Health Informatics

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Mental Health Practice in a Digital World

A Clinicians Guide

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I would like to dedicate this book to my wife Devaki, and my sons Ashwin, and Shyam.

Naakesh A. Dewan

Foreword

> *We achieve understanding within a circular movement from particular facts to the whole that includes them and back again from the whole thus reached to the particular significant facts.*
>
> Karl Jaspers, General Psychopathology[1]

In his classic treatise on the phenomenology of mental illness, Karl Jaspers emphasizes the importance of viewing a problem from differing vantage points. Also, in moving from the general to the specific and back again, we can identify the gaps in our knowledge and address them gradually as new information accrues. In some instances, filling those gaps will require research into the neurobiological and psychological underpinnings of mental illness and its treatment. In other instances, we will need to develop a deeper knowledge of the life experiences, hopes, and goals of the patient who is sitting before us. With the explosive growth in available technologies, as described in this volume, we add further dimensions to the process of understanding that go well beyond anything that Jaspers could have imagined in his era.

Although it is natural to be carried away by the excitement and potential of new technologies, it is essential that we gain a detailed understanding of their impact before rushing these technologies into everyday use. Unanticipated consequences of new technologies are common and may be positive, negative or both. Even with proven technologies, intended benefits are not invariably achieved. Here too, a "circular" approach is worthwhile. Leadership is crucial in fostering appropriate resources and culture for technological change but front-line staff must also be engaged and participate in developing features and workflows. Patients and families must also become partners in finding ways to make technology that meets their

[1]Jaspers, Karl. *General Psychopathology.* Hoenig J and Hamilton MW, trans. Chicago: The University of Chicago Press, 1963, p. 357.

needs. All too often health professionals implement innovations that we think will meet patients' needs without ever checking with them. In each of these realms, there should be iterative reassessments, integration of feedback and further reassessments so that technological advances can continue to be fine-tuned.

An additional dimension, which Jaspers could not have predicted, relates to the ways in which health care financing and regulation can alter the use and the usability of new technologies. No matter how amazing a new technology may be in improving care, it is unlikely to be used widely or in an equitable fashion unless it is covered by major health care payment models. Health care regulation can similarly foster use of new technologies through financial or other incentives. On the other hand, regulation can detract from effective use of emerging technologies when it mandates elaborate changes to software, creates burdensome documentation, or interferes with clinical workflows. Requirements for structured documentation to meet payment or regulatory requirements can also have insidious negative effects by disrupting the clinical thought process and fragmenting the patient's "story."

As you read the chapters in this volume, you will appreciate the enormous potential of new technologies for enhancing care in mental health settings. You will also learn about the complexities and possible pitfalls of those new technologies. This book will serve as a launching point for your journey in adopting new technological approaches to caring for patients. We can also foster continuing refinements in these innovations through systematic analysis and astute observation of the effects of these interventions – tasks that mental health professionals are already skilled in doing. In this fashion, we can apply Jaspers' advice about achieving understanding by "circling" from the facts to the whole and then back again. Above all, however, we cannot lose sight of the heart of the circle – the patient and his or her family. When new technologies help us improve care and enhance our understanding of patients as individuals, then we will be able to rejoice together in their success.

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Chapter 1
Past, Present, and Future Policy and IT Landscape in Public Mental Health Care

Ron Manderscheid

Abstract The purpose of this chapter is to trace the evolution of recent mental health policy in the United States since the beginning of the fourth quarter of the twentieth century, and to outline the relationship this evolution has had with mental health service delivery and the use of IT in the field. The chapter begins with an overview of mental health policy and the evolution of information technology. IT use and policies from 1975 to 2014 are reviewed by time period. The author presents each decade with Hallmarks, the Policy Context, and the IT Context, The early years are characterized by angst in the mental health field. The later decades are ones of alternating concern and hope about the future of mental health services and technology. The author offers predictions for the future use of IT in mental health.

Keywords Deinstitutionalization • Electronic health records • Health insurance exchanges • Hospitals • Psychiatric • Intellectual disability • Medical informatics • Medicare • Mental health • Mobile applications • Patient Protection and Affordable Care Act • Telemedicine

1.1 Introduction

Changes in national mental health policy exert dramatic effects upon the nature and quality of mental health care delivered in the United States (see [1]). Although intuitively a very closely related notion, the relationship between mental health policy and the information technology (IT) employed by the mental health field is much less widely known and understood.

The purpose of this chapter is to trace the evolution of recent mental health policy in the United States since the beginning of the fourth quarter of the twentieth century, and to outline the relationship this evolution has had with mental health

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service delivery and the use of IT in the field. As we recount the history of these interactions, we will identify some key barriers that have prevented the translation of policy into service practice and the translation of service practice into IT applications. We also will discuss some potential future scenarios.

Before we can begin this work, however, two prior tasks must be undertaken. First, we must circumscribe what is meant by mental health policy. Second, we must describe the evolution of IT, its interaction with the evolution of programming capacity, and the joint effects of these two factors upon the applications that actually are possible at any given time.

1.2 Mental Health Policy

Mental health policy is a very imprecise concept. We must circumscribe it so that we have a better understanding of its actual nature (see [1]).

First, we want to distinguish de facto from de jure mental health policy. De facto policy is what actually governs day-to-day mental health care in the United States. De jure policy is what has been codified into law. For example, the de facto policy of community-based mental health care began in the late 1940s and the early 1950s, and then evolved for more than a decade before in became de jure policy in 1963 with the passage of the Mental Retardation Facilities and Community Mental Health Centers Construction Act of 1963.

A second important distinction is whether mental health policy actually is national or not. National mental health policy always is codified in law, and it always applies to the entire population. For almost the entire history of the United States, either one or both of these conditions was not met. We had de facto policies that did not become de jure policies, and we had de jure policies that did not apply to the entire population. Only with the advent of the Patient Protection and Affordable Care Act of 2010 (see [2]) do we actually have national mental health policy; it is de jure policy that does apply to the entire population.

We will employ these distinctions as we discuss the evolution of mental health policy in this paper.

1.3 Information Technology

Although modern IT was introduced in a very limited way even before the end of World War II, it was not generally employed until the 1975–1980 period in the mental health field. Hence, we begin our analysis with the year 1975.

Figure 1.1 presents a graphical representation of some nodal events in the evolution of three key IT dimensions: hardware, software, and applications, and their approximate relationship to each other.

In the past 40 years, hardware has evolved from large, bulky, mainframe computers, to small, fixed, personal desktop computers, to mobile personal computers, to

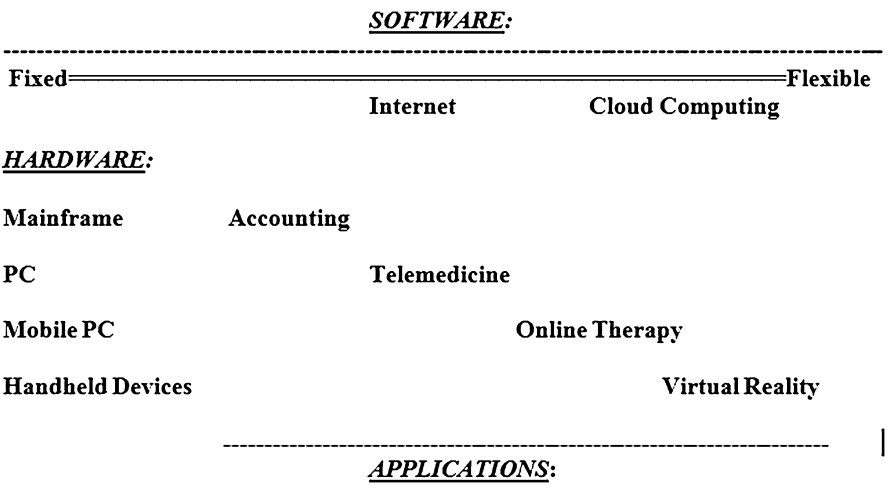

Fig. 1.1 Dynamic relationships among IT hardware, software, and applications

mobile handheld devices, such as I-pads and I-phones. At the same time, software has evolved from small, fixed programs that produce fixed results, to large, complex, smart programs that can learn and are cybernetic. This software evolution permitted the introduction of the Internet approximately 20 years ago and cloud computing approximately 5 years ago.

The interaction of these two dimensions, hardware and software, has given rise to the IT applications that have been possible in the mental health field at specific times. The mainframe computer and fixed programming lent themselves to data storage applications, such as financial accounting, client record-keeping, etc. Although telemedicine was introduced originally via a TV camera and monitor system, and was hardwired between provider and client, this system was easily adapted to fixed personal desktop computers and later to mobile personal computers. Further software evolution permitted the introduction of online therapy in which a client could interact with a smart program rather than a provider. Today, software evolution has made possible the use of virtual reality in therapy, as well as a broad array of micro applications ("apps") for handheld devices.

The reader is encouraged to refer back to this figure to understand the evolution of IT hardware, software, and applications, as we discuss their interaction with evolving mental health policy and services.

1.4 The Early Years: 1975–1984

1.4.1 Period Hallmarks

This early period, 1974–1984, could be characterized as one of major transitions, punctuated in the middle by the election of President Ronald Reagan. During the

first half of this period, the National Institute of Mental Health (NIMH) reached the midway point in construction of a national set of community mental health centers, when more than 800 of these facilities were in operation (see [3], for an informative description of major events in the history of NIMH). The states continued deinstitutionalization during this period, and large numbers of persons were released from the state mental hospitals. But warning signs were abundant. Persons who were deinstitutionalized were not welcomed into community mental health centers. The federal grants that governed the centers dictated that center efforts should be directed toward paying clients with insurance coverage.

In the latter half of this period, homelessness grew to unprecedented large numbers in the United States, and a significant portion of the homeless population consisted of people with mental illnesses. Also in this period, an NIMH Community Support Programs was begun by the federal government to provide case management for adults with serious mental illnesses, and to link these people with needed mental health, health, and social services.

1.4.2 The Policy Context

Throughout this period, the de jure mental health policy promoted the development of community-based mental health services, and the de facto policy promoted the reduction of inpatient psychiatric care (see [4], for an in-depth discussion of mental health policy in modern America). The initial governing de jure policy was the 1963 Act referenced above. In 1980, the Administration of President Jimmy Carter was successful in achieving passage of the Mental Health Systems Act designed to improve mental health service delivery, particularly for persons with severe illness. Only a few months later, this legislation was repealed by the Reagan Administration, which also defunded the original 1963 Act and replaced it in 1981 with a Community Mental Health Services Block Grant to the states with considerably reduced overall funding.

1.4.3 The IT Context

In the first half of this period, NIMH operated a program that promoted the use of IT by community mental health centers to do automated financial accounting and to collect rudimentary client and staff characteristics data, as well as program performance indicators. In addition, through the Mental Health Statistics Improvement Program (MHSIP), NIMH developed definitions and data standards for use in these fledgling IT systems (see [5]).

All of the federal IT work by NIMH came to an end with the election of President Reagan. However, the Institute continued its related work on data definitions and standards, and these definitions and standards continued to be incorporated by states and vendors into their evolving IT systems.

1.5 The Middle Years: 1985–1994

1.5.1 Period Hallmarks

The middle years, 1985–1994, can be characterized as a period of struggle and angst in the mental health field. Efforts continued at NIMH to develop the Community Support Program to address the service needs of adults with serious mental illness, albeit with minimal federal funding. A parallel program, the Child and Adolescent Service System Program, was initiated on a small scale by the Institute to address the service needs of children with serious emotional disturbance. Most federal services work during this period was oriented toward the states because of the changes introduced earlier by the Reagan Administration.

Community mental health centers continued to struggle financially with the reduced funding that they now received from the states through the federal Community Mental Health Services Block Grant Program, and they increasingly turned to Medicaid as a source of service funding. At the same time, efforts were made by the Reagan Administration to limit the numbers of persons with mental illness who could qualify as disabled under the Supplemental Security Income Program, which would entitle them to receive Medicaid funding for health and mental health services.

In an effort to conserve mental health financial resources, private sector managed behavioral health care was introduced to control mental health service utilization in private health insurance plans, and this innovation spread gradually into public sector mental health services, principally at the state level. Clearly, this innovation was quite controversial at the time, particularly among those in the mental health provider community.

Partially as a reaction of these problems, the Substance Abuse and Mental Health Services Administration (SAMHSA) was created in 1992 to separate the services work of NIMH from its research mission, and to create a fuller national voice for the development and implementation of mental health services in the community.

1.5.2 The Policy Context

Throughout this period, the de jure policy of community-based mental health services predominated, and growing attention was given to case management services in order to coordinate the broad array of health and social services needed by persons with serious mental conditions.

In 1993 and 1994, the Clinton Administration developed, but failed to achieve passage of what came to be known as the Clinton Health Security Act. This Act would have provided health insurance coverage to many uninsured Americans with a defined benefit that included mental health and substance use care.

1.5.3 The IT Context

Since neither NIMH nor SAMHSA had a defined IT program during this period, the federal government did not play a significant role in the evolution of IT introduced into the field during this decade. Hence, most of the innovation in IT applications can be attributed to the way that private vendors responded to the needs expressed by IT purchasers in the field who were delivering mental health services.

Clearly, a need existed to have detailed information on the characteristics of clients served, their service utilization, and their service costs. Thus, in this period, the rudiments of an electronic medical record began to emerge for behavioral healthcare services. However, efforts were not made to link the behavioral health record with parallel information on primary care services.

1.6 The Recent Years (1995–2004)

1.6.1 Period Hallmarks

Again, this decade was one of alternating concern and hope about the future of mental health services. Just before the beginning of this decade, the Clinton Health Security Act had failed in the Congress in 1994, thus denying millions of citizens access to needed health insurance benefits. Shortly before the end of his second term, President Clinton hosted a While House Conference on Mental Health, which resulted in an Executive Order extending parity to mental health benefits in the Federal Employee Health Insurance Benefit Program, and the Surgeon General issued the first-ever *Report on Mental Health*. Less than 3 years later, the new President, George W. Bush, announced the President's New Freedom Commission on Mental Health, which resulted in a very clear philosophical direction for the field, but very few actual resources to move the field. This Commission called for service integration between mental health and primary care, improved quality of service delivery, and better use of IT in care delivery. Throughout the decade, the needs for care far outpaced the resources available. As a result, local and county jails began to emerge as the new mental hospitals during this period.

1.6.2 The Policy Context

Community-based mental health care remained the predominant de jure policy motief throughout the decade. However, the Surgeon General had identified and the President's New Freedom Commission on Mental Health had endorsed the need to transition to integrated care. Simultaneously, recovery became generally recognized as a primary goal of care, due principally to the efforts of members of the national consumer movement, which itself came of age during this decade.

The hope of recovery—the lifelong process of regaining one's life in the community—changed forever our approach to mental health care. The import and effects of this change cannot be overemphasized. This change not only rekindled hope in those with mental conditions, but it also promoted their increased self-esteem, and even energized the national consumer movement.

1.6.3 The IT Context

Policy and service changes during this decade gave strong impetus to efforts to design and implement an interoperable electronic medical record that would encompass mental health, substance use, and primary care services. These efforts were recognized formally when the Bush Administration created the Office of the National Coordinator for Health Information Technology in the US Department of Health and Human Services. In its early years, this Office spent considerable time conceptualizing an electronic medical record and developing appropriate data dictionaries to drive comparable content. However, little funding was made available to implement these tools in the health delivery field.

At this time, it also became apparent that federal law and regulation (42 Combined Federal Regulations Part 2) governing substance use care would create a major impediment to the sharing of information on substance use care in electronic medical records. By contrast, the passage and implementation of the Health Insurance Portability and Accountability Act (HIPAA) defined the limits of privacy for personal health information and established penalties for inappropriate disclosure of this information.

At SAMHSA, a decade-long project was undertaken to develop Decision Support 2000+, a next generation management information system that would permit benchmarking across programs using real-time information from electronic medical records, shared through the Internet, which itself came of age during this period. This effort not only defined the next generation of data standards for mental health, but also fostered a major partnership with the Software and Technology Vendors Association (SATVA), which was formed to represent most IT vendors in the behavioral health field. SATVA worked closely with the federal government during this period.

1.7 The Modern Era (2005–2014)

1.7.1 Period Hallmarks

In this most recent decade, major efforts have continued to develop integrated care programs, goaded by the tragic finding that public mental health clients die 25 years

prematurely [6]. This work has proceeded despite the fact that the Great Recession dramatically reduced expenditures for public mental health services, perhaps by as much as $4.5 billion. Legislative developments during the decade provided strong support for the work on integrated care and provided financial incentives to promote it. Throughout the decade, a growing recognition also emerged that a large and ever expanding number of persons with mental health and substance use conditions were becoming incarcerated inappropriately in local and county jails, and state penal institutions.

1.7.2 The Policy Context

This decade witnessed two major policy shifts. First was the passage of the Wellstone-Domenici Mental Health Parity and Addiction Equity Act of 2008. Second was the passage and implementation of the Patient Protection and Affordable Care Act of 2010. Each is discussed below.

The Wellstone-Domenici Act extended parity for mental health and substance use insurance benefits to all large private plans that offer these benefits and that insure 50 or more persons. Here parity means equality of behavioral health insurance benefits and medical/surgical insurance benefits, as well as equality in how these benefits are managed. Not enough can be said for how important this Act has been in changing the dialogue in the health field around mental health and substance use care.

Even more monumental, the Patient Protection and Affordable Care Act of 2010 is on a par with the creation of Social Security in 1935 and the creation of Medicare and Medicaid in 1965. This Act contains many reforms (see [2]), including dramatic expansions in private and public health insurance coverage; needed adjustments to long-standing insurance provisions, such as requiring guaranteed coverage, elimination of annual and lifetime limits, mandatory benefit structure, and removal of copays and deductibles for targeted preventive interventions; introduction of federal financial incentives to promote integrated care and risk bearing capitation payment systems; and introduction of federal incentives to promote use of electronic medical records. For the mental health and substance use fields, the changes introduced by this Act are major landmarks. In fact, this Act reflects the very first national de jure policy on mental health every enacted since the founding of the United States in 1776.

Importantly, the Patient Protection and Affordable Care Act of 2010 also extended parity to all new enrollees under the State Health Insurance Marketplaces; all new enrollees under the State Medicaid Expansions; and all new enrollees in individual plans after July 1, 2014. As a result, more than 60 million citizens now enjoy this protection.

Overall, the advances produced through these two pieces of legislation codified the developments of the preceding quarter century: promotion of community-based mental health and substance use care, promotion of integrated behavioral health and primary care, and promotion of integrated electronic medical records.

1.7.3 The IT Context

Throughout the decade, efforts continued to implement electronic medical records fueled by federal financial incentives in 2009. Despite the fact that behavioral healthcare program were excluded from these financial incentives and despite the fact that federal law and regulation create great disincentives to the inclusion of substance use care data in these records, slow but steady progress continued in their implementation.

