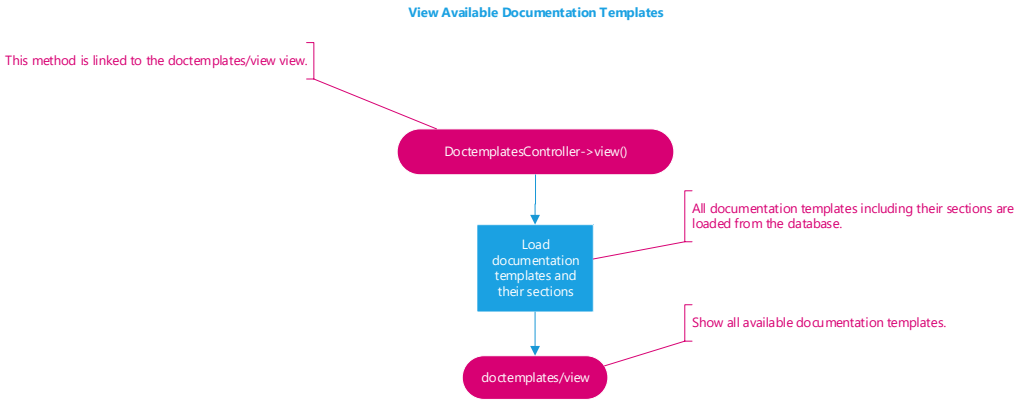


Figure A.13: Flowchart Doctemplates/view

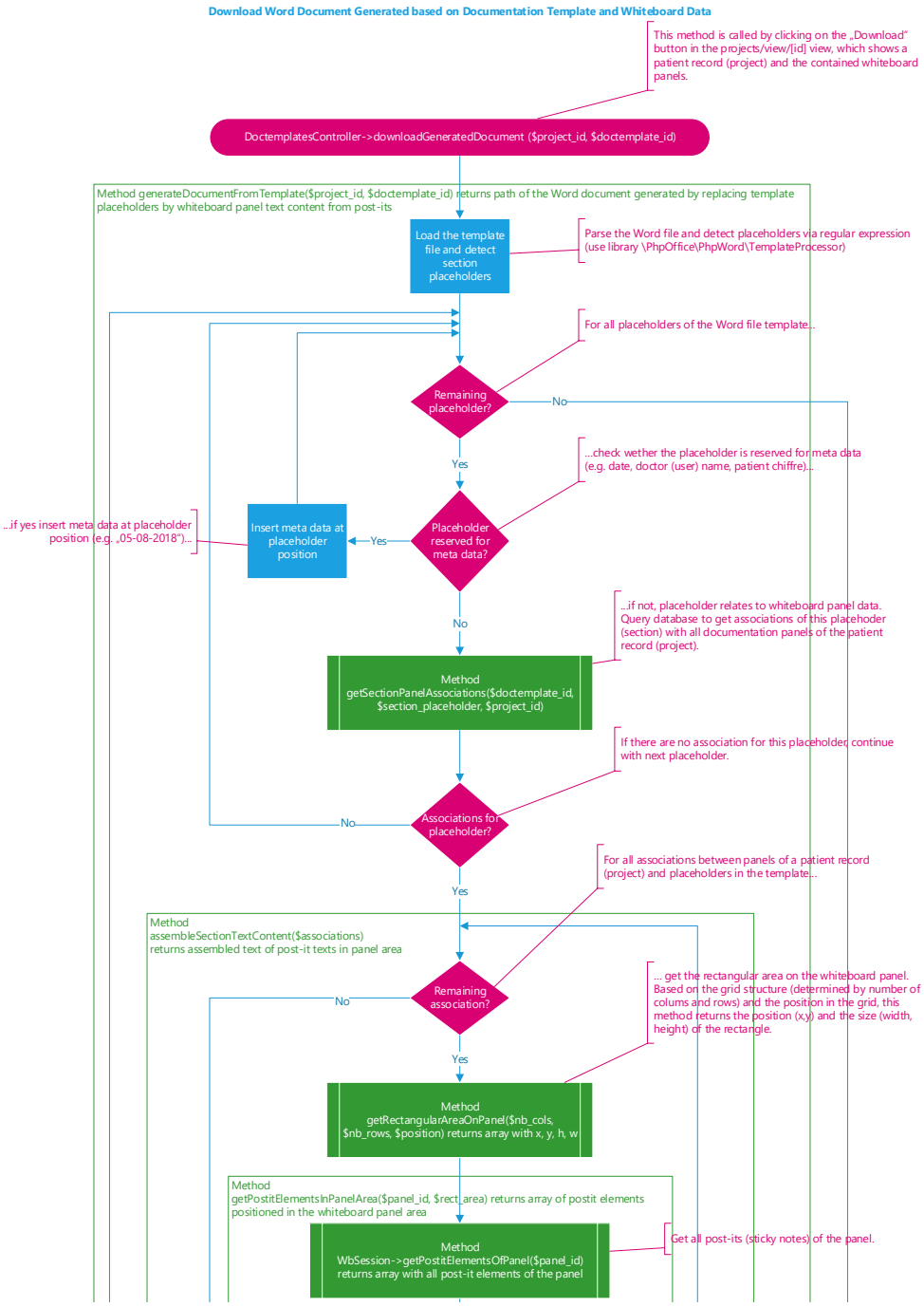


Figure A.14: Flowchart Doctemplates/downloadGeneratedDocument (1/2)