Although this clearly was the decade of the Internet, with phenomenal growth in use and a veritable explosion in mobile phone apps linked to the Internet, these developments did not translate into a commensurate impact on the use of the Internet for care delivery in the mental health or substance use fields. People can now go to the Internet to find numerous support groups, to find detailed information on disease and care, and to find a broad array of community providers, yet this exciting world generally ends at the door of behavioral health providers. One can speculate that many factors are in play to produce this dramatic discontinuity: most behavioral health providers have no IT training; many state laws discourage electronic communication between provider and consumer; and many behavioral health entities have aging IT equipment and capacity. Whatever the specific reasons, an ever growing digital divide exists between what is going on in the community and what is transpiring in the offices of behavioral health providers, particularly those working in the public sector.

Yet, even more very exciting digital developments are on the near horizon. Perhaps most interesting is the development of virtual reality helmets now beginning to be widely used in electronic games. These helmets have potential care changing possibilities in behavioral healthcare that are just now beginning to be explored by our research community. A second very exciting recent development is the growth in the use of avatars for self and others, which also have great potential in behavioral healthcare.

1.8 The Future (2015 and Beyond)

As we look to the future, it is advisable to seek a midground between what will be potentially possible and what is actually likely to be achieved. With this balance in mind, here are a few predictions for the next decade.

Our new de jure parity and health reform policies will continue to energize behavioral healthcare. Additional people with behavioral health conditions will continue to enroll in health insurance, the field will continue to grow, and integration efforts will accelerate (see [7]). Each of these developments is very important, and each is very positive for behavioral healthcare.

Predictions regarding the use of IT in behavioral healthcare need to be much more guarded, with many caveats. Our work in implementing integrated, interoperable electronic medical records will continue, but progress will be retarded by the

workarounds necessary to accommodate federal law and regulation regarding the confidentiality of electronic records for substance use care. Further, unless we are able to extend federal financial incentives for implementing electronic medical records to include behavioral healthcare entities, the mental health and substance use fields are likely to progressively fall behind medical settings in implementing and using these electronic tools. The development of integrated medical homes and health homes may ameliorate this disparity somewhat, but will not completely overcome it. Clearly, we need changes in federal law which will be very difficult to achieve in the current environment.

Undoubtedly, a large disparity will continue to exist between what digital applications are possible in care delivery and what actually occurs in the mental health and substance use fields. The irony is that consumers and peers will be far more advanced in digital application use than will care providers. Thus, without specific planned interventions, care delivery is likely to continue to be provided very much as it has been in the past.

If we are to reach the potential of IT in the delivery of mental health and substance use care in the future, several national actions will be needed. Although this topic goes far beyond the scope of the present chapter, here are a few possibilities for consideration. First, the US Department of Health and Human Services should create an Office of Digital Healthcare. This Office would be responsible for identifying new digital care applications, assessing their effectiveness, and disseminating them to the field. Second, SAMHSA should provide broad-scale, ongoing technical assistance to current program managers and clinicians, so that mental health and substance use care programs are aware of and are able to implement digital tools for managerial, administrative, and clinical applications. The initial goal of this technical assistance should be to help these mental health and substance use care delivery programs catch up with the current mainstream of digital care applications. Third, future clinical and managerial training for persons entering the mental health and substance use fields should include fundamental courses in digital technology and current mainstream digital applications, such as I-Phone apps (see [8], for examples of emerging digital tools).

As we rapidly enter the era of the Affordable Care Act, we can expect the number of mental health and substance use clients to almost double over the next decade. Because no specific plans are in place to increase the mental health and substance use workforce, the only way we will be able to cope with this dramatically increased workload is through much more effective use of digital technology. Hence, this is an urgent call to immediate action.

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Chapter 2
Electronic Health Records Technology: Policies and Realities

Lori Simon

Abstract This chapter begins with a succinct review of the history of electronic health records (EHRs) in the U.S., including recent efforts by the federal government to encourage the use of them through their Meaningful Use program. It then discusses the low participation in this program by mental health providers and the reasons for the general lack of acceptance of EHRs by them. In fact, in 2012 only 7.1% of psychiatrists participated in the Meaningful Use program. The chapter next proceeds to discuss various efforts to increase the use of EHRs in the mental health field, including those by the American Psychiatric Association, the Substance Abuse Mental Health Services Administration (SAMHSA), and the HL7 organization. The second part of the chapter provides in depth guidelines to selecting and implementing an EHR, beginning with making the decision whether to actually get one. Once the decision is made to do so, the chapter talks in great detail about the preparation process prior to the selection, followed by the steps involved in the actual selection and implementation processes. The chapter closes with a renewed emphasis on the need to do a thorough job prior to the implementation so as to avoid many problems after the EHR goes live, as well as the importance of including the ultimate users of the EHR in the entire selection and implementation processes.

Keywords Centers for Medicare and Medicaid Services (U.S.) • Cost of illness • Documentation • Expert systems • Health information management • Health Insurance Portability and Accountability Act • Information systems • Meaningful use • Medicaid • Medical informatics • Medical records • Mental health • Motivation • Psychiatry

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2.1 History

There are few industries where computer technology is needed as much as in healthcare. Yet, for a long time now and for a variety of reasons, it has been much more of a struggle to implement such technology than in other industries, such as banking, insurance, media, transportation, and others. Back in the 1970s, these industries began embracing computer technology quite successfully, because for the most part, they were composed of private corporations with the financial resources to devote to these efforts. As a result, they were able to build strong in-house IT departments who developed software to suit the specific needs of their own corporation by working very closely with the users of that software throughout the development cycle. They were also able to purchase the hardware needed to run this software, as well as build robust back-up systems.

With regard to healthcare, any efforts that were undertaken were primarily initially done by two groups: (1) Academic institutions affiliated with major medical centers. (2) Software vendors. With regard to academic institutions, as far back as the 1960s–1970s, there were some major early successes, including the work at Massachusetts General Hospital led by G. Octo Barnett, MD which led to the development of the Computer Stored Ambulatory Record (COSTAR) using the MUMPS programming language that was specifically developed for health information technology. Robert Greenes, MD, PhD, a co-developer of MUMPS, also made huge contributions to the field of medical informatics during this period. Homer Warner, MD, PhD of the University of Utah and Latter Day Saints Hospital was instrumental in developing the HELP system which first became operational at LDS Hospital in 1967. It eventually expanded into a full-blown integrated hospital information system with sophisticated clinical decision-support capabilities. William Stead, MD and W. Ed Hammond, PhD also began developing what became The Medical Record (TMR) at Duke University. Significant early work was also done at Stanford University by Gio Wiederhold, PhD, a computer scientist who did significant research on large scale databases and Edward Shortliffe, MD, PhD, who developed MYCIN, a medical expert system, in the 1970s [1]. Lawrence Fagan, MD, PhD and Terry Winograd, PhD began making important contributions to the field of health related computer science beginning in the 1970s at Stanford University, as well. During the 1970s, Clem McDonald, MD led the team at Indiana University's Regenstrief Institute which developed one of the first EHRs (RMRS) in the US. However, these efforts represented only a small fraction of the healthcare institutions in the U.S. With regard to mental health, Marvin Miller, MD, in his book "Mental Health Computing", describes a number of applications for specific mental health functions that existed during the 1990s which were primarily developed by small groups of academicians [3]. Since the 1980s, the National Library of Medicine (NLM) has provided significant funding to academic institutions for informatics related activities. One major program has been the Integrated Advanced Information Management Systems (IAIMS) Awards.

Vendors also started developing software for the healthcare marketplace. Again, as early as the 1960s, several companies, including two aerospace companies,

Lockheed and McDonnell Douglas, began developing software to fully automate medical records for large hospitals. The aerospace company involvement was in response to government inducements to develop software for the healthcare field. Their healthcare software divisions subsequently became known as TDS and HBO, respectively. During the 1970s, software to support patient billing and admissions, discharge, and transfer functions for hospitals became prominent. During this time, IBM developed the Shared Hospital Accounting System (SHAS) followed by the Patient Care System (PCS) in conjunction with the work Dr. Stead and his team were doing at Duke University. It evolved into an application generator tool which allowed for additional clinical software applications to be incorporated. Another early leader was Shared Medical Systems (SMS) which began in 1969 and was eventually acquired by Siemens in 2000. Niche software for certain clinical functions, primarily radiology and the laboratory, began appearing, as well in the late 1970s-early 1980s [2]. During the early 1980s, Cerner developed a lab system which was progressively expanded into a comprehensive EHR and other supporting health information technology. Throughout the 1990s and early 2000s, the percentage of hospitals implementing computer technology slowly increased, but they still represented a minority of healthcare institutions. During this time, vendors began developing software for office practices, especially primary care and a small number of such practices began using it. Increasingly more robust EHRs also began making their appearance.

However, at the same time, it started becoming apparent that there are significant problems and complexities within healthcare which have been hindering the more widespread adoption of computer technology. First, most hospitals have not had sufficient IT staff to manage these projects and ensure that not only the software truly satisfies their requirements, but that other needs, including training and documentation are also being met. This problem has been compounded by the software, itself. As vendors understandably try to market their software to the largest number of customers, it becomes impossible to fully satisfy each customer's requirements.

Second, the healthcare environment is extraordinarily diverse with patient care occurring in a variety of settings by many different providers and ancillary staff, potentially involving the use of multiple software applications needing to communicate with one another. Governmental reporting requirements also impose the need for interoperability with these systems. In addition to the complexity of having disparate software products from multiple vendors communicate with one another is the added burden of privacy and security issues and the need to ensure compliance with HIPAA and other governmental privacy/security laws.

Over the years, various efforts have arisen to help overcome some of these difficult challenges. The Health Level 7 (HL7) organization was established in 1987 and as per its website, it is a "not-for-profit, ANSI-accredited standards developing organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that supports clinical practice and the management, delivery and evaluation of health services. HL7's 2,300+ members include approximately

500 corporate members who represent more than 90% of the information systems vendors serving healthcare". In recognizing the importance of involving healthcare professionals in their work, they have recently established a category of membership for them.

Other organizations that have played a large role in supporting the use of computer technology in healthcare include the Healthcare Information Management Systems Society (HIMSS), the American Medical Informatics Association (AMIA), and the American Health Information Management Association (AHIMA). HIMSS was started in 1961. During its earlier years, it was focused more on IT and healthcare management/administrators. In fact, its membership statistics for 1977 included Management Engineering (37.9%), Hospital Administration (23.1%), Health Care Consultants (14.8%), Information Systems/Data Processing (11.5%), Health Care Planning (4.7%), Financial Management (3.5%), University Professors (1.9%), and Other (2.6%). Clinicians were not even mentioned. However, over time, it has evolved into a multi-disciplinary organization representing all of the major players involved in HIT, including clinicians. In 2005, they hosted a Physicians' Symposium for close to 300 physicians and other healthcare professionals from both the inpatient and outpatient community. It has also been working collaboratively with other professional organizations.

According to their website, "AMIA is a professional scientific association that was formed by the merger of three organizations in 1988: the American Association for Medical Systems and Informatics (AAMSI); the American College of Medical Informatics (ACMI); and the Symposium on Computer Applications in Medical Care (SCAMC). AMIA's program and services are centered around core purposes to:

- advance the science of informatics
- promote the education of informatics
- assure that health information technology is used most effectively to promote health and health care
- advance the profession of informatics
- provide services for our members such as networking and opportunities for professional development."

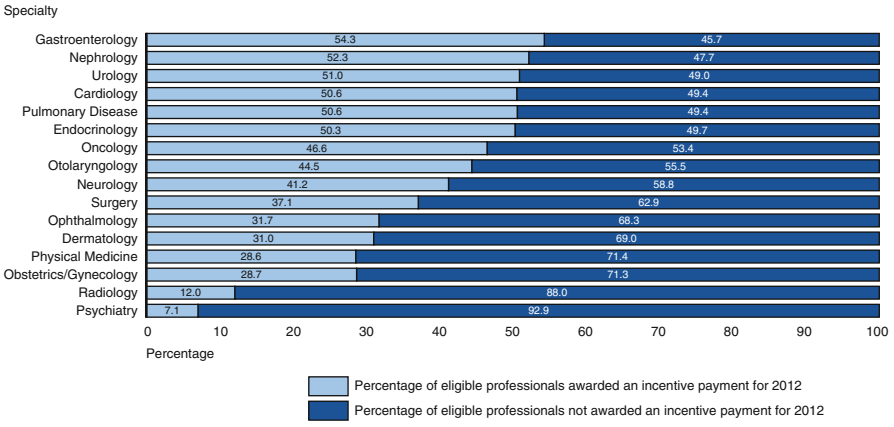
AMIA has traditionally been the home for more academically minded medical informatics professionals, especially clinicians. However, as with other organizations involved in the use of technology in healthcare, they have recognized the need to become more inclusive with other HIT professionals and collaborate with other organizations, including HIMSS.

AHIMA traces its history back to 1928 when the American College of Surgeons established the Association of Record Librarians of North America to deal with issues involving clinical records. In subsequent years, it changed its name several times as it expanded its focus to keep up with the changing landscape of health information and the increasing use of computer technology. In 1991, it began using its current name.

In 2004, the federal government stepped in with the establishment of the Office of the National Coordinator (ONC) for Health Information Technology by Executive Order. Five years later, it was legislatively mandated in the Health Information Technology for Economic and Clinical Health (HITECH) Act. Among HITECH's many efforts to promote the use of computer technology in healthcare has been the development of the Meaningful Use (MU) Program which provides monetary incentives for Medicare and Medicaid providers to implement EHRs which have been certified by ONC. ONC has worked with CMS to establish the criteria that must be satisfied by Medicare providers using the certified EHRs, while the Medicaid programs in each state have been overseeing the Medicaid incentive program. Medicare providers who fully participate in the program will be able to receive up to $44,000 while Medicaid providers can receive a maximum of $63,750. The program began in 2011 and ends in 2016. 2014 was the last year that Medicare providers could begin participation in the program and still receive incentive payments, but Medicaid providers have until 2016 to begin participation. Starting in 2015, there will actually be penalties to those Medicare providers who haven't yet implemented this technology unless they qualify for a hardship exemption, but Medicaid providers will not be penalized.

2.2 Status/Ongoing Problems

So, how much progress has been made? As of the end of 2013, 58% of hospitals had at least a basic EHR and some success with meeting the requirements of MU Stage 1, but only 5.8% were able to meet all of the Stage 2 criteria. With regard to individual physicians, the Fig. 2.1 shows the percentage of physicians by specialty



Source: GAO analysis of CMS data

Fig. 2.1 Percentage of specialty practice physicians who were awarded a Medicare EHR incentive payment for 2012, by selected specialty

who received a meaningful use incentive payment in 2012. Although a number of specialties reached the 50% mark, psychiatry ranked at the bottom with only 7.1% participation.

Other statistics from 2012 further illustrate the low participation of psychiatrists in the Meaningful Use program. Of the approximately 41,000 practicing psychiatrists that year, 55% accepted Medicare and 43% Medicaid. Yet, only 375 Medicare and 292 Medicaid psychiatrists received an incentive payment.

Why the low participation? First, 85% of psychiatrists are in solo private practice. Most do not have the time, manpower, and financial resources to embark on the selection and implementation of an EHR. Other psychiatrists work in mental health clinics or psychiatric hospitals, both of which are not eligible to participate in the Meaningful Use program. Second, as the Meaningful Use program's focus is on primary care, it is extremely rare to find any support for mental health providers from the Regional Extension Centers (RECs) that were established throughout the U.S. to assist providers with the selection and implementation of EHRs. Third, the EHR software developers have been slow to incorporate functionality needed by mental health providers, even for such basic requirements as support of DSM. Fourth, more so than in many other specialties, as seen by the chart below, mental health care involves many different types of providers. Therefore, EHRs must not only satisfy the needs of this diverse group, but depending upon the care setting, ensure that they are able to communicate amongst each other, as well.

Clinical Workforce Totals (2012)

- 41,000 Psychiatrists
- 96,000 Psychologists
- 193,000 Clinical Social Workers
- 14,000 Psychiatric nurses
- 48,000 Substance Abuse Counselors
- 145,000 Counselors
- 62,000 Marriage and Family Therapists

Source: Data assembled from various sources by SAMHSA and published in *Behavioral Health, United States, 2012*.

In addition, as many studies have shown that a majority of visits to primary care providers have some sort of mental health component, the need exists to not only have EHRs for primary care include the ability to capture this information, but also to communicate it with various mental health providers. Finally, an additional burden placed upon vendors supporting mental health is the set of laws in place to protect the confidentiality of patients with mental illness. Two in particular are 42CFR which addresses the confidentiality of substance abuse information and the extra protection accorded to psychotherapy notes, over and above the confidentiality requirements for all evaluation and progress notes. This is, of course, in addition to the HIPAA confidentiality laws for all patients. As a result, many Health Information Exchanges (HIEs) which were established throughout the U.S. to provide greater accessibility to providers for their patients' clinical information have restricted the

storage of mental health information, primarily because they don't want to have to deal with this additional confidentiality burden. In August 2011, ONC sponsored the creation of the Behavioral Health Data Exchange Consortium amongst five states, Alabama, Florida, Kentucky, Michigan, and New Mexico, to pilot the secure interstate exchange of behavioral health records among treating health care providers. In June 2014, the Consortium issued a report detailing their findings and recommendations [4]. Not surprisingly, it highlighted the challenges of dealing with the additional privacy concerns imposed by behavioral health data. The primary lessons they learned include: "(1) Behavioral health data exchange is complex, but possible (2) Provider education is key to success, and (3) Cooperation and flexibility are invaluable when addressing complex problems."

In 2004, the Certification Commission for Health Information Technology (CCHIT) was established and 2 years later began certifying EHRs, including those for Behavioral Health. As part of this work, they needed to develop extensive requirements and test scripts for each health field they were certifying. However, due primarily to the significant financial, manpower, and time resources needed by the EHR vendors to achieve this certification, many chose not to participate. As a result, only three Behavioral Health EHRs received the certification and in 2014, CCHIT stopped their certification program altogether.

2.3 How to Proceed

In recognizing that the mental health community is not being adequately supported by the Meaningful Use program, ONC has begun to investigate the possibility of developing a voluntary certification program for EHRs that provide support for the mental health community. As a result, early in 2014, they sought input from this community, including both providers and patients, to better understand their needs. They also asked vendors that have developed EHRs which provide some degree of functionality for mental health for their opinion on the need for such a certification program. They then asked for public comment and are now further deliberating on whether to move forward with such a program, and if so, what should be the design and content of such a program.