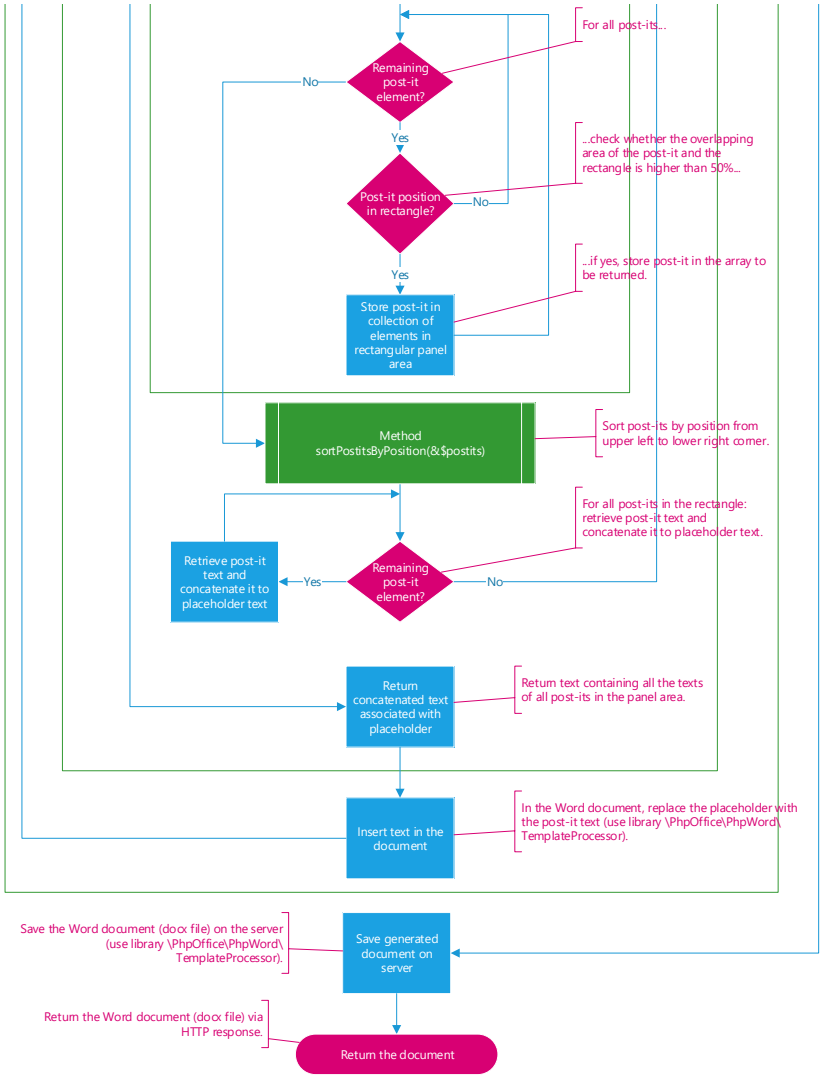


Figure A.15: Flowchart Doctemplates/downloadGeneratedDocument (2/2)