Mental Health professional organizations can play an important role in providing assistance on computer technology to their members in several ways. First, they can represent their members' needs and serve as an intermediary with vendors. They can also provide links to information sources on their websites and host vendors at their conferences. For example, in recent years, the American Psychiatric Association (APA) has steadily increased its activities in this area. During their annual meeting, vendors have an opportunity to discuss and demo their software in the Exhibit Hall and their EHR committee has presented workshops and symposia on relevant computer technology topics. In 2013, the Committee changed its name to the Mental Health Information Technology (MHIT) committee to reflect its widening scope in dealing with HIT topics beyond EHRs. Its members have expertise and are

involved in such areas as privacy/security, health information exchanges (HIEs), and telepsychiatry. It has been responsible for developing a detailed set of requirements that EHRs need to satisfy to support psychiatry. Those requirements, along with a variety of documents and links to other sources of information, are posted on the APA's website. In 2014, in recognizing the need to establish a more direct relationship with vendors, the MHIT committee hosted a webinar for them during which they acquainted the vendors with various HIT related activities going on within the Mental Health field. Two MHIT Committee members are members of the American Association of Child and Adolescent Psychiatrists (AACAP), as well, which has also been working on various HIT related activities. The MHIT Committee has recognized the importance of collaborating with other Mental Health professional organizations, as well, and in the near future hopes to develop a more formal structure for reaching out and working with them on HIT activities of mutual interest.

The Substance Abuse Mental Health Services Administration (SAMHSA) is a federal organization within the Department of Health and Human Services which has been in existence since 1992. In recent years, it has had an increasingly strong focus on HIT and its strategic goals for 2011–2014 have included:

Goal 6.1: Develop the infrastructure for interoperable EHRs, including privacy, confidentiality, and data standards.
Goal 6.2: Provide incentives and create tools to facilitate the adoption of HIT and EHRs with behavioral health functionality in general and specialty health care settings.
Goal 6.3: Deliver technical assistance to State HIT leaders, behavioral health and health providers, patients and consumers, and others to increase adoption of EHRs and HIT with behavioral health functionality.
Goal 6.4: Enhance capacity for the exchange and analysis of EHR data to assess quality of care and improve patient outcomes.

SAMHSA has been heavily involved in the HL7 organization, particularly with one of their many workgroups, Community Based Collaborative Care (CBCC), which has developed both a Behavioral Health Functional Profile based on HL7's EHR Functional Model and a Behavioral Health Domain Analysis model. The APA is an organizational member of HL7 and several members of the APA's MHIT Committee have become involved, as well. The CBCC workgroup, with help from their SAMHSA and APA members, will be working on integrating the APA's Function Requirements and CCHIT's Behavioral Health Function Requirements with their Behavioral Health Functional Profile with the intent on further expanding it to other Behavioral Health settings. Eventually, the intent is for these requirements to be used by software developers to build products that more closely satisfy the needs of the Mental Health field and for prospective users of these products to be able to determine which ones most satisfy their own needs.

The American Association for Technology in Psychiatry (AATP), a non-profit organization of physician and mental health professionals, began in 1995 as a meeting and in 2002 expanded its scope. Its mission is to:

- promote the use of information technology to improve the quality and availability of psychiatry and mental health care
- promote the development and dissemination of knowledge in the use of technology in psychiatry and mental health
- foster technology in psychiatry and mental health as a recognized body of knowledge
- promote the development and dissemination of standards and best practices for use of technology in psychiatry and mental health, including respect for, and preservation of, confidentiality and privacy
- inform and influence public policy in the use of technology in psychiatry and mental health

2.4 Decision to Use an EHR

The decision to incorporate an EHR into one's practice involves a number of factors:

1. If you are a **Medicare provider**, you will need to determine to what extent the penalties you will incur if you haven't begun using an EHR in 2014 will affect your income . With regard to having to satisfy the Meaningful Use criteria, although as mentioned earlier they are oriented towards primary care providers, there is sufficient flexibility so that it is possible to satisfy the criteria as a psychiatrist, something I have been able to do in my solo private practice.
2. **E-Prescribing**, including controlled prescriptions, is starting to be required by individual states. For New York physicians, this will be as of March 27, 2015. Using a standalone product for this purpose, only, could be a good place to start incorporating computer technology into your practice, especially if it is one that is also integrated into an EHR which you are considering implementing at a later date. I have found e-prescribing to be a huge time-saver, both in eliminating the calls to pharmacies and recording what medications my patients are taking. The software that you use should allow you to keep track of not only what you're specifically prescribing, but all of the medications your patients are taking, both OTC and those prescribed by other providers. Most e-prescribing programs also have drug interaction checking built into them.
3. **Interoperability**: If you practice in either an inpatient or large outpatient setting, you probably have recognized the importance of being able to communicate with other providers and staff within that setting through some form of automation. Those of you who practice in solo or small group practices may feel that this has not been an issue. However, the ability to easily communicate with other providers, esp. those in primary care, with whom you likely share patients, can decrease the time you normally take and staff resources you use to do this manually. Of course, the computer is not intended to replace the sometimes essential direct conversation with another provider, but often that conversation can be all the more optimal if both parties have detailed clinical information

about the patient they are discussing right in front of them. In addition, for those of you who practice in settings where governmental reporting requirements have been mandated, computer software is likely going to be essential to providing the data being requested.

4. **New Practices**: If you are just starting out in your own practice, other than obtaining e-prescribing software, you would probably benefit from holding off getting anything else for the first 6 months – 1 year to give yourself time to better understand what your own needs are and how best an EHR can help satisfy those needs.
5. **Finances**: As most EHRs are not free, you will want to determine whether you have the financial resources to invest in one, either paying a one time fee for the life of your contract or paying on an installment basis. Financial considerations will be discussed in more detail later on in the chapter.
6. **Time/Manpower Resources**: In order to successfully implement any software in your work setting, it is critically important that considerable time be spent in preparation, which I describe in the following section. For solo/small group practices, this can be made much more manageable if you give yourself plenty of lead time prior to when you plan on beginning use of the software and develop a plan which minimally impacts your practice. Realistically, some work on weekends may be needed, but the more lead time you give yourself, the less time you will need to spend during any one weekend. This is not the time to procrastinate and then cram at the last minute – that may have worked for you when taking tests, but it is not a good strategy to use here!

2.5 Selection Preparation

Once you make the decision to incorporate a clinical software product into your practice setting, it is absolutely essential that you do a thorough analysis of that setting to determine exactly what you are going to need. **One of the primary reasons there have been so many problems with the implementation of EHRs, in general, is that the preparatory work is not done nearly as well as it should. For hospitals and large outpatient settings, clinicians and administrators representing every department who will possibly be affected by the EHR should be involved in many of these preparatory steps**. These steps include:

1. **Assembling A Team**: For large practices and hospitals, the very first step is to assemble a team of clinicians, administrators, and staff representing the involved departments who are willing to commit to working together with the IT staff throughout the Preparation, Selection, and Implementation phases. Typically, a Chief Medical Informatics Officer (CMIO) who is often, but not always, a clinician, leads this team and works closely with the head of the IT staff. As the work involved in this effort can be rather time consuming, members of this team sometime need to be able to cut back on their normal

duties for a period of time. Their work is extremely important, as the knowledge they acquire and provide from undertaking many of the following steps in the Selection Preparation phase will be essential for selecting an EHR which best fits the needs of their practice setting. They will then play a critical role in ensuring that the Implementation phase goes smoothly and is successful.

2. **Decide Which Functions and Data You Need**: EHRs contain many functions that providers may need, but it isn't necessary to implement all of them at one time or even at all. Therefore, you need to assess the settings in which you will be providing care to determine which functions and data are most important to you, both now and in the future. If you are a Medicare/Medicaid provider and planning on participating in the Meaningful Use program, you may need certain functions and data for that purpose. If you treat children and adolescents, you will most likely need the EHR to maintain certain data elements unique to those patients, ex. growth charts. As a solo practitioner, I wanted to initially implement the billing, e-prescribing, and clinical charting functions, but decided to hold off on the EHR's appointment function while I continued to use Microsoft Outlook.

   Now 3 years later, I decided to switch over to their own appointment function and implement both their patient portal and patient reminder functions. I initially chose to do this to provide additional functionality to my patients, but then discovered that I needed to use elements of these functions to satisfy the Meaningful Use Stage 2 requirements.

   The functions needed by hospitals will be somewhat different. For example, computerized order entry (CPOE) for various tests, including labs, radiology, etc. will be essential, but an appointment function likely will not be needed. I do order lab tests for my patients and many EHRs for outpatient practices do have functionality to allow providers to electronically send lab orders to specific laboratories and receive the results electronically. However, the frequency that I do so is relatively low, so for me, it isn't important to use an automated function. Instead, I continue to send lab requests the old-fashioned way, i.e. write the labs I want on a prescription pad with a note to fax me the results and then either fax it directly to the lab or give it to the patient.

   Understanding a practice setting's future needs, as well as their current ones is extremely important, because you want to make sure that the EHR which is selected will be able to support those future needs, both from a function and data perspective. It may well be that some degree of customization may be needed to support those needs, but if the underlying software and database structures are not compatible with the customization that would be needed, you would want to know that before the EHR is selected. The worst thing that could happen is to have to replace the EHR in the future, because this upfront work was never done.

   Once it is determined what functions are needed, it is critically important to understand **how** they are used in a particular care setting. This involves a thorough analysis of the daily work flow, who is involved, what functions they use, and what data gets accessed. This analysis can not only be helpful in

preparing for the selection and implementation of an EHR, it can also be highly useful in determining how work flows might be improved **without** automation. Computers can't and shouldn't fix everything!

One hospital that did not do sufficient preparation in this area ran into problems during their implementation which involved the need to transfer patients from the medical/surgical inpatient units to inpatient psychiatry. The first time this had to be done after the system went live, there was great difficulty in doing so, because the EHR did not easily support the functionality that was needed when this type of transfer occurred.

3. **Who Needs Access to the EHR?** You will need to decide which functions other providers and staff in your office or department need to access and whether those who access a particular function can both read and update the corresponding data or only read it. For example, a staff member who handles the patient billing would need both read and update access to all of the billing related functions, but would likely only need to read any clinical data. The bigger the practice or for an inpatient psychiatry department within a hospital, both deciding what functions are needed and then who and to what degree providers and staff have access to those functions becomes a much more involved task, but again, is absolutely necessary to do. Within hospitals, in particular, an additional complexity is that access to patient data can be temporary, ex. for covering physicians, residents, or consultations.

   Patient portals are becoming increasingly popular and are actually part of Meaningful Use Stage 2 which requires more than 5% of your patients to actually access their clinical data online. These portals provide patients with such functions as access to subsets of their own clinical data and links to diagnosis related education, appointment scheduling, authorization to share parts of their chart with other providers, and the ability to communicate electronically with their own treatment providers, all within a secure environment.
4. **User and Data Accessibility**: Nowadays, EHRs can be accessed on more than the computer sitting on your desk or at a nursing station. Once it is determined what functions will be needed and by whom, it then needs to be determined how and where these users will be accessing those functions. Even if you are a sole proprietor, there are options. For example, do you want to be able to readily access the EHR while you're talking to patients to review medications and other clinical data? Are you planning on writing progress notes during the session? I know of one psychiatrist who actually projects the note he is writing onto a large screen so the patient can view what he is writing and provide input. How about using tablets or smart phones to access data? I personally find it very helpful to be able to access my e-prescribing functions on my smart phone so that if a patient calls me while I am not at home or in the office, I can readily check their medication regimen and even send in a prescription electronically. In addition, for many years, I have used one lightweight laptop (approx. 3 lbs) that I take with me to both of my offices and also use at home. Community mental health organizations may have outreach programs whereby clinicians see patients where they reside. It could be quite advantageous for

these clinicians to have some form of portable device allowing them access to a subset of the functions of the organization's EHR.

In a hospital setting, there are many more possibilities for user access beyond the nursing stations, including ORs, ancillary areas, satellite clinics, and even patient rooms, as well as all of the administrative and support staff offices. Within each area, is the hardware used for access stationary, i.e. on a desk or at a nursing station, or does there need to be the option of having it be portable? For example, should a clinician (nurse, physician, physical therapist, etc.) be able to access their patients' information from a tablet that they take with them into the patients' rooms or an admissions representative when they need to admit a patient from the ER? If the hardware is stationary, ex. at a nursing station, how many computers will be needed to ensure that every clinician who needs one at any point in time will have the requisite access? If it's portable, can they be shared or should every clinician have their own? If shared, how many is enough?

If you are in a solo or small group practice, the data and actual EHR software typically physically reside in the "cloud", which are actually remote servers located anywhere in the US or abroad and accessible via the Internet. The larger the practice setting, the more likely the data and software are housed on more local servers, somewhere within the vicinity of that setting. If that is the case and it is permitted, you may want access to the data and software remotely, ex. from your home.

5. **Volumes of Data**: Again, if you are in a solo or small group practice, most EHRs should be able to handle the amount of data associated with the patients within your practice. However, larger outpatient settings and hospitals need to be able to quantify the volumes of data they expect an EHR to handle, both currently and in the future, optimally projecting out to the next 3–5 years. These numbers need to include both average and maximum amounts during the course of a day, week, and month for each of the functions the practice setting will be using. An important component of these calculations are the number of concurrent users of the EHR, again both average and maximum numbers, because this directly affects the overall volumes of data. Interoperability requirements also place demands upon an EHR system and need to be understood in detail, as well. All of this information needs to be part of any discussion with vendors to determine whether their software will be able to handle these volumes of data without any degradation in response time and what accompanying hardware, ex. servers, will be needed.
6. **What Data Needs to be Moved into the EHR?** If you've been in practice for a number of years, the thought of transferring every piece of data you have for each patient into an EHR is enough to scare you away from ever getting one! Not to worry – you don't need to do that unless you want to. First, you should focus on your current patients. The data that is particularly important includes medications, both current and history, diagnoses, allergies, other clinical information, demographics, insurance, and billing. If you have

been seeing a patient for a long time and have lots of handwritten notes, don't feel you have to scan in every one of them. Rather, for each patient, decide how far back and which notes you would like to have readily accessible. With regard to billing information, a good strategy is to determine the current balance owed by each patient as of a specific starting date. Then from that point, you can start using the EHR to record each visit. Any payments you receive for visits prior to that starting date should be able to be credited to the patient using one of the EHR's billing functions.

Clearly, implementing an EHR in a hospital setting can be much more complex, because it is a very dynamic environment and great care needs to be taken to ensure that every activity related to a patient is accurately captured. If your practice setting is currently using software applications to capture data, it may be necessary to have data conversion programs written to transfer the data from the old system to the new one. I know of one hospital who rather than doing that decided to manually enter every medication each patient was taking up to a specific cut-off point. After that, they continued to use the old system, but also entered new medication orders manually into the new EHR when it went live the following day. However, what was not recorded in the new EHR were medications that were stopped after the cut-off time, but prior to the new EHR going live. Fortunately, this was discovered a short while later.

7. **Hardware Platforms**: If you are in a solo or small group setting, you will have more decision making power regarding your preference for using specific computers (PCs or MACs), smart phones and tablets (Apple, Android, Amazon, Microsoft, etc.). You may need to have some flexibility if the EHR or other software you like doesn't support your choice in hardware platforms. If you work in a hospital or large group setting, it is likely that these decisions will be made for you.
8. **System Availability**: Hospitals, of course, need to ensure that their EHRs are normally up and running 24 h/day, 7 days/week and, if not, alternative procedures need to be established for planned and unplanned outages. This will be further discussed in detail in the Implementation section of the chapter. As the data and software are typically stored in local servers and hospitals have backup generators to ensure that they have an ongoing supply of electricity, they usually have more control over their system availability.

   If you work in an outpatient setting, you or your facility needs to decide when you need the EHR to be available and, as with hospitals, what to do when you don't have access to it. One concern I have always had about data and software located in the cloud and accessible via the Internet is what happens when your Internet service stops working, ex. during a storm. In that situation, I can use the hotspot function on my smartphone as a backup as long as my cell phone is still working, but if you don't have unlimited data, that can very quickly become costly. Usually, such outages are restored fairly quickly, but after super storm Sandy hit the east coast several years ago, it took much longer. One way to lessen the impact of an interruption in access to the cloud would be for EHRs to provide a way for critical data to always be downloaded to

the computer and the software for important functions housed there, as well. However, this would involve the need for the EHR to keep the data in both places in sync and the software be kept up to date on the local computer.

9. **Interfaces to other Applications/Systems**: This is currently and typically only of concern for most solo and small group practices in a limited way. In these settings, interoperability can be relevant for interfacing with labs, other providers, especially in primary care, and perhaps with a hospital with whom you are affiliated. As health information exchanges (HIEs) become more established and robust in the future, sending to and receiving patients' clinical information from them to achieve better coordination of care will become increasingly important.

   Hospitals have more complex interoperability needs, because in addition to the EHR, they have a number of disparate systems, all of which need to be in communication with each other in real time. Examples include lab, radiology, OR scheduling, pharmacy, and billing. Nowadays, it is not uncommon for multiple hospitals to be part of one overall healthcare system, increasing the possibility that individual hospitals may need to communicate with each other, as well.

   One area of interoperability that can potentially affect both large and small providers is the increasing reporting requirements, including clinical quality measures (CQMs), being imposed by both federal and state governments. As the states often have their own unique set of requirements, it can be difficult for a vendor to support them for every state. Therefore, it is important to have a good understanding of your or your institution's own reporting requirements, so that you can discuss this in detail with prospective EHR vendors.
10. **Implementation Timeframes**: There can be specific deadlines that impact the need to implement an EHR or other software applications. These need to be identified as soon as possible to ensure that sufficient time exists to complete all of the steps needed for a successful implementation. One example is the e-prescribing requirement mentioned earlier. This not only impacts outpatient providers, but hospitals, as well, who routinely give patients prescriptions when they are discharged.

2.6 Cost Considerations

When determining your budget for getting an EHR, there are a number of both initial and ongoing costs that you need to consider. These include:

1. Does the vendor want you to purchase the EHR outright? If not, what is the monthly cost and is any interest charged?
2. Are any discounts available for either paying the entire cost of the contract up front or for purchasing a more long term contract?
3. Is there any charge for software updates?

4. What is included in the costs? If they're not, what are the additional charges for each of the following:
   (a) Additional Users.
   (b) Data Conversion Programs.
   (c) Hardware Needs Analysis and Purchase.
   (d) Customization (pre and post-implementation) for templates, interfaces/interoperability, additional functionality, etc.
   (e) Documentation.
   (f) Training (pre-implementation plus post-implementation for new users).
   (g) Implementation Support.
   (h) Technical Support (pre and post-implementation).

   Many of these topics will be discussed in detail in the next section.
5. Additional staffing may likely be needed by larger healthcare entities to adequately prepare and implement the EHR. However, even solo or small group practices may find it beneficial to hire someone to help them with the additional workload imposed by the preparation and implementation phases.

2.7 Selection

The more thorough the preparation, the easier will be the selection process. **The first step is to determine which EHRs satisfy the requirements you have identified during the preparation**. There may be some requirements that the EHR can't initially satisfy, but you may be able to receive assurances that they will be able to do so within the timeframe that you need it. In that case, you would want to ensure that the satisfaction of these future requirements are stipulated in your contract. This is particularly relevant if you or your institution are planning on participating in all stages of the Meaningful Use program. **The clinicians and administrators who worked on the Selection Preparation steps should also be involved in the Selection process. They need to have the opportunity to actually use a demo system to provide feedback on the functions they will be using, including how user friendly they are.**

A **vendor's reputation** can be very helpful in the selection process. The best way to determine that is to be able to speak directly to their current and former customers. Vendors should be able to provide you with those contacts. However, in addition and if possible, you should try to identify providers from alternative sources. For example, the AmericanEHR organization works with professional organizations to provide detailed information on EHRs and providers' experiences with them via member surveys and other means. This information is accessible on their website (www.americanehr.com). You should also determine how many overall and mental health customers the vendor has. Although a relatively new vendor with a limited number of customers can have a robust product, you would want to make an extra effort to ensure the excellence of their products and that they will continue to have

sufficient resources, including finances and manpower, to not only support your practice setting, but remain in business for the foreseeable future.

Certification can be another way of determining how well an EHR performs. Of course, a particular certification would only be important to you if the criteria for that certification is relevant to your own needs. Currently, ONC is the primary entity certifying EHRs which they do for their Meaningful Use program, but if you have no intention of participating in that program, that certification may not be of much value to you. Other considerations in choosing an EHR vendor include the following:

1. **Privacy/Security**: In addition to HIPAA and other privacy regulations that must be met for all healthcare specialties, you need to ensure that the EHR vendor is satisfying the regulations that are unique to mental health, including the two that I mentioned earlier in the chapter, 42CFR and those related to psychotherapy notes. Care needs to be taken to prevent any patient's data from being transferred to any provider without the patient's explicit authorization to do so. Security is equally important, as it is essential that all data that travels outside of the office or hospital be adequately encrypted and as safe as possible from any form of hacking. Within an office or hospital, no one should be able to gain access to any functions or data within the EHR unless they are specifically authorized to do so. The ability should exist to have users automatically logged off within a specific period of time of no activity to prevent unauthorized users to gain access to the EHR during the previous user's logon session.
2. **Legal Ownership of Data**: It is important to ensure in writing that the EHR vendor does not have any intention of owning the data that is generated by the EHR. The policies that are in place for data ownership, particularly patient related, within a practice setting shouldn't change merely because the data is now being captured and maintained electronically instead of being stored in paper charts.
3. **Affordability**: After discussing all of your requirements with the prospective vendors and determining all of the costs discussed earlier, ultimately you will need to make a decision whether you can afford to implement an EHR or other software. If not, you may want to look into phasing in subsets of the EHR, especially if you work in a solo or small group practice and anticipate your practice growing.
4. **Adequate Testing**: It is extremely important that, as a prospective buyer, you have access to an exact replica of the EHR to ensure that all functions work as intended in a user-friendly manner which is acceptable to you. You should also ask the vendor what volumes of data, concurrent users, and test scenarios they used to determine if the functions could handle them without any degradation in response time. This is an area where being able to discuss the experiences of an existing or former customer of similar size and workload can be extremely helpful.
5. **Access to Test System**: Having access to a test system throughout the implementation process is very important for additional testing of any customization

that is done for your practice setting and then for subsequent training. Any customization testing should be completed as much as possible prior to the training so that the users do not see a system in constant flux as a result of changes that have to be made to fix errors encountered during the testing.

6. **Training**: There are various ways that training can occur, including in-house classes and on-line, either self-directed or with a vendor representative directing the training by phone or through the computer. Many large practices and hospitals use the "train the trainer" approach which involves initial comprehensive training for a subset of users of the EHR who will then assist with the training of their colleagues. The training needs to address the day-to-day work of each user, not just how each function works. For example, if the EHR is providing an inpatient order entry function, it is not sufficient to only provide training in how to enter an order. A surgeon who needs to d/c orders when a patient goes to the ER, enter new orders when the patient moves to the recovery room, and then restart some of the original orders that were in effect prior to the surgery would need to be shown how to accomplish that sequence of events.

   The test system should ultimately contain the full functionality of the EHR so that users can practice, even when they're not in a specific training session. Training needs to be available for not only current employees when the EHR is first implemented, but ongoing for any new employees or existing employees whose job responsibilities change.
7. **Documentation**: Comprehensive documentation for all functions provided by the EHR is needed. It should be on-line and easily accessible from each function. Optimally, it should also be available in hardcopy, especially during training, so that users can enter their own notes and be able to use it as a personal reference. As with training, it is important that the documentation reflect not only the EHR's basic functions, but how they are used in actual practice. The documentation should also be updated whenever any changes/additions are made to the EHR.
8. **Ongoing Technical Support**: It is absolutely essential that a robust set of technical support services be provided. Key elements include:

   (a) **Availability**: Coverage should be provided during the bulk of the time you will be using the EHR, regardless of time zone differences and including weekends. This is especially important for systems where the functions and data are housed in the cloud where the customer has little ability to fix any problems that may arise nor likely has the technical expertise readily at hand.
   (b) **Responsiveness**: Once you report a problem or need some kind of help, how quickly can you expect that help or a resolution of the problem?
   (c) **Disaster support**: In the event of a significant unplanned downtime, it is crucial for the vendor to provide additional support in order to minimize the impact on a customer's daily functioning, particularly with regard to direct patient care.
   (d) **Contact Modes**: This is typically by phone and, optimally, includes the ability of the vendor to take remote control of your EHR to fully investigate

a problem. For large customers, it is important to consider the need for onsite vendor support if a significant upgrade/change is made to the EHR.

(e) **Competence**: It is also highly preferable to have that support be provided by people who speak English well and truly understand the system they're supporting, not merely reading a script. Even better are support specialists who actually know your practice, because when problems arise, it makes it easier to diagnose and fix them. Large practice settings such as hospitals should have sufficient in-house support to handle emergency problems as those settings usually need 24/7 availability of most EHR functions.

9. **Software Updates**: These are updates the EHR vendor makes and are typically to provide additional functionality. In rarer circumstances, they could also be to fix a problem that has been detected. The vendor should be able to provide a detailed plan of how they expect to implement these updates, both on a scheduled and as needed basis, as well as the anticipated impact on the availability of the EHR during this process.
10. **Adequate Support/Manpower for Implementation, including Customization and Date Conversion Needs**: The vendor needs to commit to providing sufficient manpower to support every step of the Implementation process. It is important that they view the relationship with new customers as a partnership with staff from both the vendor and the practice setting working together to achieve a successful implementation.

2.8 Implementation

Once you have selected an EHR, now the work begins to prepare yourself and your practice setting for eventually using it.

2.8.1 Develop a Work Plan/Staffing

By now, you should have decided exactly what functions you want to start using in an EHR, what data you are going to need to move into the EHR, and made any necessary changes to your practice setting's workflow. At this point, you need to start developing an explicit plan and schedule leading up to a start date for using the EHR. You should decide whether you are going to be able to do all of the work yourself, enlist a friend or family member to help, or hire a consultant. The schedule needs to include time for data migration, testing, and training.

If this is a large outpatient setting or a hospital, it is extremely important to maintain a team of IT staff and clinicians working together throughout the implementation, usually the same people who worked on the earlier Preparation and Selection phases. The IT staff needs to clearly understand the needs

of these clinicians and administrators, because they will be representing those needs to the vendor. **The clinicians and administrators need to be particularly heavily involved in testing, developing a training plan, and deciding what documentation they need**. As with smaller practices, the development of testing, training, conversion, and implementation timelines, along with plans for adequate staffing/coverage, is extremely important in keeping the entire implementation process manageable and under control.

2.8.2 Software Addition/Changes

An early step in the implementation process is to finalize any requirements for additions/changes to the EHR, itself, as well as other programs that may be needed, so that work can begin on them. This would typically include:

1. function modifications
2. required interfaces
3. data conversion programs

As previously mentioned, these needs should have been discussed with the vendor during the Selection phase to determine whether this was feasible to do and at what cost. For larger practices and hospitals with a robust IT staff, some of this work can possibly be done in-house.

2.8.3 Hardware Needs

Any additional hardware that will be needed should be ordered early in the implementation phase to ensure that they will arrive in time to install them prior to their use in testing, training, and conversion to the new EHR. This would typically include:

1. Laptop/desktop computers
2. Servers
3. Power/data transmission lines
4. Backup Generators
5. Mobile devices

2.8.4 Downtime Procedures/Disaster Recovery

1. **Downtime procedures** need to be developed to be used in the event of a system failure. This is typically a set of manual procedures that utilize paper forms to

capture data (orders, demographics), etc. that can then be entered into the EHR once the system becomes available, again. In addition, communications protocols using phone, fax, etc. need to be established to ensure that daily work is not compromised.
2. **Disaster recovery** consists of a set of protocols to address the sudden loss of the use of the EHR and includes:

   (a) Switching to downtime procedures.
   (b) Assembling a support team to investigate the source of a problem and fix it. For larger practices and hospitals, this would likely include in-house staff working in conjunction with the vendor. For smaller practices, the vendor would be the primary focal point for assistance.
   (c) Entering any date that has been captured by the downtime procedures into the EHR once it becomes available, again. In doing so, it is important to address any synchronization issues. For example, during downtime a lab order may have been recorded manually on paper. When the EHR becomes available, again, the order would have to first be entered into the system before the lab results could be recorded.

2.8.5 Testing

There are several levels of testing that need to be done to ensure a successful implementation. First, the vendor/developer of the EHR needs to do their own testing:

1. **Unit**: Each program within the EHR is tested to eliminate all errors.
2. **Integrated**: All programs are tested to ensure they work together without errors. You should ask the vendor/developer to provide assurances that both unit and integrated testing has been done.
3. **Function**: The next level of testing verifies that each function successfully works with not only the vendor/developer's own test data, but the customer's data, as well. This can be done even prior to actually purchasing an EHR by having access to the vendor/developer's demo system and testing out various real-life scenarios. It can be a good way to determine if the EHR will fit the customer's needs or whether any customization, if possible, is going to be needed.
4. **Systems**: This testing is used to confirm that the EHR can handle expected volumes of data and user utilization, both average and maximum, within response time parameters. This is particularly important for customers who have large volumes of data and many users. The vendor/developer should be able to give you assurances that such testing has been done on their own even prior to your purchasing their EHR. However, once the product is purchased and after any customization is completed, the customer will need to repeat this level of testing with their own data.

5. **User**: This is an opportunity for the actual users of the EHR to verify that it is functioning exactly as expected. Test scripts should be developed with extensive input from the users of the EHR which comprehensively reflect the daily work being done by them. **It is imperative that this be done prior to the EHR actually being used in production.**

Sometimes, particularly when a facility has an existing software product and is converting to another, it may elect to run both systems in **parallel** for a short time to ensure that the new system provides the same output as the previous one for functions where this is expected to happen. This can be somewhat time consuming, because it requires the same data to be inputted into two different systems and the results then compared. For example, if a facility had an EHR which produced patient billing statements a certain way and the facility needed the replacement EHR to create a statement with the same information on it, it may want to use parallel testing for this purpose.

2.8.6 Training

As described in the Selection section, the developer of the EHR which is selected needs to provide comprehensive training and documentation. Once it has been thoroughly tested and the test system is stable, a training schedule needs to be established for everyone who will be using it. The test scripts that were used for testing the EHR can be used as part of the training process. In addition, the documentation requirements described in the Selection phase need to be customized to exactly reflect your practice setting's version of the EHR. It is important for all users to know to what resources they have access if they run into difficulty after the EHR goes live and they are using it in their daily work. For solo practices, this will typically be the vendor's technical support hotline. Larger practices and hospitals usually benefit from having colleagues in their own departments serve as an initial contact point with backup from the IT department and vendor, as needed.

2.8.7 Conversion/"Go Live"

After all of that hard work, you and your practice setting are finally at the point where you can start using the EHR in your daily work. Final steps involve:

1. **Migration of any data into the new EHR**. For large practices and hospitals, it is sometimes necessary for the vendor/developer to write computer programs which automatically convert and move customer data directly into it. For smaller practices, it will be up to the customer to manually enter any data that will be needed using the functions provided by the EHR, but you should consult with the vendor/developer to determine the optimal way to do this.

2. **Developing a specific plan to switch from your current way of managing your practice to using the new EHR**. This plan needs to minimize the impact on your daily work as you make the switch. One aspect of the plan is to determine whether you want to implement all of the EHR's functions immediately or phase them in. Sometimes timing can be a critical issue, ex. in hospitals where a new EHR may be replacing an older system. In such a dynamic place where the system is constantly being used, consideration needs to be made to ensure that no data is lost during the transition and sometimes downtime procedures may need to be used for a short time as the switch is being made. Timing and coordination are also critical with interfaces between any other software applications.

   Sometimes outside events can influence the best time to go live with the EHR. One hospital did not consider a yearly community event which typically leads to increased activity in the ER and went live that weekend. As a result, the ER was overwhelmed with caring for an increased patient load while trying to get used to dealing with a new EHR.
3. **Vendor Support**: It is important to ensure that an adequate amount of vendor/developer support will be available during the conversion process, both in-house, if needed, as well as by phone.

2.9 Post-implementation/Ongoing

Congratulations, you did it!! Hopefully, you are now using the EHR or other software that you have implemented in your daily work with patients. You need to give yourself time to get used to it which can take weeks. Will everything go perfectly right? Probably not, especially if your practice setting is a large one. However, if you or your practice setting did a thorough preparation, those problems should be minimal. One hospital reported receiving 6,500 calls to their "command center" during the first day they went live and were actually proud of the fact that those calls had decreased to "only" 1,000 on the fifth day. There should never have been anywhere close to that many calls, either on the first day or the fifth.

For large practice settings, especially hospitals, it is important to do a post-mortem within several weeks after the implementation to assess how well it went, identify the problems that were encountered, determine the causes, and learn from them so that future implementations can be improved.

2.10 Last Thoughts

A lot of information has been provided in this chapter, but the two most important points to remember are:

1. Do as much planning as you can prior to starting to use an EHR or other software. The more work you do upfront will undoubtedly save you countless hours and

headaches trying to fix problems that likely will develop after the implementation if you don't do sufficient planning in advance.
2. It is absolutely imperative that the users of the EHR be extensively included in every step along the way to implementing it. In my opinion, the mismatch between the EHRs that have been developed and what the users want and need has been one of the biggest causes for the problems that have existed for years in gaining greater acceptance of software in healthcare.

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Chapter 3
Leading Health IT Optimization: A Next Frontier

Greg Hindahl

Abstract This chapter has four key points. (1) Physician IT Leadership: Depending on the size of the organization this may be a part-time or full-time position. It should be a physician or other clinician with a good general understanding of Healthcare Information Technology capabilities but a great understanding of clinical workflows and processes and how they will be impacted by the implementation of an EMR. (2) EMR System Selection and Implementation: This process is very critical to an organization's success and can last from months to years depending on the size and complexity of the organization. The five key phases are System Selection, Design, Build, Testing and Go-live. (3) Governance: EMR governance is often an afterthought and frequently undervalued. It is very important during the implementation phase but equally important during optimization. The governance group(s) should decide what will be done and often as important what will not be done. (4) EMR Optimization: Finally getting an EMR live is not the end it is the beginning. Making a system better and more efficient over time is critical so we can take the best possible care of our patients. This is accomplished through constantly evaluating and improving Clinical Decision Support (CDS) tools and trying to minimize alert fatigue whenever possible. Optimizing an EMR is often as much and sometimes more about improving the patient care processes and workflows than it is about making changes to the EMR itself.

Keywords Computer systems • Consensus • Cooperative behavior • Delivery of health care • Documentation • Electronic health records • Health information systems • Knowledge bases • Meaningful use • Medical errors • Medical informatics • Patient care • Patient rights • Physicians • Standard of care • Workflow

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3.1 Organizational Issues and Oversight

3.1.1 CMIO Role Morphing: Crossing the Implementation to Optimization Chasm

In the previous edition of this book the Chief Medical Information Officer (CMIO) wasn't listed as a part of the HealthCare IT Team. Over the last several years most large organizations and many small organizations have created this role to help their organizations negotiate all the challenges with not just getting an EMR implemented but getting it optimized. It's important for everyone to understand that getting any health IT system live isn't the end. It is just the beginning.

Depending on the size of your organization the CMIO may or may not be an "official" role. If your organization or practice is not large enough to have a physician dedicated to this work full-time, it still needs to have a physician(s) in the organization or practice who is engaged with the team that's getting the EMR solution(s) live. This doesn't need to be a physician who can build his or her own computers or networks but it should be someone who understands the clinical workflows very well. This physician also needs to be part of the decision making team that decides what's going to get built and how it will be used when it's live.

Another key role for the physician IT leader is understanding and appreciating how much change their organization will go through during an EMR implementation. This process is rarely smooth and it often changes the way everyone in the organization does his or her job. The physician doesn't have to be the one who leads or drives the change management but they should be engaged and supportive of the change even when times get tough because there WILL be some tough times. It is also important to remember that getting from where you are to where you're going isn't a straight line. There will be missteps, detours and course corrections along the way. It is important to be flexible during this process and get input from other members of your team. During this process it is critical to not let perfect get in the way of good. Any health IT system has to be safe before you use it but it is much easier to make a system better once it's live and being used by your care team in their day to day work.

Leveraging Your Systems' Capabilities

Any organization that is involved with building or maintaining a Health IT System must be familiar with that organization's IT Roadmap. The size and complexity of the roadmap can vary greatly based on the size and complexity of your healthcare organization or practice. The roadmap needs to consider the organization's existing Health IT systems and capabilities. It needs to consider where the organization needs to go from a patient care perspective. It needs to consider whether changes are required to comply with new regulatory or billing requirements. It needs to

consider any existing or new competitive marketplace forces. Once all these items are considered, gaps can be identified that exist between current systems and future needs.

One pitfall for many healthcare organizations is moving to a new IT System without maximizing the use of their current system or systems. This can happen for many reasons. Some organizations don't invest enough time or resources into the evaluation of existing practice processes. It has been said (probably a thousand times) that even the best Electronic Medical Record in the world can't make a bad process good.

Some organizations don't keep up with system upgrades due to expense, practice disruption, lack of office staff time or expertise, or various other hardships. Training is another area that is very often under-valued and under-emphasized. This applies to both the initial training of users when a system first goes live and then the retraining of users as upgrades are performed and system capabilities change. Health IT Systems are very expensive so make sure you have maximized the use of your current system and have some really good reasons to change before you trade what you know for what you don't know.