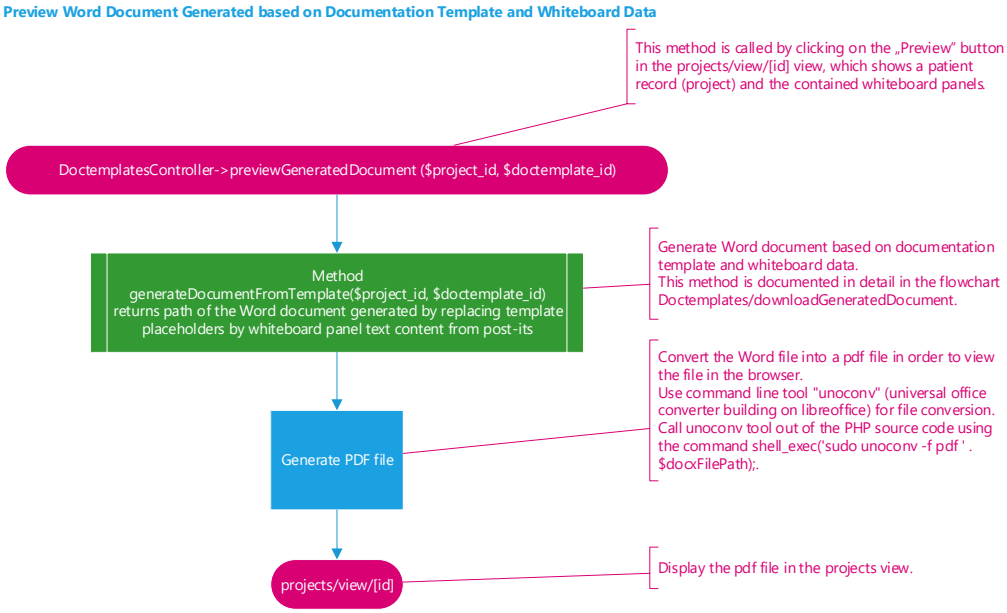


Figure A.16: Flowchart Doctemplates/previewGeneratedDocument

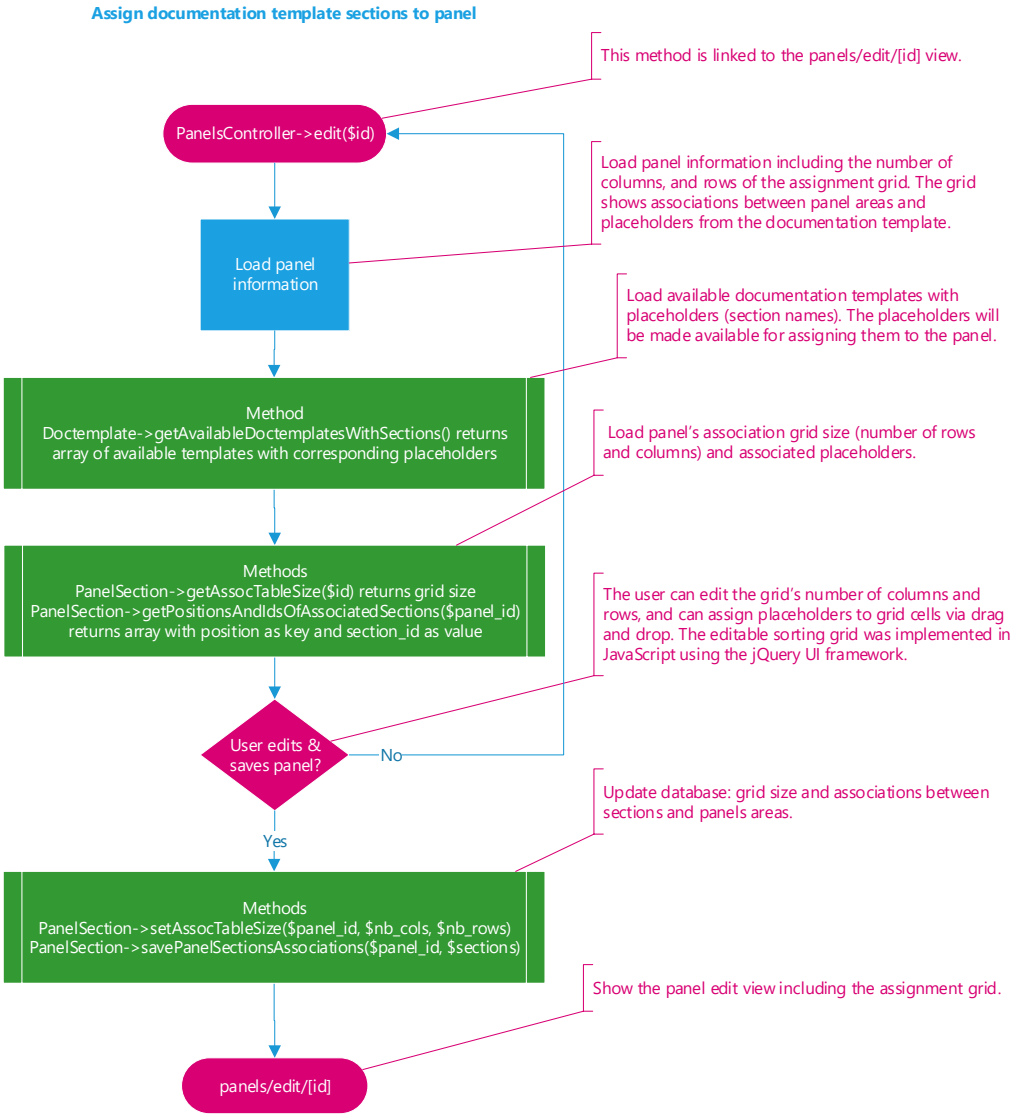


Figure A.17: Flowchart AssignSectionsToPanel

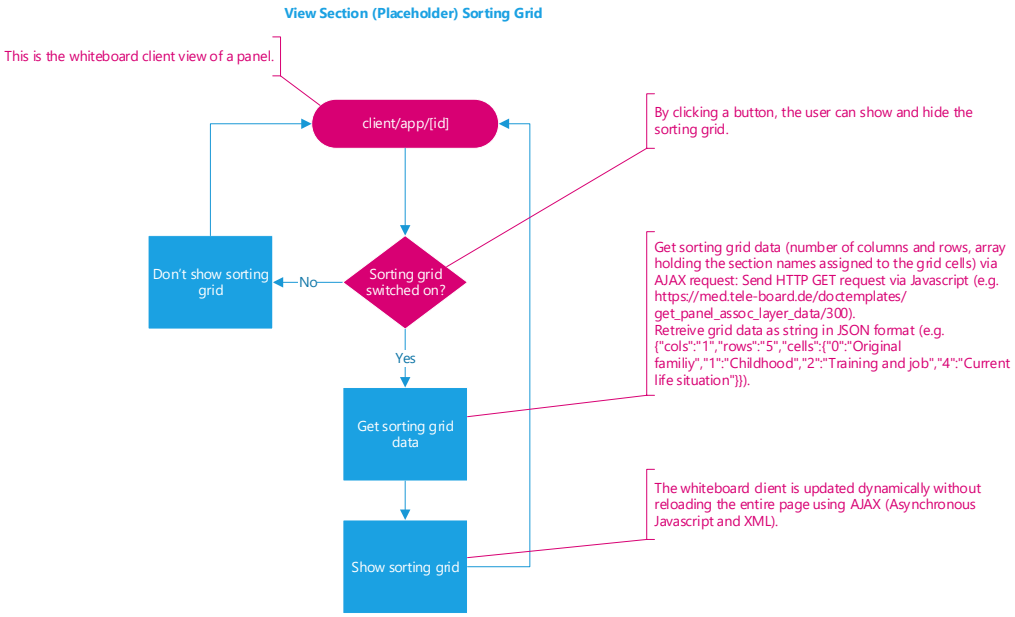


Figure A.18: Flowchart ViewSectionSortingGrid

Appendix B

Questionnaires Used in Evaluation Studies

B.1 Expert Rating Study

Evaluation of the Tele-Board MED Live Demo

Audience Version

Part 1 – Traditional Scenario

You just saw a demo which showed a traditional therapist-patient scenario. We are interested in how you perceived the scenario. Please check one answer per statement.

	Clearly not	Doesn't seem so	I don't know	Seems so	Clearly so
The patient and the therapist have the same therapeutic goals.					
The therapist listens to the patient.					
The patient is allowed in the decision-making process.					
It is easy for the patient to understand the therapist's instructions.					
It is possible for the patient to recognize documentation errors.					