Understanding Your Systems' Limitations

Nothing has made more organizations face the realities and frustrations of health IT system limitations than HITECH's Meaningful Use Program (MU). Meaningful Use has made all EMR vendors and many healthcare providers focus on Health IT. Many healthcare entities had already started implementing EMRs before 2009. The attraction of recovering some of the expenses connected with installing an EMR, and the plan for eventual financial penalties for those not meaningfully using certified Health Information Technology by 2015 has caused most health systems and many physicians to focus on the capabilities of their Health Information Systems. The money available for Eligible Providers who started Meaningful Use at the beginning was $44,000 for Medicare or $63,750 for Medicaid providers if they met all the criteria and requirements (http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/index.html?redirect=/ehrincentiveprograms/).

Most EMR vendors have spent the last few years upgrading their systems so they can meet the ever changing and increasingly more difficult requirements of Meaningful Use. However just because a system has been upgraded to meet the meaningful use requirements doesn't necessarily mean it can do everything you need it to do to manage your practice or your health system especially related to Stage 1 requirements. Stage 1 MU was mainly about the basics for many EMRs and many healthcare providers. It was visioned by the US Government as a way to speed the adoption of Health IT especially for those who weren't previously interested or simply didn't want to use an EMR to practice medicine. Stage 1 was about picking a system. Designing the system to meet what you thought your needs were. Installing the EMR and then using the EMR.

EMRs don't come prebuilt with all the rules and alerts needed for every specialty and every clinical situation. Rules and alerts can be lifesaving for patients but they shouldn't be overdone because they can cause alert fatigue. Alert fatigue is when a system has so many alerts that most or all of them get ignored over time (http://www.clinical-innovation.com/topics/ehr-emr/study-examines-negative-consequences-ehr-alert-fatigue). Medication formularies aren't always included in the EMR and if they are they often don't cover all the insurance plans your patients may have. As new drugs come on the market they have to be added to an EMR's formularies either manually or through third part pharmacy databases like Medispan™ or First Databank™. Also not all EMRs come with the ability to ePrescribe (electronically send prescriptions from hospitals and medical offices to pharmacies) or accept electronic refill requests from pharmacies. ePrescribing is a menu requirement for meaningful use and often requires a contract with a vendor like SureScripts™. SureScripts (http://surescripts.com) is used by a majority of the pharmacies in the U.S. as a secure way to (ePrescribe). It also can manage electronic refill requests coming from retail or mail order pharmacies back to physicians' office EMRs.

It is becoming more common that the information needed to care for your patients is not all present in a single EMR or health IT system. This information gap is sometimes remedied by exchanging health information with another EMR or health IT system. A common name for this entity is a Health Information Exchange (HIE). A critical component to Health Information Exchange is the consent process. If you work for a health system they will likely manage this or at least give you guidance. Developing a consent and managing the governance for a Health Information Exchange can often take as long as or longer to develop than to build the technical capabilities required to send the information from one system to another. It is imperative that as you develop your consent you take into account items related to HIPAA and Privacy Laws. It is also very important that you understand the laws of your state because not all states have the same laws related to the sharing of health information. Many states have an "Opt Out" model. That means a patient's health information is included in the HIE unless the patient specifically states they want it excluded. Other states, like Florida, have an "Opt In" model. This means that a patient's information can't be included in a HIE unless the patient signs a consent that says they want their health information to be included (http://www2.illinois.gov/gov/HIE/Documents/SNConsent%20Draft%207%2020%2012%20(2).pdf).

Technology vs. Process: It Is Not Always the EMR's Fault

Once an EMR is implemented it is not uncommon to attribute any and all problems related to patient care to the EMR. No EMR **EVER** eliminates the need for clinical reasoning and critical thinking by the clinician and other members of the healthcare team. Health IT is a tool and often a very valuable tool but it doesn't replace a well-honed and experienced clinical brain.

An EMR goes through many interesting stages/phases in its "Organizational Life-Cycle". This life-cycle might take several weeks up to many months for a small practice. The EMR life-cycle might take several years for a large healthcare system. Each stage or phase has risks and challenges that have to be understood and managed. The first stage is deciding that you need an EMR or if you already have one that you might need a different one. Even with the EMR "dropout" caused by MU there are still a few hundred EMRs on the market. Picking the right one for your health system (**System Selection Phase**) or practice can be quite a daunting task. There are lots of ways to approach this but the most common tactics are (1) Hiring a consultant to help you decide (2) Talk to others who use the EMR you are interested in (3) Consult entities, like KLAS, which rate EMRs and EMR vendors (4) Let someone else decide for you (5) All of the above.

Once an EMR is selected you enter the **Design Phase**. Depending on the EMR and the size of your organization the design phase may be as short as a few days to as long as several months. Designing an EMR is as much about understanding the processes and workflows that operate in your practice every single day as it is about understanding how the EMR needs to be configured for your practice. I have heard it said by many seasoned CMIOs and CIOs that a large benefit of implementing an EMR is identifying your processes and workflows that aren't optimal (aka bad, broken) and improving or changing them before you go live with the EMR. It is critical to involve Subject Matter Experts (SMEs) in the design of your system. This may be as simple as using your office manager, billing person and nurse as your SMEs. It can also be as massive as double digit teams including physicians, nurses, pharmacists, therapists, case managers, etc, etc. meeting regularly for weeks or months. The key is to involve enough of the right people who understand how you deliver care to your patients. Dedicating enough time and resources to this stage is critical for a successful EMR implementation.

Next is the **Build Phase**. This is the step where you take what you learned during the Design Phase and you, your team, your EMR vendor or a combination thereof "build" the EMR to match the design as closely as possible. Depending on the EMR this can be fairly easy or very difficult. You and your team should have an idea of how difficult the build will be if you and your team did a good job during the system selection phase.

After Build comes the **Testing Phase**. Testing the EMR is usually divided into one or more phases. Phase one of testing usually starts with "Unit Testing". Unit Testing is where you and your vendor try all the different sections of the EMR to make sure everything works as designed and built. Testing is usually aided by the use of "testing scripts". Testing scripts are usually scenarios that try to simulate or mimic what happens when you see a patient using the EMR. If issues are identified during Unit Testing they need to be fixed before you progress to the next phase, which is "Integrated Testing". Integrated Testing involves testing the EMR and the connections it will have with any other system like your billing, scheduling and registration system. These functions are usually part of a Practice Management System (PMS). The PMS may be part of the EMR or it may be a totally different system from the same or different vendor. You also need to

test connections between the EMR and other components, if you have them, like a scanning system, connection to a HIE, ePrescription and a Patient Portal, to name some of the more common ones. The larger and more complex the Health IT system the more "rounds" of integrated testing that are required. Any errors, bugs, or glitches that are discovered during Integrated Testing need to be dealt with before proceeding to the next round of Integrated Testing. Once Integrated Testing is satisfactorily completed there should be at least some "Usability Testing". Usability Testing consists of physicians, nurses and other office personnel using the system with "test" patients to make sure all the different components of the system work as designed, built and tested.

Once your team is satisfied that the system will work when you start using it with patients you are ready for the **Go-Live Phase**. Go-Live is usually anticipated and planned out months in advance. Normal preparation for a Go-Live usually involves at least the following: (1) Requiring everyone in the organization to go through adequate training so they know how to use the system. (2) Arrange for go-live support. Go live support are folks who know the EMR and PMS inside and out so they can help your team continue to learn the system while you're seeing patients. (3) Reduce your scheduled patients if possible. Learning to use an EMR is stressful enough with real live patients but it's super stressful if you try to learn to use it with a totally full schedule the first few days or weeks. Most practices reduce their scheduled patients by 50 % and then increase the schedule based on how quickly the care team becomes proficient in using the system. (4) Communicate with patients ahead of time and during go-live that you and your office staff are using a new system to better serve their needs. Ask them to be patient with you and your staff while you learn the system. Don't forget to take your signs down. I've seen offices "go-live" for 2 years (at least that's what their signs said).

Once your EMR has been live for many weeks to many months and your users are fairly comfortable with using the system, you likely will enter an **Optimization Phase**. Once EMR optimization starts it never stops so I'd like to dedicate a whole section to it.

3.1.2 Governing Optimization: Balancing Control with Throughput

Anytime you **S**elect, **D**esign, **B**uild, **T**est, and **G**o-Live with any Health IT System you need to remind all of your clinical and non-clinical users that going live isn't the end it is the beginning. Some users might think going live with an EMR is the end of the world as they know it and it sort of is. The good news is it usually keeps getting better and it is fairly uncommon for users to say they would really want to go back to paper.

EMR Optimization is adjusting an EMR along with your care processes so it works better for the clinicians, non-clinicians and your patients. In small

organizations and individual physician offices EMR optimization can be as simple as the physician saying I wish the EMR would work this way. Someone on your EMR team or the vendor's team makes the change(s) (you TEST the change). Then you continue to use the EMR to see if the change was helpful.

However, for healthcare organizations with any significant size or degree of complexity (200–1,000 physicians or more), Optimization is "not just a job it's an adventure". The reason it's an adventure is because every single change you make to the EMR has the potential to impact 5 or 20 or 200 other systems depending on how many systems the EMR is connected to. Sometimes these impacts aren't good and can even be disastrous with great impact to patient care and patient safety. Another major challenge with EMR Optimization is that continuous changes to the system, especially if based on the desires of a few users, can lead your organization away from One Standard of Care and Evidence Based Care, if that is something your organization cares about.

Next let's talk about what you might want to optimize. Most EMRs go-live with a pre-built set of note templates and order sets for the clinical users. This is what most new EMR users want to adjust or add to first. Depending on the EMR and size of the organization these changes can often be made by the users themselves. Many EMRs are more "locked down" by design so they require the EMR vendor or an analyst on your "build team" to make the changes to the system.

Another EMR capability that is never perfect out of the box is Clinical Decision Support (CDS). CDS are important tools built into every good EMR. CDS tools are any rules, alerts, or third party content, like drug formularies and "clinical knowledge bases" that help the clinicians make better clinical decisions as they use the EMR to care for their patients. Most EMRs go-live with too many alerts turned on. Well-designed alerts are critically important to leverage the "life-saving" capabilities of an EMR. Unfortunately all alerts aren't created equally. Even if an EMR's alerts aren't too numerous many are often what are referred to as "nuisance" alerts. A nuisance alert is an alert that pops up for the user and makes them stop to consider the information presented before they proceed. The issue the nuisance alert warns of might be inaccurate or in many cases just not clinically relevant for that particular patient in that particular situation. Too many alerts and especially too many nuisance alerts and your users are well on their way to alert fatigue. As mentioned above alert fatigue is common and is where the EMR users ignore all of the alerts, even the important ones. Optimization of an EMR's CDS tools over time is extremely important and is rarely successful without involvement of the clinical users of the system.

EMR vendors are spending more time designing their systems with users in mind but clinical users are rarely satisfied with a system's look, feel, colors, buttons, number of clicks, etc. General EMR look and usability is important to improve if possible (because sometimes it's not possible or is possible only at a great cost of time, resources and or money), but shouldn't take priority over optimizing an EMR's clinical content and CDS tools.

Any discussion about EMR Optimization without a laser focus by you and your team on your organization's workflows and clinical process is likely to fail

miserably. Remember the EMR is a very valuable tool that can greatly support your clinical processes and workflows but it is not a replacement for them.

An often undervalued aspect of Optimization is Governance especially for larger organizations. Governance of EMR Optimization is critically important and needs to happen before any changes are made to any Health IT system EVER. This governance will look very different depending on the size and complexity of your practice. In single physician practices it can be as simple as physicians and staff talking through what changes need to be made and why. In larger organizations Governance is a multi-step and multi-layered process involving Physicians, Nurses, Pharmacists, IT SMEs and the vendor if necessary.

Despite its critical importance, EMR Optimization Governance has the potential to significantly slow down the pace of optimization and not always for the better. No organization ever has enough resources to do all the optimization that is requested nor should it. Part of EMR Optimization Governance is taking all the incoming requests and deciding which changes will be made to the EMR and the clinical processes. As important as deciding what you're going to optimize is deciding what changes you're NOT going to make. Another critical step in Optimization Governance is prioritizing the items to be optimized. After these decisions are made and agreed to by all the committed parties, the decision and "progress" should be communicated to the person or group who made the optimization request. This communication is very important even if the Governance decision is that the system/process change will not occur.

3.1.3 Major Challenges for the CMIO/Clinical Health IT Leader

One of the roles of the Health IT Physician Champion, whether they have the title of CMIO or not, is to identify the many issues and challenges inherent in implementing and managing a Clinical Health IT System. As I mentioned above this doesn't have to be a physician with an extremely technical knowledge of computers and computer systems. It should be a physician who understands clinical workflows extremely well however. This should also be a physician who is good at collaboration and working with matrixed teams because EMR implementation is never something that one physician can or should even want to manage without lots of help.

3.1.4 Clinical Standardization: How Can There Be So Many Experts and Why Do They Never Agree?

One thing EMRs can be very good at, if that functionality is embraced, is helping an organization drive clinical standardization. Unfortunately some physicians will see this as trying to force them to practice "cookbook medicine". The truth of the matter

is a lot of medical errors happen because of the inconsistencies, omissions and a general lack of practicing to one standard of care (http://www.ahrq.gov/research/findings/factsheets/errors-safety/improving-quality/index.html). This One Standard of Care, when such a standard exists, should be based on medical evidence, best practice or both. A coexistent challenge suggested by the bullet above is trying to manage the expectations of medical specialists or "experts" who all have different opinions about what the One Standard should be for a particular clinical care item, issue or situation.

The goal should be to establish a group of the right clinical experts who are adept at evaluating clinical best practices and the medical literature. They don't necessarily have to do all the work themselves (review all the literature or best practices), but they should have the authority to review collated data and put forward a consensus statement for the organization. It is important to establish, before this process even begins, that One Clinical Standard proposed by the group will have weight and will be adopted and followed by other members of the organization's clinical care team. This is a major challenge and one that very few healthcare organizations in the U.S. have completely figured out.

Copy/Paste/Cloning: Doing the Wrong Thing Faster

Anyone who has anything to do with EMR implementation or usage has probably heard the term copy/paste and cloning. There has been tremendous focus on this practice recently because CMS feels that many providers are using this "efficiency" tool inappropriately and that it is leading to fraudulent billings to CMS for Medicare and Medicaid patients (http://oig.hhs.gov/oei/reports/oei-01-11-00571.pdf). The CMS claim, and it certainly can be valid, is that some providers electronically copy large sections of their, or even other providers', clinical notes and then paste them into newly created clinical notes. Most clinicians go in and edit the pasted text so it accurately reflects what is going on with that patient right then. Most importantly the documentation should reflect what has changed with that patient since the original copied note was generated. When it is used appropriately copy/paste saves a clinician time and creates an accurate clinical note that helps everyone take better care of their patients.

Unfortunately many clinicians do not appropriately edit their newest note so that it has the most updated information in it. This is a horrible practice that often creates a very unsafe environment for the patient because other members of the care team are acting on information that is not up to date and thus may be inaccurate. If a physician or other clinician is billing CMS for this "unedited work" it is viewed by CMS that the physician is billing for work that they didn't actually perform (http://journal.ahima.org/2012/10/17/hhs-warns-hospital-groups-on-ehr-fraudulent-billing/). That, of course, is illegal. Copy/paste can be easy or less easy depending on the changeable settings in the EMR you're using. Because almost all EMRs function in a Windows environment, it is technically impossible to completely shut off copy/paste so that it can't be used in an EMR. Most organizations have addressed

copy/paste/cloning through EMR Appropriate Use policies. If your organization hasn't yet developed a policy addressing copy/paste practices I would strongly recommend that you do so.

Managing Note Bloat: More Is Not Always Better

One of the unfortunate byproducts of most EMRs is the relatively effortless creation of massive and sometimes relatively meaningless notes (http://www.healthcareitnews.com/news/note-bloat-putting-patients-risk). In my experience this is typically the daily progress or rounding note but can also be seen with electronically documented History and Physicals and Discharge Summaries as well. In the olden days clinicians were writing their daily progress notes. This usually led to briefer notes that, if you could read them, usually gave a concise but accurate "story" of what was going on with the patient. In the current EMR era with copy/paste, smarttext, smarttemplates, macros, smartforms, smartphrases, quick this, quick that etc. it is very easy to generate a very large note in a very short period of time.

Very few organizations understand this issue before they go live with their EMR. It is common to teach physicians all the different EMR tools and "tricks" they can use to pull everything under the sun into their notes. Just because all of this information is in the EMR doesn't mean you need to include every bit of it in every note every single day. It is important to review the clinical information and document that you reviewed it. It is also appropriate to include pertinent normal and abnormal results from time to time. The detailed information and normal values and reports are usually contained somewhere in the EMR and can be viewed anytime you want to see them. Clinicians justify these multipage progress notes with arguments that all of the information needs to be included for billing purposes or to decrease their risk of being sued. Large notes are like white noise and most frequently a distraction and a nuisance to the busy physician. The large mass of text might have some useful information included but good luck finding it. Some organizations have tried to combat this practice with different tactics like the APSO note. An APSO note puts the Assessment and Plan at the top of the note so the clinician can easily find what's being done for the patient. The Subjective and Objective part of the note can be quickly scanned by an interested clinician after they've reviewed the assessment and plan.

Voice Recognition: Roaming Profiles and Other Major Challenges

Though it is becoming less common, using an EMR has been a major challenge for the physician who can't type well. Most EMRs require at least some typing by the clinicians to get what is in their head into the patient's electronic medical record. Many EMRs have templates that physicians can point and click with a mouse or keyboard but this type of information entry is usually very tedious and time consuming.

Voice recognition software is usually well suited for physicians who don't type well. The technology has improved greatly over the years and has gotten to be fairly accurate and fairly fast and efficient, especially over the last couple years. That being said, voice recognition is not without its challenges. Voice recognition is like most other electronic tools used by physicians. It requires training and practice to become proficient in its use. Many physicians don't like to spend the time training their voice profile and this leads to greater inaccuracy in the recognition of their spoken words. Voice recognition inaccuracy leads to dissatisfied users. Even worse this practice can lead to inaccurate information in a patient's chart if the voice recognized text contains errors and isn't proofread and corrected by the dictating physician, or someone else with the knowledge and privileges to make the corrections for the physician.

In a small organization the deployment of voice recognition is usually simplified by installing the software on the physician's local or personal device. This creates what is called a "local profile". This is a file that has learned how the physician speaks and also is what recognizes spoken words anytime a physician uses the speech recognition software. In larger organizations, and especially where physicians are seeing patients in multiple locations and facilities, it is usually preferable to set the physician or other clinicians up with a "roaming profile". A roaming profile is unique to each physician and sits on a server. This allows the physician to access their voice profile no matter where they are seeing patients and entering spoken text into the EMR.

Whether the profile is local or roaming it is important that the software is configured correctly so the user's profile is regularly optimized. Individual voice profiles can get quite large. A large profile can slow down performance and is a dissatisfier for the user. Optimization also takes words that a physician has "trained" the system to recognize correctly and incorporates those words into the users profile so they won't be misrecognized in the future. Training the system is particularly helpful for unusual names which are being used frequently by the physician in their notes or correspondence to other physicians.

Regulatory Compliance: HIPAA and Privacy and Why They Make Health Information Exchange Harder

One of the major recognized benefits of electronic medical information (compared to paper) is that the information is in a format that allows that information to be more easily shared with another clinician(s) who is taking care of that patient in the same location or several thousand miles away. "Global" access to patient information is seen as a way to eliminate the performance of unnecessary duplicated and expensive medical tests (http://www.healthit.gov/providers-professionals/medical-practice-efficiencies-cost-savings). Sometimes reperforming an expensive test is necessary. However, many times an expensive test is reperformed because the physician doesn't have access to the original result and the patient may not even remember they had a particular test done let alone what the results were.

A significant component for Meaningful Use (and rumored to be a much bigger part of MU Stage 3) is the sharing of a patient's health information with providers outside of your health system and particularly those who may use a different EMR than you do. Many states are making progress in the Health Information Exchange (HIE) space but in most areas of the country there is still not the ability to easily share a patient's information over a large geographic area. Besides the technological challenges of sharing Protected Health Information (PHI) between providers in your own organization or with another organization come the challenges of making sure the information is secure and that it is only viewed by someone who has a legal and clinical right to view that information.

Inappropriate Record Access: It's Not Just for Celebrities

Most healthcare organizations of any significant size have a person or persons dedicated to ensuring that stored PHI is secure and only being accessed by those with a clinical or business need and right to see the information. There are many different ways an organization can secure their information. It is critical that every device that contains PHI is encrypted. Theft of PHI is becoming a big money opportunity for those who are unscrupulous and have a basic understanding of health information systems. We have seen many stories in the news over the last several years of hospitalized celebrities having their information inappropriately viewed by large numbers of hospital workers with no justification to view the information (http://journal.ahima.org/2010/04/29/californian-sentenced-to-prison-for-hipaa-violation/). Most of these cases have resulted in the firings of all of the hospital employees who viewed the celebrity's PHI. More recently the news has informed us of cases where hundreds and even millions of patients have had their PHI stolen by various means (http://www.phiprivacy.net/community-health-systems-says-4-5-million-patients-data-stolen-in-cyber-attack/). This information is often sold to those who then use it to perform identity theft or use it to receive health services as the person whose PHI was stolen.

Besides encrypting all of your devices (especially anything portable) it is critical to enforce a strong password policy and require your users to change their strong passwords at least every 90–180 days. A strong password is considered to be one of at least eight characters with three out of the following four choices: Capital letters; lower case letters; numbers; special characters. Strong passwords should not contain names of you or your family members, birthdates, addresses, or any other information that could easily be learned or guessed by someone who is snooping around either at your work or online (like the public facing part of your Facebook page). User names and passwords should NEVER be shared with anyone and anytime you think someone has acquired knowledge of your username or password they should be changed immediately. Besides the generalized trauma of having your patients' identities stolen, not protecting PHI can result in massive fines to healthcare organizations which allowed a PHI breach to occur (http://www.healthdatamanagement.com/news/breach-notification-hipaa-privacy-security-wellpoint-ocr-46377-1.html).

3.1.5 *ICD 10: I Don't Want to Be a Coder I Just Want to Practice Medicine*

ICD 10 getting delayed until at least October 1, 2015 received "mixed" reviews from those trying to get it live. Many organizations put a hold on their ICD 10 go-lives once the announcement was made. Other organizations moved forward to finish the work to be ready if and when ICD 10 ever goes live. One of the many complaints physicians have with EMRs is they often feel that a lot of the work that used to be done by a "clerical" person has been shifted to them. Physicians also frequently argue, and sometimes with good reason, that they are being asked to perform coding tasks that should be performed by coding experts and not physicians. Physicians' modern mantra that they don't want to be coders they "just want to practice medicine!" has the potential to enter a whole new level of "realism" when ICD 10 goes live. Going from ICD 9 to ICD 10 will expand the number of diagnosis codes used by physicians from somewhere in the 13,000 range to something more like 68,000 with ICD 10 (http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Data-and-Systems/ICD-Coding/ICD-10-Changes-from-ICD-9.html).

Many feel the only way for physicians to survive ICD 10, 11, or 20 (besides retiring) is to have tools embedded in EMRs that help physicians select the correct codes and warn them when a code is not specific enough for the documentation that is included in the medical record. Most EMR vendors understand this and have been working to embed these tools in their EMRs for quite some time. One of the tools that is being looked at to help physicians with ICD 10 coding is Clinical Language Understanding (CLU), often an add-on (requires a separate license and additional fee) to speech recognition software. CLU works with typed or dictated text and can identify "discrete" clinical terms that exist in a large document of "non-discrete" text. Discrete terms can be mapped to coding software or can work with an EMR to make it easier for a physician to do things like add pertinent problems to a patient's problem list or even respond to a "coding query-like" question in near real-time.

3.2 Work Flow Problems and Solutions

3.2.1 *How Do EMRs Improve Care and Safety: What Is the Evidence and Why Is It Important?*

The act of implementing an EMR doesn't guarantee you or your organization will practice safer better medicine. There are tools which have been shown to improve patient safety if they are used consistently. CPOE (Computerized Physician Order Entry (http://psnet.ahrq.gov/primer.aspx?primerID=6)) and BCMA (BarCode Medication Administration (http://www.ncbi.nlm.nih.gov/pubmed/19592882)) are

two activities with evidence suggesting they improve patient safety. CPOE is felt to be most valuable when it is tied to well built CDS tools.

3.2.2 Improving Clinicians' Efficiency: WIIFM (What's In It For Me)

Up until the last couple years it was fairly easy for a physician who didn't want to use an EMR to find a healthcare organization that was still using paper processes. It was also fairly easy to find organizations that were not yet mandating that all their physicians use CPOE. Those opportunities are rapidly fading because it is getting harder to find organizations who haven't implemented at least some type of EMR. Most of these organizations are also live with CPOE. So for the ("I'm not going to use an EMR") physicians, retirement is not just an option it's quickly becoming the only option. Despite the reality that most physicians have to use an EMR it is still necessary that EMR vendors and those implementing EMRs do everything in their power to make physician usability one of their top priorities. EMRs are intended to make patient care better and safer and to make clinicians more efficient. These things don't just happen. They require effort by everyone on the information technology and care teams. Making physicians more efficient is something that all EMRs should do to help answer their question of "What's In It For Me". Now let's look at some of the ways EMRs can make physicians more efficient if they are designed and used correctly.

3.2.3 Physician Portals

Unfortunately many of the Health Systems requiring physician interaction do not have a common platform. This causes many physicians to log into multiple systems (often with different user names and passwords) in order to get access to all the information they need to care for their patients and access to other activities related to their work as physicians. Sometimes the next best thing to having everything in the same system is to at least have everything in a common online location like a physician portal. Well built physician portals can be "one-stop shopping for physicians". It can have "connections" to all the different types of professional information a physician needs. Examples of useful connections through a physician portal might be: access to an inpatient or ambulatory EMR; access to medical staff calendars, documents, policies, procedures, meeting minutes; access to library resources and various knowledge databases; access to online radiology and cardiology images; personalizable links to their favorite websites (like specialty societies); and secure messaging and collaboration with other physicians. Most physician portals are designed to be accessed from a PC or laptop but more and more they are being mobile enabled for use with tablets and smartphones.

3.2.4 Mobility: Citrix vs. Native Apps

Seems like everything in the world is going mobile and that certainly pertains to information physicians and other clinicians need to take care of patients. We used to be satisfied with receiving past medical records in the mail from another practice within 2–4 weeks. Now we're not happy if retrieving patient records takes longer than brewing a cup of coffee with whatever instant coffee machine you prefer. HealthCare still generates forest loads of paper but more and more clinicians are happiest if they can see their patient's information on some sort of portable device. There are lots of challenges with retrieving PHI on a portable device. Probably the most critical is maintaining the privacy and security of the information on the device (http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_049463.hcsp?dDocName=bok1_049463).

Another challenge with delivering medical information to a portable device is getting it in a format that can be easily viewed by the clinician. There are two general ways physicians access this information. One is through a tool called Citrix ™. Citrix is a secure way to remotely access a system and it is similar to being logged into the device that the system resides on (like a desktop PC). With Citrix all of the information "lives" on the remote server so if the portable device is lost or stolen there is no risk that PHI will be recoverable from the device. One of the challenges with Citrix is that the EMR or other application typically behaves as if you are using it on a PC with a big monitor. This usually causes lots of scrolling to view all of the available information.

One technique used to present medical information in a more "optimized" way for portable devices, like tablets and smartphones, is through what is known as a native app. A native app is similar to any other free or purchased app from any App Store. The app is downloaded to the portable device. Once the user is provisioned (given appropriate security clearance based on the user's credentials) the app can be opened and used to view health information in a way that is better suited for the size of the screen of the device being used.

3.3 Technology Problems and Finally

3.3.1 Care Transitions and Patient Engagement: Critical Elements for Population Health

As the U.S. tries to rein in the rising cost of health care and improve the care we provide to our population it has become fairly widely accepted that we need to do a better job managing patients' conditions over long periods of time (http://www.forahealthieramerica.com/ds/impact-of-chronic-disease.html). It is also critical we do a better job interacting with the population before they become patients so we can

help them maintain their health (http://www.healthit.gov/providers-professionals/patient-participation). There are lots of terms being used currently to describe this model but Population Health may be at the top of the list. One important component of Population Health is CDM (Chronic Disease Management). CDM can be challenging due to a lack of medical or financial resources, patient non-compliance related to medication or medical follow up, and failure of patients to stay in the same location so they can always go to the same hospitals, the same physician offices, and see the same physicians. Many health systems and healthcare providers are trying to leverage existing and new technologies to manage populations and engage patients. Patient engagement is loosely defined as getting patients and their families interested in actively participating in their own health care.

3.3.2 Customer Relationship Management Tools (CRM)

One of the challenges and often frustrations for both patients and healthcare providers is the ability or inability to keep track of their patients and their patients' needs in a useful way. For decades non-healthcare industries have been excellent at knowing who their customers are and often everything there is to know about that customer. This has been fairly difficult in healthcare because of the siloed way care is delivered in many parts of the country. Many large healthcare providers are starting to develop CRM tools (also called Care Management tools). These tools are used by many different members of the healthcare team to identify who their patients are. Once patients are identified the system documents the interactions the healthcare providers have with the patient. Many patients get very frustrated when they are being called by large numbers of healthcare workers trying to follow up on a procedure or hospitalization the patient just had. Often the sixth caller doesn't know what questions were asked by the first five callers and they frequently ask the same questions over and over. This lack of coordinated followup can be perceived by the patient and their family as the healthcare system or provider not knowing who the patient really is and what their needs are.

3.3.3 Patient Portals

Another patient engagement tool that has recently gained wider acceptance and is becoming more available for patients is the Patient Portal. Patient portals are websites or apps patients can use to interact with their healthcare system and their healthcare providers. Not all patient portals are created equally but the majority give patients access to similar information like lab results, hospital and office discharge instructions and patient education, medication lists, lists of allergies and immunizations, and a list of their ongoing medical problems. Many patient portals give patients the ability to message their physicians or their physicians' office

staff. Some allow patients to request an appointment or even schedule their own appointment at the desired date and time. Patient portals should never be used to provide care for emergencies or other serious medical conditions. These should still be handled by the nearest emergency room or other acute intake center.

3.3.4 Home Monitoring and Data Integration

One challenge when providing care for patients with chronic conditions is making sure they get regular meaningful followup with the different members of their care team. Technology is making this easier for patients with certain conditions through the use of home monitoring devices. There are currently many devices that can be used by patients in the home with physician supervision. These include scales to monitor the weight of heart failure patients. Blood pressure monitoring devices are used with patients with a history of high blood pressure or conditions where blood pressure control is critical like previous history of a stroke. Many devices that measure a patient's blood glucose now have the ability to transmit those results to their physician office and sometimes directly into the patient's medical record in the physician's office EMR. More recently various devices have emerged to monitor medication compliance by patients (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3264437/). This may involve a "smart" medication box or dispenser that tracks which pills are removed and records the date and time. Some researchers are working with medication dispensing devices with video capabilities. These are being developed so a healthcare provider's staff or behavioral health staff can observe the patient taking their medication after it is removed from the dispenser. Devices like this are becoming a reality due to the widespread availability of high speed internet.

Finally let's discuss Emerging technologies and Standards meant to optimize Health IT for patients and clinicians.

3.4 Emerging Technologies

Seems like every few months brings a new tool or technology to Healthcare IT. This is likely to continue as digital memory continues to get cheaper and high speed wireless connectivity improves. Most new technologies are aimed at making it easier, better, faster for clinicians to care for their patients. They are also aimed at making it easier for patients to be involved with the management of their own health. One of the challenges with dealing with the massive amount of data present in today's EMRs is being able to use that data for many different purposes besides just caring for the individual patient like (billing, quality reporting, decreasing readmissions, chronic disease management, value based purchasing to name just a few). In order for EMR data to be useful for the above purposes it almost always needs to be

in a discrete data format (http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_050085.hcsp?dDocName=bok1_050085). Discrete data means having a data element in a format that is consistent and understood by users to have roughly the same meaning every time that data element is present. Historically getting discrete data into EMRs meant the user had to click a selection or pick from a list of discrete choices for things like medications, allergies, medical problems, procedures, etc. This type of data entry often slows down busy physicians. Historically this made it difficult if not impossible to use typed or dictated text for anything that required discrete data unless it was manually abstracted by a person skilled in abstracting that type of information.

Technology has been developed to help convert typed or dictated text into discrete data elements which can be used for tasks, reports, or activities that require discrete data. This technology is often described as NLP and CLU (http://www.nuance.com/for-healthcare/resources/clinical-language-understanding/index.htm). NLP stands for natural language processing. NLP is computer software that can take typed or dictated text and analyze it related to words that are present and the order of the words. It works similar to the way we process speech when we hear it related to context certain words may be used in. CLU stands for Clinical Language Understanding. In a greatly simplified description, CLU is NLP but from a clinical perspective. It is software that is able to identify clinical words and terms in "blobs" of text. Once identified these clinical terms can be "discretized" so they can be use for some of the tasks and activities listed above. NLP/CLU has been around for a while primarily in the hospital coding world but will likely soon find more widespread use by clinicians in the clinical sections of an EMR.

I would like to close by summarizing what I feel are the four key points from this chapter. (1) Physician IT Leadership: Depending on the size of the organization this may be a part-time or full-time position. It should be a physician with a good general understanding of Healthcare Information Technology capabilities but a great understanding of clinical workflows and processes and how they will be impacted by the implementation of an EMR. It should also be a physician who works collaboratively with other members of the healthcare and clinical IT teams. (2) EMR System Selection and Implementation: This process is very critical to an organization's success and can last from months to years depending on the size and complexity of the organization. The five key phases are System Selection, Design, Build, Testing and Go-live. (3) Governance: EMR governance is often an after thought and frequently undervalued. It is very important during the implementation phase but equally important during optimization. The governance group(s) should decide what will be done and often as important what will not be done. Once decisions are made as to what will be done, the governance group(s) help prioritize what will be done in what order to maximize the use of an organization's valuable IT and clinical resources. The governance group should also have a good process for communicating their decisions to the users who will be impacted by those decisions. (4) EMR Optimization: Finally getting an EMR live is not the end it is the beginning. Making a system better and more efficient over time is critical so

we can take the best possible care of our patients. This is accomplished through constantly evaluating and improving CDS tools and trying to minimize alert fatigue whenever possible. Always remember, optimizing an EMR is often as much and sometimes more about improving the patient care processes and workflows than it is about making changes to the EMR itself.

Chapter 4
Computer-Aided Psychotherapy Technologies

Marni L. Jacob and Eric A. Storch

Abstract Computer aided psychotherapy addresses the many barriers of access to evidence-based psychotherapy. Programs are either completely computer-based delivered via the Internet or a stand-alone program, or they may be combined with intervention by a therapist. Telepsychiatry is another popular method for delivery of psychotherapy. Self-guided computerized treatment programs have the advantage of translation into several languages, eliminate the barriers of appointment time and location, and offer more anonymity to patients. The majority of self-guided programs utilize cognitive-behavioral therapy (CBT). Studies have demonstrated that these programs result in significant reduction in anxiety and mood symptoms. Self-guided substance use treatment uses motivational interventions to decrease quantity and frequency of drinking. Computer-assisted treatment programs incorporate therapist interventions to clarify skills or tailor treatment approaches. These programs have been effective in treating anxiety disorders, obsessive-compulsive disorder, and mood disorders. Virtual reality therapy has been used in exposure therapy to treat post-traumatic stress disorder, phobias, and anxiety disorders. Telepsychiatry is an effective delivery mechanism for CBT, and has demonstrated effective treatment of anxiety disorders, with the advantage of facilitating clinician access.

Keywords Agoraphobia • Anxiety • Cognitive therapy • Computer literacy • Depression • Drinking behavior • Eating disorders • Electronic mail • Headache • Mental health • Mental health services • Minors • Mood disorders • Motor activity • Obsessive-compulsive disorder • Outcome assessment (health care) • Parental consent • Personal satisfaction • Phobic disorders • Psychopathology • Stress disorders post-traumatic • Suicidal ideation

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Mental health problems are a significant public health concern, with numerous children and adults worldwide endorsing various symptoms of psychopathology, as well as associated distress and impairment. Mental health problems are common, with reports estimating the prevalence of mental illness to be approximately 20 % in individuals in the U.S. [1, 2]. Left untreated, mental health problems cause a significant burden both to the individual and society at large due to reduced productivity and cost of disability [3–5].

Effective psychological and pharmacological treatments exist for mental health problems. Psychotherapy seeks to help individuals identify and manage their symptoms to improve functioning and quality of life. However, dissemination and implementation of evidenced-based psychotherapy approaches can be challenging given difficulty finding effectively trained clinicians or obtaining access to effective treatments given their geographic location, financial constraints, taking time off from work or having to arrange childcare to participate consistently in therapy, concerns about stigmatization, or avoidance of treatment if the nature of their difficulties (e.g., agoraphobia) limits their ability to leave the home, or if symptoms are primarily manifested at home (e.g., hoarding).