The patient and the therapist collaborate at eye-level.					
The patient and the therapist develop joint knowledge that they can build on in the next session.					
The patient and the therapist have a common understanding of the treatment procedure.					

Part 2 – Scenario with Tele-Board MED

You just saw a demo which showed a therapist-patient scenario with Tele-Board MED. Here again, we are interested in how you perceived the scenario. Please check one answer per statement (the statements are the same as above).

	Clearly not	Doesn't seem so	I don't know	Seems so	Clearly so
The patient and the therapist have the same therapeutic goals.					
The therapist listens to the patient.					
The patient is allowed in the decision-making process.					
It is easy for the patient to understand the therapist's instructions.					
It is possible for the patient to recognize documentation errors.					
The patient and the therapist collaborate at eye-level.					
The patient and the therapist develop joint knowledge that they can build on in the next session.					
The patient and the therapist have a common understanding of the treatment procedure.					

B.2 Technology Acceptance Study (Therapist and Patient Questionnaire)

Fragebogen zu Tele-Board MED (TBM)

Bitte geben Sie uns eine Rückmeldung zu Ihrem Eindruck von Tele-Board MED. Ihre persönliche Meinung interessiert uns sehr! (Und es gibt keine falschen Antworten.)

Ihre anonymisierte Kennung: _____
(Erste zwei Buchstaben des Vornamens der Mutter – erste zwei Buchstaben des väterlichen Vornamens – erste zwei Buchstaben der Straße, in der Sie wohnen)

Allgemeiner Teil

Geschlecht: ☐ weiblich ☐ männlich ☐ anderes Alter: _____ ☐ will mein Alter nicht nennen

Wie lange arbeiten Sie bereits in der Suchtberatung und/oder –therapie?

☐	☐	☐	☐	☐
keine Erfahrung	bis zu 1 Jahr	1 bis 2 Jahre	2 bis 10 Jahre	über 10 Jahre

Welche KlientInnen beraten/therapieren Sie hauptsächlich? (z.B. Suchtfeld, Alter)

_____

Wie viele Berichte (z.B. Sozialberichte, Therapeutische Berichte) haben Sie bereits geschrieben?

☐	☐	☐	☐	☐
keine	bis zu 10	10 - 30	30 – 100	mehr als 100

Wenn Sie bereits Berichte erstellt haben, schätzen Sie bitte Ihren persönlichen Arbeitsaufwand ein:

	Wie oft? (z.B. x mal pro Woche)	Wie lange? (Stunden pro Fall)	Geschätzt mit TBM? (Stunden pro Fall)
Sozialberichte	_____	_____	_____
Therapeutische Berichte (Zwischen-/Abschlussberichte)	_____	_____	_____

Wie würden Sie Ihre Einstellung zu Technik (insbesondere Computern und Handys) beschreiben?

☐	☐	☐	☐	☐
technik-feindlich	technik-skeptisch	neutral	technik-freundlich	technik-begeistert

Über Tele-Board MED

Anmerkung: Die folgenden Fragen beziehen sich auf den möglichen Einsatz von Tele-Board MED in Einzelgesprächen (nicht in Gruppensitzungen).

	stimme nicht zu	stimme eher nicht zu	weder noch	stimme eher zu	stimme zu
Ich empfinde TBM zur Erledigung meiner Dokumentationspflichten als nützlich.	☐	☐	☐	☐	☐
Ich empfinde TBM zur Unterstützung der Kommunikation mit meinen KlientInnen als nützlich.	☐	☐	☐	☐	☐
Wenn ich TBM mit meinen KlientInnen nutzen würde, wären unsere Sitzungen ergiebiger.	☐	☐	☐	☐	☐
Mit der Nutzung von TBM würde sich das Engagement meiner KlientInnen in der Suchtbekämpfung erhöhen.	☐	☐	☐	☐	☐

	stimme nicht zu	stimme eher nicht zu	weder noch	stimme eher zu	stimme zu
Mit dem Einsatz von TBM könnte ich meine Arbeit als BeraterIn / TherapeutIn verbessern.	☐	☐	☐	☐	☐
Auf Basis von TBM-Behandlungsnotizen könnte ich Berichte schneller erstellen.	☐	☐	☐	☐	☐
Der Einsatz von TBM würde die Anzahl der Dokumentationsfehler reduzieren.	☐	☐	☐	☐	☐
Ich denke, dass es einfach ist, die TBM-Software zu nutzen.	☐	☐	☐	☐	☐
Ich denke, dass es einfach ist, ein digitales Whiteboard (berührungssensitiver Bildschirm) in Sitzungen zu nutzen.	☐	☐	☐	☐	☐
Ich denke, dass es einfach ist, einen Laptop und einen Beamer in Sitzungen zu nutzen.	☐	☐	☐	☐	☐
Ich kann mir vorstellen, während der Sitzung mit einer Tastatur zu dokumentieren.	☐	☐	☐	☐	☐
Ich kann mir vorstellen, während der Sitzung mit Tablet-Computer und digitalem Stift zu dokumentieren.	☐	☐	☐	☐	☐
Ich denke, dass es einfach ist, die Bedienung von TBM zu lernen.	☐	☐	☐	☐	☐
Ich denke, ich könnte die Nutzung von TBM flexibel in meine Sitzungen einbringen.	☐	☐	☐	☐	☐

	stimme nicht zu	stimme eher nicht zu	weder noch	stimme eher zu	stimme zu
Personen, die Einfluss auf mein berufliches Verhalten haben, denken dass ich TBM nutzen sollte.	☐	☐	☐	☐	☐
Menschen, die mir wichtig sind, denken dass ich TBM nutzen sollte.	☐	☐	☐	☐	☐
Das Konzept von TBM passt zu meiner Einstellung über die Einbeziehung von KlientInnen.	☐	☐	☐	☐	☐
Das Konzept von TBM passt zum Leitbild der AWO-Suchtberatung und -therapie.	☐	☐	☐	☐	☐
Ich könnte TBM gut in meinen Arbeitsalltag einbeziehen.	☐	☐	☐	☐	☐
TBM würde existierende Dokumentationspraktiken gut ergänzen.	☐	☐	☐	☐	☐
Ich würde TBM gerne in meinen Sitzungen nutzen.	☐	☐	☐	☐	☐
Wenn ich Zugang zu TBM habe, werde ich es nutzen.	☐	☐	☐	☐	☐