Given these barriers, along with the upsurge of technology, computer-aided psychotherapy programs have been developed. Programs may be completely computer-based, which involve receipt of the intervention exclusively through a self-guided delivery format. Self-guided treatment programs are often highly interactive and may involve several forms of media (e.g., video, audio) delivered either through the internet or as stand-alone computer programs [6]. Computer-assisted treatments provide intervention strategies that are combined in conjunction with some degree of interaction (e.g., face-to-face, via email) with a therapist. Another form of computer-aided intervention is the provision of therapy via videoconferencing, also known as telepsychiatry. The demand for increased access to treatment, advances in relevant technology, and the increasing publication of outcome research supporting the use of computer-aided treatments make this feasible.

4.1 Descriptions of Computer-Aided Psychotherapy Technologies

4.1.1 Self-Guided Computerized Treatment Programs

One manner of improving access to treatments is to utilize self-guided computerized approaches. These programs can be used at home or in health-care settings. Self-guided computerized treatment programs may address some of the significant barriers to receipt of treatment, such as geographic location and having little or no access to a therapist, scheduling issues, transportation difficulties, or if the patient is reluctant to attend therapy for some reason. Patients can also work at their own pace and review material as often as desired [7]. Another benefit of computer-

administered treatments is that they can be translated into different languages (e.g., [8, 9]). Individuals may even be more willing to reveal sensitive personal information to computers rather than human interviewers if there is anonymity. However, self-guided treatment programs require a sufficient reading level and degree of computer literacy, and internet based programs require internet access. Cartreine et al. [6] emphasize several empirical questions that are necessary to better understand the utility of self-guided treatment. These include: (1) to what extent is tailoring, the use of an individual's personal characteristics to customize a computer program, necessary, and for what types of people, clinical problems, and interventions?; (2) What level of health care provider involvement, if any, is needed for the intervention to be effective?; (3) How can self-guided treatment programs be improved to maximize their effectiveness?; and (4) What are the active components of a given self-guided treatment program?

Many current self-guided treatment programs utilize cognitive-behavioral therapy (CBT), which is a psychosocial treatment that involves several core treatment components (e.g., psychoeducation, identification of maladaptive thinking patterns, use of exposures to feared stimuli, modification of maladaptive behaviors). The structured nature of CBT along with the learning of particular skills is conducive to a computerized approach [10]. Spek et al. [7] conducted a meta-analysis of the effects of 12 randomized controlled trials of internet-based CBT across anxiety and mood disorders, with minimal or no therapist assistance. Treatments resulted in significant reductions in anxiety and mood symptoms, with interventions for depression demonstrating a small mean effect size ($d = .27$), and interventions for anxiety demonstrating a large effect size ($d = .96$). However, this meta-analysis suggested that effects of treatment are more substantial if computer-delivered treatment is accompanied by regular contact with a clinician [7], as treatments with therapist support had a large mean effect size whereas interventions without therapist support had a small mean effect size. Self-guided treatments have also been utilized for different types of psychological disorders, which are reviewed next.

4.1.2 Self-Guided Computerized Treatment Programs for Anxiety Disorders

Several self-guided computerized treatments use CBT for anxiety disorders. Reger and Gahm [11] completed a meta-analysis of 19 internet and computer based cognitive-behavioral treatments of anxiety disorders in adults, which used software on a standard PC to automate the delivery of CBT. Internet and computer based programs included a variety of skills, such as encouragement of goal setting, modules which facilitate use of cognitive-behavioral therapy strategies to modify cognitive distortions, and use of exposure strategies. Interventions were delivered almost exclusively via the computer, though some studies included minimal clinician contact, such as some degree of individual feedback via email for

homework, for questions associated with different modules, or to provide more tailored recommendations at different stages in treatment. Other studies included the therapist working with the patient for the first 5 min of each session (either to demonstrate the computer program or set the stage for the session), the ability for patients to post messages on an online discussion forum, prompts to guide participants as they move through the program, or just technical support. Of note, in one of the studies in the meta-analysis (i.e., [12]), the computer-based treatment augmented therapist-delivered CBT, and another of the studies incorporated 20 min of coaching during six sessions (i.e., [13]). Results of this meta-analysis showed a moderate-to-large mean effect size of Cohen's $d = .76$ between the internet and computer based treatments compared to a waitlist control group. The benefits were also statistically equivalent or superior to treatment as usual. Other self-guided computerized treatment programs have been used to successfully treat individuals with phobias or panic disorder (*Fearfighter*; [14, 15]).

Some work has also looked at use of self-guided computerized treatment programs for youth with anxiety disorders. March et al. [16] examined the efficacy of CBT for child anxiety disorders when delivered entirely over the internet, supplemented by minimal therapist contact by phone or email. The intervention (BRAVE for Children-ONLINE) was adapted from a clinic-based CBT program (BRAVE program) for youth aged 7–14 years old with anxiety disorders [17]. The BRAVE program is comprised of 10 weekly, 60 min child sessions and 6 weekly, 60 min parent sessions. Two booster sessions are also conducted, at 1 month and 3 months post-treatment. In the March et al. [16] study, 73 children with anxiety disorders and their parents were randomly assigned to either the internet-based CBT (BRAVE for Children – ONLINE) or a wait-list condition. Sessions in BRAVE for Children-ONLINE are comprised of reading material, question and answer exercises, games, quizzes, and homework, all in an appealing and eye-catching online format. Anxiety management strategies include recognizing physiological symptoms of anxiety, relaxation, use of cognitive restructuring, exposure, problem-solving, and self-reinforcement of "brave" behavior. At post-treatment, youth in the internet-based treatment program showed small, but significantly greater reductions in anxiety symptoms than youth in the waitlist control group, and these improvements were enhanced at 6-month follow-up [16].

4.1.3 Self-Guided Computerized Treatment Programs for Obsessive-Compulsive Disorder

Self-guided programs have been used to successfully treat individuals with obsessive-compulsive disorder (OCD; *BT steps*, [18, 19]). For example, *BT Steps*, available via Waypoint Health Innovations, is a web-based CBT program which teaches skills to facilitate self-management of OCD symptoms. Lack and Storch [20] completed a review of eight studies which utilized self-guided

computer-administered treatment for OCD in adults. The programs were either completely self-administered, partially self-administered, or used as an adjunctive treatment method, and studies generally showed moderate to large effect sizes in demonstrating a significant reduction of OCD symptoms as well as improvements in overall functioning.

4.1.4 Self-Guided Computerized Treatment Programs for Mood Disorders

Studies have provided support for computer-guided treatment for depression [21–23]. *Thrive*, available via Waypoint Health Innovations, is a web-based self-help program for depression, which teaches individuals to identify depressive symptoms, modify maladaptive thinking and behaviors, and manage mood. Modules specifically teach cognitive restructuring, social skills training, and behavioral activation. A program developed by Carter et al. [24] for the National Aeronautics and Space Administration (NASA) uses problem-solving therapy for managing psychosocial problems, such as interpersonal conflict and depression, on long-duration space flights. Kaltenhaler et al. [25] reviewed four randomized clinical trials of self-guided CBT treatments for mild to moderate depression and found three of the four treatments to be efficacious.

4.1.5 Self-Guided Computerized Treatment Programs for Substance Use

Self-guided programs have been used to successfully treat individuals with substance use [26, 27]. One example, is the *Drinker's Check-Up* (DCU, [28, 29]), which is a brief, computer-based motivational intervention designed for individuals who are ambivalent about changing their drinking. It provides a comprehensive assessment of drinking behavior and seeks to motivate behavioral change. The program consists of integrated assessment, feedback, and decision-making modules that are sensitive to the person's level of readiness for change. This program has been evaluated in a randomized trial of 61 participants who either received immediate treatment or were in a wait-list control group, which received treatment after a 4 week delay [30]. Analyses demonstrated that the improvement of the immediate group between 0 and 4 weeks was significantly greater than in the delayed condition; however, the improvement of the delayed group between 4 and 8 weeks was not significantly greater than in the immediate group. The mean effect size for the immediate group was .93 as compared to .21 in the delayed group for the baseline to 4-week period, whereas the mean effect size for the delayed group was

.32 as compared to .04 for the immediate group in the 4-week to 8-week period. Both groups exhibited 50 % reductions in the quantity and frequency of drinking from baseline to 12-month follow-up. Research has also examined web-based programs for smoking cessation ([31]; see [32] for a review).

4.1.6 Self-Guided Computerized Treatment Programs for Other Mental Health Difficulties

Self-guided programs have been used to successfully treat individuals with eating disorders [33] and for insomnia [34]. Doyle et al. [33] completed a multisite randomized controlled trial evaluating a 16-week internet-delivered cognitive-behavioral program targeting weight loss and eating disorder attitudes and behaviors in adolescents. Results showed significant reductions in body mass index scores from baseline to post-intervention as well as greater use of healthy eating-related and physical activity-related skills in the adolescents who completed the internet-delivered CBT program compared to adolescents receiving usual care. In regards to insomnia, Strom et al. [34] investigated a 5-week cognitive-behavioral self-help intervention which primarily consisted of sleep restriction, stimulus control, and cognitive restructuring. Some statistically significant improvements were found in the treatment group on many outcome measures, but some improvements were also noted in the control group, suggesting that further research is necessary to examine the potential utility of such programs. Programs have also shown benefits of applied relaxation and problem solving, administered via the internet and email, in treating headaches [35].

4.1.7 Summary

Based on the research thus far, self-guided computerized treatments seem to be a promising avenue by which patients can receive mental health services. Despite the potential benefits, there are challenges involved in the administration of self-guided treatments [36]. It may be challenging to ensure that patients attend to and process the information in the self-guided treatment, as this would likely be easier to monitor in a face-to-face intervention. To increase the likelihood of this with youth, Spence suggests using eye-catching graphics and interactive tasks to facilitate attention and comprehension [36]. Given that one of the aims of developing an online program is to reduce concerns about stigma, BRAVE-online avoids using the term “therapist” and uses the term “trainer” instead. Spence et al. [36] describes that development of an exposure hierarchy in self-guided computer-based anxiety based treatment is challenging, and it may be harder to monitor other things like treatment resistance, non-compliance, and completion of sessions in a reasonable time frame. The content

of the self-guided program should also take in to account developmental factors and fit with the age of the patient. Illness severity is also very important to consider when determining the fit of such programs.

Further, Cartreine et al. [6] discusses that liability is a question for self-guided computer treatment programs. It is indicated that whereas a clinician might be deemed liable if a patient receives improper care, authors of self-help books are not likely to be held liable if a reader commits suicide or experiences some other deleterious outcome while reading the book. This begs the question of whether developers of self-guided computerized treatment programs should be liable. Cartreine et al. [6] also asks about the ethical and legal obligations that may be relevant; if a computer is able to notify someone of a user's suicidal ideation, must it in fact do so? And if so, who should be notified? There is also an issue of parental consent for minors. Would minors have access to self-guided interventions, or would access depend on some method of obtaining parental consent to the treatment program. In the March et al. [16] study, parents and children visited an online information page explaining the procedure of the study, which was followed by provision of online informed consent. What is ethical in terms of obtaining informed consent for treatment? Would a clinician be accessible to answer questions? A potential answer to this dilemma would be that self-guided computerized interventions should still be overseen by a healthcare professional or only used in health care settings where clinicians are accessible. For quality control, there should also be some way for consumers and professionals to identify self-guided programs that have met the standards to be considered empirically-based treatments. Thus, data is necessary to demonstrate that such treatments are in fact evidenced-based treatments.

Overall, continued research is necessary to better understand the efficacy of these interventions, as it seems that some treatments work better than others [6]. Randomized controlled trials using these methods need to be conducted to obtain more information about their efficacy. Interestingly, one benefit of internet and computer-based approaches is that treatments may be more likely to provide standardized, equivalent doses of treatment which is helpful in randomized controlled trials to ensure that all participants received the same dose of treatment [11].

4.1.8 Computer-Assisted Treatment Approaches

The majority of the studies mentioned above use the computer as the primary source of training. However, computer-assisted treatment programs have also shown promise for a variety of mental health problems. These programs combine the structure of a computerized program with real life participation in clinician-administered therapy. Benefits of computer-assisted treatment programs include several of the potential advantages mentioned above for self-guided treatment, such as the maintenance of structure and the flexibility associated with using a computer program. However, although treatment modules can be completed independently,

clinicians can be available to clarify any therapy skills that the patient finds confusing, facilitate problem-solving, or attempt to tailor treatment approaches more to the individual patient if the computer program does not do so adequately.

4.1.9 Computer-Assisted Treatment Approaches for Anxiety Disorders

Computer-aided treatments have been utilized for a variety of mental health difficulties in adults. Research has shown that computer-aided vicarious exposure for spider phobia shows comparable results to therapist-delivered live exposure [37], with both treatments being more effective than a relaxation placebo treatment. One program, *CALM Tools for Living*, is used in session by clinicians to guide patients with anxiety disorders through CBT [38], and another program guides posttraumatic stress disorder (PTSD) treatment in session and facilitates therapy homework [39]. Other studies have found support for the use of internet-based CBT (I-CBT) for social anxiety [40], with even greater gains attained when compared to group CBT for social anxiety.

Computer-aided treatments have also been used with youth with anxiety disorders. Spence et al. [17] compared youth, aged 7–14, with anxiety disorders who were randomly allocated to either a group CBT clinic-based treatment, the same CBT delivered partially over the internet, or a wait-list control group. The group CBT treatment consisted of 10 child sessions and 6 parent sessions, plus booster sessions at 1 and 3 months post-treatment. A similar format was used for the CBT + internet condition, as half of the child and parent sessions were delivered via internet. Results showed that children in the clinic and clinic + internet conditions showed significant reductions in anxiety from pre to post-treatment and were more likely to no longer meet diagnostic criteria for their anxiety diagnoses, compared to the waitlist group. There were also no significant differences between the clinic and the clinic + internet treatment conditions at post-treatment [17]. Another example of a computer-assisted program is *Camp Cope-A-Lot* [41, 42], which is a 12-session computer-assisted interactive cognitive-behavioral treatment program for anxiety in 7–13-year-old youth, based on the Coping Cat treatment [43]. Participants complete the first six sessions independently, during which they follow along with a camper at *Camp Cope-A-Lot* to learn strategies to cope with anxiety using an interactive and engaging format, with each session focusing on learning a different skill (e.g., identifying physiological symptoms of anxiety, problem solving skills training). The remaining six sessions are completed with the therapist and involve use of graduated exposures. In those sessions, the child initially watches a short video at the beginning of the exposure sessions in which the camper demonstrates exposure completion, and this is then followed by the child completing exposures. Two parent sessions are also included to convey the treatment plan. The program also incorporates optional video game rewards. In a randomized controlled trial of

Camp Cope-A-Lot [44], 49 children with primary anxiety disorder diagnoses were randomized to the Camp Cope-A-Lot condition (CCAL), individual CBT (ICBT), or computer-linked education, support, and attention (CESA). Results demonstrated that the CCAL and ICBT groups showed significantly higher remission rates of primary anxiety disorder diagnoses compared to CESA, with 81 %, 70 %, and 19 %, respectfully, no longer meeting criteria for their principal anxiety disorder diagnosis. No significant differences were found between youth who participated in the CCAL group compared to ICBT. Additionally, parents and children participating in CCAL and ICBT reported higher satisfaction than CESA children, supporting the acceptability of those treatment approaches. Programs such as CCAL are thought to ensure effective, standardized education in cognitive-behavioral strategies while also maintaining the benefits of face-to-face treatment [44] with no negative effect on treatment alliance. Computer-assisted programs have also demonstrated positive outcomes in treating spider phobia [45] in youth.

4.1.10 Computer-Assisted Treatment Approaches for Obsessive-Compulsive Disorder

Andersson et al. [46] completed a pilot study of internet-based CBT (ICBT) for adults with OCD. In I-CBT, the patient accesses a website and works with written self-help materials and homework assignments, and this work is supported by regular contact with an online therapist. In this study, all participants read the same material regarding psychoeducation and treatment rationale for OCD, yet specific examples of obsessions and compulsions were provided based on the participant's individual symptoms. The self-help program consisted of 15 modules, and a homework assignment had to be submitted after each module. A psychologist provided feedback and support on all homework assignments. Significant reductions in OCD symptoms, as well as positive changes across several other measures of functioning (e.g., increases in global assessment of functioning, decreases in depressive symptoms) were also shown.

4.1.11 Computer-Assisted Treatment Approaches for Mood Disorders

Several computer-assisted programs have also been used for depression (see [47] for a review). Commonly used programs include *Good Days Ahead: The Multimedia Program for Cognitive Therapy* [48], *Beating the Blues* [49–51], and *MoodGYM* [52, 53]. Cavanagh and Shapiro [54] conducted a meta-analysis of five depression computerized CBT self-treatment studies and found pre-post improvements for

individuals who used these programs versus wait-list controls or people receiving treatment as usual, though computerized CBT treatment was not as effective as face-to-face clinician-administered CBT treatment.

4.1.12 Computer-Assisted Treatment Approaches for Other Mental Health Difficulties

Other studies have found support for the use of internet-based CBT (I-CBT) compared to an attention control condition for hypochondriasis [55]. Computer-assisted programs have also been used with patients with irritable bowel syndrome [56] and in patients with schizophrenia [57, 58]. Several programs have also been used to treat eating disorders (e.g., *Student Bodies* Internet program, [59, 60]). Another study found eight sessions of participation in a private online chat room overseen by a moderator, to improve eating habits and body image concerns in college-age women at risk for an eating disorder, when compared to a control group [61]. Self-help based on CBT in conjunction with internet support was also shown to be effective in treating bulimia nervosa and binge eating disorder in adults [62]. Internet support consisted of contact with a graduate student via email to provide feedback on homework and guidance on using the self-help program. Patients also had access to an online private discussion forum. Computer-assisted programs have also demonstrated positive outcomes in treating encopresis [63] and selective mutism [64] in youth.

4.1.13 Summary

As indicated, a variety of computer-assisted approaches have been effectively used to treat a variety of mental health problems. Certain aspects of treatment, such as psychoeducation, can be conveyed via this means without requiring face-to-face contact with a clinician. Computer-assisted treatments may also help provide structure for less experienced therapists. However, there are also limits to computer-assisted programs. Computer-assisted treatments may be focused on addressing particular symptoms or disorders, and may not be able to tailor treatments as specifically as individualized treatment. For instance, whereas the randomized controlled trial of Camp Cope-A-Lot showed significant reductions in anxiety disorder diagnoses, many children continued to meet diagnostic criteria for a comorbid diagnosis for which more treatment for non-anxiety issues might be warranted [44]. Individuals may present with complex psychopathology or comorbidities that may impact or limit the effectiveness of the computer-assisted intervention. Thus, it is important to investigate whom computer-assisted treatment programs will most likely benefit, in terms of type and severity of disorder. Large scale effectiveness

research is necessary to determine the cost-effectiveness of the programs, as well as how they can be best implemented and sustained [44]. Further, now that research has demonstrated support for computer-aided psychotherapy programs, future research that includes appropriate control groups (e.g., clinic-based treatment group) is also needed to determine the ideal level of clinician contact required to show treatment efficacy [16]. See Newman et al. [65] for a review of the literature on how much therapist contact is necessary for a positive treatment outcome, ranging from completely self-administered to predominantly therapist administered, for anxiety and depression. Overall, continued research will likely identify ways to improve treatment compliance and improve the impact of treatment.