Was gefällt Ihnen besonders gut an Tele-Board MED? _____
_____

Was würden Sie sich bei Tele-Board MED anders wünschen? _____
_____

Gibt es Klientengruppen, mit denen Sie TBM gern nutzen würden? _____
_____

Gibt es Klientengruppen, mit denen Sie TBM gar nicht nutzen wollten? _____
_____

Vielen Dank für Ihr Mitwirken!

Fragebogen zu Tele-Board MED

Bitte geben Sie uns eine Rückmeldung zu Ihrem Eindruck von Tele-Board MED. Ihre persönliche Meinung interessiert uns sehr! (Und es gibt keine falschen Antworten.)

Ihre anonymisierte Kennung: _____ (Erste zwei Buchstaben des Vornamens der Mutter – erste zwei Buchstaben des väterlichen Vornamens – erste zwei Buchstaben der Straße, in der Sie wohnen)

Allgemeiner Teil

Geschlecht: ☐ weiblich ☐ männlich ☐ anderes Alter: _____

Wie viele Sitzungen zu Suchtberatung / -therapie (Einzelgespräche und Gruppenteilnahmen) hatten Sie bereits?

☐	☐	☐	☐	☐
0-5	6-15	16-30	31-50	mehr als 50

Welches Suchtmittel steht in Ihrer Therapie im Vordergrund?

☐	☐	☐	☐	☐	☐
Alkohol	Medikamente	Illegale Drogen	Glücksspiel	Medien	_____

Wie würden Sie Ihre Einstellung zu Technik (insbesondere Computern und Handys) beschreiben?

☐	☐	☐	☐	☐
technik-feindlich	technik-skeptisch	neutral	technik-freundlich	technik-begeistert

Über Tele-Board MED (abgekürzt: TBM)	stimme nicht zu	stimme eher nicht zu	weder noch	stimme eher zu	stimme zu
Ich denke, der Einsatz von TBM würde sich positiv auf die Kommunikation in Gruppensitzungen auswirken.	☐	☐	☐	☐	☐
Ich denke der Einsatz von TBM würde die Kommunikation mit dem/der TherapeutIn unterstützen.	☐	☐	☐	☐	☐
Durch den Einsatz von TBM kann ich mein Wissen über Suchtbilder und Therapieansätze erweitern.	☐	☐	☐	☐	☐
Der Einsatz von TBM würde dazu beitragen, dass ich mich besser in das Gespräch einbezogen fühle.	☐	☐	☐	☐	☐
Durch die Nutzung von TBM würde sich mein persönlicher Einsatz in der Sitzung erhöhen.	☐	☐	☐	☐	☐
TBM ist eine gute Unterstützung für Gruppensitzungen.	☐	☐	☐	☐	☐
TBM ist eine gute Unterstützung für Einzelsitzungen.	☐	☐	☐	☐	☐
Ich kann mir vorstellen, auch selbst während der Sitzung Dinge auf TBM mit zu dokumentieren.	☐	☐	☐	☐	☐
Wenn mir bei der Sitzungsdokumentation mit TBM Fehler auffallen, würde ich sie korrigieren.	☐	☐	☐	☐	☐
Ich würde das Angebot nutzen, eine Kopie der Sitzungsnotizen zu erhalten.	☐	☐	☐	☐	☐
Eine Kopie der Sitzungsnotizen würde mir helfen, die besprochenen Themen besser nachvollziehen zu können.	☐	☐	☐	☐	☐
Wenn ich mit Angehörigen über die Sitzung sprechen möchte, würde ich eine Kopie der Notizen nutzen.	☐	☐	☐	☐	☐

Bitte wenden ->

Was gefällt Ihnen besonders gut an Tele-Board MED?

_____

_____

Was würden Sie sich bei Tele-Board MED anders wünschen?

_____

_____

Gibt es Situationen, in denen Sie Tele-Board MED gern nutzen würden?

_____

_____

Gibt es Situationen, in denen Sie Tele-Board MED gar nicht nutzen wollten?

_____

_____

Vielen Dank für Ihr Mitwirken! **Kontakt: tele-board-med@hpi.de**

B.3 User Experience Study (Emotion Sample, User Experience Curve, Questionnaire)

_____

Bitte schätzen Sie ihr Gefühl zu diesem Zeitpunkt im Patientengespräch ein:

angenehm |----------| unangenehm

gelassen |----------| aufgeregt

Meine Aufmerksamkeit war zu diesem Zeitpunkt hauptsächlich gerichtet auf …

Patient / Patientin |----------| Tele-Board MED

Gefühlskurve zum Therapiegespräch mit Tele-Board MED

Bitte blicken Sie auf den gesamten Gesprächsverlauf vom Beginn bis zum Ende zurück und zeichnen Sie eine Gefühlskurve. Kommentieren Sie den Verlauf, z.B. Höhe-, Tiefpunkte, Änderungen.

Kurze Beschreibung der Änderungen im Kurvenverlauf:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Fragebogen

Allgemeiner Teil

Geschlecht: ☐ weiblich ☐ männlich ☐ anderes Alter: _____ ☐ will mein Alter nicht nennen

Wie würden Sie Ihre Einstellung zu Technik (insbesondere Computern und Handys) beschreiben?

☐	☐	☐	☐	☐
technik-feindlich	technik-skeptisch	neutral	technik-freundlich	technik-begeistert

Bitte schätzen Sie Ihre Therapieerfahrung ein:

☐	☐	☐	☐	☐	☐	☐
keine Erfahrung	PiA 1 Jahr	PiA 2 Jahre	PiA über 2 Jahre	Therapeut/In 1 Jahr	Therapeut/In 2 Jahre	Therapeut/In über 2 Jahre

Wie viele Gutachterberichte (zu Übungszwecken und für echte Fälle) haben Sie bereits geschrieben?

☐	☐	☐	☐	☐
keine	bis zu 5	6 - 10	11 - 20	über 20

Wenn Sie bereits Berichte erstellt haben, wieviel Zeit benötigen Sie üblicherweise zum Schreiben eines Erstantrags für die Krankenkassen zur Beantragung von Therapiestunden? ca. _____ Stunden

Über Tele-Board MED und die Berichterstellung

Bitte betrachten Sie den eben erstellten Bericht und schätzen Sie den inhaltlichen Fortschritt im Hinblick auf die finale Version ein. Der Entwurf enthält ca. _____ % des Inhalts des finalen Berichts.

Ich würde noch ca. _____ Minuten benötigen, um die vorhandenen Inhalte in einen abgabefertigen Berichtstext zu überführen.

Inwieweit haben die beiden Ziele des Therapiegesprächs (gute Gesprächsführung mit dem Patienten vs. Erfassung relevanter Informationen) zusammengepasst? Bitte setzen Sie ein Kreuz auf der Linie:

Die Ziele haben sich gegenseitig unterstützt. |----------| Die Ziele haben sich widersprochen.

Wie gehen Sie bei der Erstellung des Berichts üblicherweise vor?

☐ Ich beginne mit dem Schreiben des Berichts, sobald die Anamnesegespräche abgeschlossen sind.

☐ Ich schreibe nach jedem der Anamnesegespräche bereits einen Teil des Berichts.

☐ _____

Soeben genutzte Zeit für die Bearbeitung des Berichts: _____ Minuten

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