4.1.14 Virtual Reality

Virtual reality technology has been used as a treatment tool to immerse the patient in a setting where the technology can be used to control the patient's visual, auditory, tactile, and olfactory experiences. Virtual reality programs can also facilitate assessment by examining behavioral and physiological responses when in virtual environments, such as in the case of individuals with phobias of tunnels [66], or anxiety responses in individuals with test anxiety [67] or OCD [68]. Additionally, since it is not always feasible or realistic to expose the individual to a feared scenario, they provide an environment in which the individual can practice using coping skills without being in the actual situation. The individual can first learn the skills (e.g., diaphragmatic breathing, cognitive restructuring, exposure) and then practice them in the safe and controlled virtual environments at their own pace [69]. This may facilitate treatment for individuals who may be too anxious to undergo exposure in vivo.

4.1.15 Virtual Reality for the Treatment of Anxiety Disorders, Phobias, and Post-traumatic Stress Disorder

Virtual reality therapy has been used in exposure therapy to treat PTSD symptoms resulting from warfare [70, 71], the September 11, 2001 terrorist attacks [72, 73], criminal violence [74], or motor vehicle accidents [75–77]. It has also been used to treat phobias such as fear of public speaking [78, 79], social anxiety [80, 81], panic and/or agoraphobia [82–84], claustrophobia [85], fear of heights/acrophobia [86, 87] and fear of flying [88–90]. A meta-analysis by Powers and Emmelkamp [91] examined 13 studies comparing virtual reality exposure therapy (VRET), administered as a stand-alone treatment, with in vivo exposure and with control conditions for anxiety disorders and specific phobias. Results showed a large mean effect size for VRET compared to the control conditions (Cohen's $d = 1.11$), and

VRET was shown to be equally effective and in fact have a slight advantage over in vivo exposure (Cohen's $d = 0.35$). However, the Powers and Emmelkamp [91] meta-analysis investigated VRET as a stand-alone treatment, therefore excluding studies which combined VRET with CBT in treatment. However, more recently, a meta-analysis of 23 studies was conducted by Opris et al. [92], which compared use of virtual reality in conjunction with classical evidenced-based interventions (e.g., CBT or behavioral therapy) to evidence-based interventions in which no virtual reality component was utilized. Results showed a large and statistically significant effect size when comparing VRET (consisting of behavioral therapy or cognitive-behavioral therapy augmented by virtual reality exposure) to waitlist control at post-treatment (weighted $D = 1.12$). When comparing VRET to classical evidenced-based treatments, results revealed no overall effect for VRET compared to the classical evidenced-based treatments. Thus, results showed similar efficacy between the cognitive-behavioral and behavioral interventions incorporating a virtual reality component to the classical evidenced-based interventions with no virtual reality component [92]. Results also showed no significant differences in dropout between the virtual reality and in vivo exposure conditions.

Other studies have examined the use of online virtual environments in psychological treatment. *Second Life* is an online virtual environment, created by Linden Research, Inc., in which users create their own avatar which they use to interact with other avatars within the virtual environment. Conversations occur via typed messages or through voice-over IP headsets. Yuen et al. [93] conducted a study of use of *Second Life* to treat social anxiety. Treatment used acceptance-based behavioral therapy and cognitive-behavioral therapy strategies, and therapists and patients met in a private, secure virtual room and communicated vocally and visually using avatars. In session exposure exercises were conducted within the virtual world, such as conducting a presentation inside of a virtual conference room. After 12 treatment sessions, participants showed significant pretreatment to follow-up improvements in social anxiety symptoms, depression, disability, and quality of life. Another study developed the T2 Virtual PTSD Experience for use on the *Second Life* platform, which was created to educate individuals about combat-related PTSD [94]. Sarver et al. [95] examined the utility of an interactive virtual environment for adolescents with social anxiety. Children received Social Effectiveness Therapy for Children [96] in conjunction with the opportunity to practice skills in a virtual environment, and both clinicians and participants were satisfied with the program and indicated that they would recommend the program to others.

4.1.16 Virtual Reality for the Treatment of Other Mental Health Difficulties

Although studies have shown the utility of virtual reality in treating anxiety and phobias, virtual reality has been used for other disorders as well. For instance, virtual

reality programs have been used in the treatment of attentional difficulties [97], to elicit craving and cue reactivity with alcohol [98] and cocaine [99], when conducting pediatric rehabilitation (see [100] for a review), to improve social skills in patients with schizophrenia [101], and to address body image concerns in individuals with eating disorders ([102]; see [103] for a review).

4.1.17 Telepsychiatry

Telepsychiatry, in which therapy occurs using videoconferencing technology, is being used more often by clinicians. Telepsychiatry has a variety of potential benefits. First, it can connect individuals who do not have geographic access to a specialist to an expert clinician so that the individual is able to receive empirically-based treatment that he or she may otherwise not have had access to. Second, telepsychiatry can also be used to facilitate exposure therapy in the patient's home setting, which provides a more realistic setting than a therapist's office, which maximizes ecological validity. Third, telepsychiatry can also help people who are housebound due to physical abilities or mental health difficulties (e.g., agoraphobia, social anxiety). Fourth, telepsychiatry provides patients with privacy due to being able to connect to clinicians in their home setting, rather than having to visit a clinician's office. This may be particularly helpful for patients who have concerns about stigmatization. It also provides convenience in that practitioners may be able to offer more flexible scheduling options.

Studies have shown CBT delivered via telepsychiatry to be effective for a variety of mental health difficulties. Kessler et al. [104] conducted a randomized trial (RCT) that demonstrated the effectiveness of therapist-delivered online CBT for adults with depression, with gains maintained after 8 months. In another RCT, Stubbings et al. [105] compared 12 sessions of in-person CBT to CBT via telepsychiatry in adults with anxiety or mood disorders, and results showed the two conditions to be comparable. Cognitive-behavioral therapy via telepsychiatry has also been successfully used to treat OCD [106, 107], panic disorder with agoraphobia [108, 109], PTSD [110, 111], bulimia [112], and to provide psychological treatment for patients with cancer in rural settings [113].

Administration of CBT via telepsychiatry also has shown promise when working with children and adolescents. Storch et al. [107] conducted a randomized controlled trial of family-based CBT delivered via web-camera compared to a waitlist control group, in children and adolescents with OCD. Results showed that web-camera delivered CBT was superior to the waitlist control group at post-treatment on all primary outcome measures, which demonstrated large effect sizes of $d \geq 1.36$. Comer et al. [114] conducted a case series of five youth (ages 4–8) with early-onset OCD who participated in family-based CBT (based on Family-Based CBT for Early Childhood OCD; [115]) delivered via telepsychiatry. All youth in the study showed OCD symptom improvements and global severity improvements from pre to

post-treatment, and 60 % no longer met criteria for OCD at post-treatment. Nelson et al. [116] conducted a randomized control trial of 28 children which compared 8-weeks of cognitive-behavioral therapy face-to-face to the same treatment over telepsychiatry. The CBT treatment across both conditions was effective, and an interaction effect reflected a faster rate of decline in child reported depressive symptoms for the telepsychiatry group.

Aside from CBT, other treatment methods have shown promise when administered via telepsychiatry. Acceptance-based behavioral therapy administered via telepsychiatry has been successful in treating adults with social anxiety [117]. Behavioral activation treatment delivered via videoconferencing was shown to be effective in reducing depression in older adults [118]. One study compared internet-based group therapy (*e-Getgoing*, CRC Health Group, Inc) to on-site group therapy for substance abuse [119]. *E-Getgoing* is a telepsychiatry platform that was developed to deliver verbal- and visual-based therapy to individuals with substance abuse problems. Participants have their own log-on identification and password to ensure confidentiality. The group leader is able to verify the identity of all participants in the group, yet participants could not view other members of the group and were just provided with a real-time video picture of the group leader. Patients in both conditions responded positively to treatment, with treatment satisfaction being comparable across conditions. Overall, increasing research is demonstrating the numerous benefits provided by psychotherapy via telepsychiatry.

Though there seem to be significant benefits to use of telepsychiatry in therapy, several concerns are present, such as issues of privacy, confidentiality, as well as liability and risk management in situations where the patient's safety may be at risk (e.g., suicidality) and inaccessible to the clinician. For instance, it is not well-established how emergency situations such as suicidality be managed in this format. Another question is how therapy strategies must be modified to be delivered this way. Accordingly, the ethical and legal questions related to use of telepsychiatry are not clearly established. However, some practice guidelines have been established by the American Psychiatric Association (see APA, [120]) and the American Telemedicine Association (see ATA, [121]). The use of telepsychiatry treatment is also limited due to the fact that treatment may not be reimbursed by insurance companies, due to the absence of various trials demonstrating its efficacy as well as some of the ethical and legal concerns mentioned. Studies to determine clinical efficacy and cost-effectiveness of services are necessary to determine if this treatment modality should be supported by insurance companies. Clinicians using telepsychiatry may face the barrier of not being licensed to practice across state lines. Further, patients may feel that they are in need of treatment when they happen to be in a different state, and should they be denied treatment simply because they are traveling? Is it in the interests of the patient's welfare if the clinician is not allowed to interact with the patient from different locations? Continued discussion of these issues will likely result in clear standards by which telepsychiatry can be used in treatment.

4.1.18 Future Innovations

Interest is also growing in the use of other computerized technologies for therapy goals, such as using of smartphones, tablets, and personal digital assistants. Several applications have been developed for use with smartphones or computers and are available to assist individuals or clinicians in symptom monitoring, ecological momentary assessment, treatment, and tracking progress [122–124]. For instance, interventions have used multimedia mobile phone programs for symptoms of depression, anxiety, and stress [125], smoking cessation [126, 127], recovery from alcoholism [128, 129], and weight loss [130]. An application called the *Dialetical Behavior Therapy (DBT) Coach* demonstrated some support in a pilot study in which the application was used for individuals with borderline personality disorder and substance use disorder [131]. *Mobilyze* is an application that has been successfully used to decrease symptoms of depression [132]. Another smartphone application, "*PE Coach*," has been used to support the provision of prolonged exposure therapy [133]. Jones et al. [134] conducted a pilot study of a technology-enhanced version of the evidence-based behavioral parent training program, *Helping the Noncompliant Child (HNC)*, for youth, ages 3–8, with clinically significant disruptive behavior from low-income families. Families were randomized to receive either standard *HNC* or technology-enhanced *HNC (TE-HNC)*, which included several smartphone enhancements: skills video series, brief daily surveys, text message reminders, video recording home practice, and midweek video calls. Both groups exhibited clinically significant improvements in disruptive behavior, but between-groups analysis suggests TE-HNC may enhance child treatment outcome, likely due to the increase engagement in that condition. Some support has also been demonstrated through the use of a smartphone application, *Anxiety Coach*, to enhance the treatment of pediatric OCD [135]. Text messaging has also been used for the aftercare treatment of individuals with bulimia [136], in college students for smoking cessation [137], and as an adjunct to CBT in adults with depression [138]. Despite the potential for these programs to facilitate treatment given the widespread use of smartphones and similar technology, the majority of mental health applications that are available to date lack scientific evidence about their efficacy [122]. It is also important to consider the issues of confidentiality and patient safety when using these programs. Accordingly, continued research will be important to further assess the utility of such technology.

4.2 Conclusion

This chapter has reviewed the utility of several different computer-aided psychotherapy options. Self-guided programs, computer-assisted programs, use of virtual reality technology, and engagement in therapy via telepsychiatry have all shown

promise in addressing a variety of psychological difficulties. Accordingly, such programs offer a variety of potential advantages. Together, they offer increased accessibility to treatment, allow clinicians to help more people, and address other barriers such as the logistics of traveling to treatment or dealing with stigmatization. Another motivator for the development of computer-assisted treatment programs is the potential savings in cost. Several studies detail the overall savings in cost when using computer-assisted treatments [139, 140]. Additionally, use of computer-assisted treatments will also likely save on clinician time [13], and studies indicate that use of computer therapy programs also allow clinicians to reach a greater number of patients [141, 142]. Use of computer-assisted treatment may also save on patient time if it minimizes the need to travel to a therapy session, potentially missing work. McCrone et al. [139] showed that patients who participated in the computerized therapy program, *Beating the Blues*, had fewer doctor-certified days absent from work in the 8 months following randomization when compared to the treatment as usual group. Cavanagh and Shapiro [54] discuss that the main cost implications of computer-assisted treatment involve three components: (1) the costs of the computer treatment software, (2) overhead of housing and maintaining such treatment systems, and (3) the cost of oversight by a facilitator, administrator, or clinician. They discuss that the potential cost savings include more efficient use of therapist resources, short- and longer term health service costs offsets, and sickness absence cost offsets. These costs must be considered in regard to treatment outcomes for each program.

Despite the potential advantages noted, these programs may also be associated with several disadvantages. As indicated, the structured nature of some computer-aided programs may focus on particular symptoms or disorders, and thus programs may not tailor treatment to consider the individual factors and potential comorbid symptoms or disorders that an individual exhibits. It may also be more challenging to monitor treatment engagement and resistance in the absence of face-to-face interaction with a clinician. Additionally, there are ethical and legal issues such as confidentiality, liability, and risk management which are not clearly established with these technologies. In sum, this chapter emphasizes the importance of more research examining the efficacy of computer-aided psychotherapy programs. It will be important to have a clear understanding of the utility of such programs, as well as for whom they are appropriate. It is hoped that continued research on the use of computer-aided psychotherapy will likely facilitate more people getting the help that they need.

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Chapter 5
Computerized Cognitive Training Based upon Neuroplasticity

Charles Shinaver and Peter C. Entwistle

Abstract Computer assisted cognitive training is used in the treatment of traumatic brain injury (TBI), schizophrenia, and attention deficit hyperactivity disorder (ADHD). Pilot studies and case studies have now progressed to randomized controlled trials and meta-analyses that demonstrate efficacy of computer assisted cognitive training. In patients with schizophrenia, computer assisted cognitive remediation has demonstrated improvement in general and social cognition, as well as verbal and working memory, attention/vigilance, and speed of processing. Cognitive rehabilitation in TBI has shown evidence for effectiveness of attention training and language and visual spatial training for aphasia and neglect. Cogmed, a computerized massed practice approach to working memory training, has an adaptive process, to adjust to the person's performance. Cogmed has frequently been used with patients diagnosed with ADHD. Compliance with treatment is a key to achieving benefit. Working memory training is based on neural plasticity, the concept where the brain is stimulated and reacts by changing. These changes are in neural pathways and synapses. Computerized cognitive training does result in changes in the brain, and these changes are sustained over time. Cogmed has resulted in increased verbal and visual spatial working memory and improvements in attention with ADHD clients. Also gains in reading comprehension and mathematics have been found after completing Cogmed.

Keywords Attention deficit disorder with hyperactivity • Brain injuries • Cognition • Control groups • Early intervention (education) • Memory disorders • Memory • Short-term • Psychotic disorders • Research design • Schizophrenia

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5.1 Computerized Cognitive Training Holds Exciting Potential

Computer assisted cognitive training is an exciting innovation with seemingly surprising potential that has been studied fairly extensively and with rigor within some specific clinical populations (e.g. schizophrenia, traumatic brain injury (TBI) and Attention Deficit Hyperactivity Disorder (ADHD)/working memory deficits) and even with some frequency in normal or typically developing samples. There are numerous additional clinical populations for which computerized cognitive training has been researched tepidly and for which there is optimism but as yet limited data. With a few exceptions, most of those clinical areas have studies that have been limited by research design with case studies, pilot studies, small sample sizes and single sample test-retest designs lacking control groups. However, computerized cognitive training has been applied in more substantive and systemic ways in randomized controlled trials (RCT's) and meta-analyses in three key clinical areas: schizophrenia, TBI and ADHD/working memory deficits. Yet, even in these areas this approach is not without controversy. Computerized cognitive training appears to have the most research and least controversy in treating schizophrenics, then TBI and lastly with ADHD/working memory deficits. Given the more contentious area of working memory training with ADHD & those with working memory deficits some studies of Cogmed with typically developing children will also be considered to shed light on some conceptual issues and the likelihood or possible obstacles of near and far transfer. Cogmed working memory training will be explored in detail partly because of the present authors have worked extensively with Cogmed extensively and partly because it has an substantial body of research. However, the development of science is, by nature, a contentious process such that claims within each of these subfields merit review. Research in these three clinical areas has enough substance to allow for defensible, though not totally unassailable, empirical conclusions. In fact, consideration of this data can inform whether and how the utilization of such interventions might be efficacious in some of the more recently broached clinical areas as well.

5.2 Computerized Cognitive Training with TBI, ADHD & Schizophrenia

To start at the ending, one finds that all three of these areas, schizophrenia, TBI & ADHD come to somewhat similar conclusions in meta-analyses regarding the usefulness of computerized cognitive training with these clinical populations. It helps. It is "efficacious". It is worth doing and in some respects may be a key element among intervention components one might use to help such clients. Yet, it is not typically considered to be optimized when it is delivered in isolation as a solo intervention. The degree to which computerized cognitive training helps and

in what specific ways one might benefit will be discussed in more detail below. We will first examine the seemingly less contentious areas of cognitive training for schizophrenia and then TBI which has had some mild controversy to determine how they might inform the more contested area of computerized cognitive training as it is applied to ADHD/working memory deficits and in some cases typically developing clients.

5.3 Computerized Cognitive Training with Schizophrenia

In considering recent meta-analyses of cognitive training with schizophrenics investigators have found the "usefulness of cognitive remediation when applied in the early course of schizophrenia and even in subjects at risk of the disease" [1]. Keep in mind that several investigators do not separate out computerized cognitive training from cognitive training. This is partly because often today cognitive training has at least components that are computerized. Barlati and colleagues further assert an even stronger claim regarding cognitive training: "Cognitive remediation is a promising approach to improve real-world functioning in schizophrenia and should be considered a key strategy for early intervention in the psychoses" [1]. The empirical basis for such strong narrative statements is worth consideration.

The actual effect sizes, the basic metric of meta-analyses, which are the basis of the narrative conclusions stated above [1] are intriguing to consider. In terms of clinical outcomes (essentially symptom reduction) for cognitive training for schizophrenics the effects sizes ranged from .26 to .68 [1]. This range would be typically described as small to moderate effect sizes in Cohen's terms. However, utilizing the binomial effect size display method (BESD) suggested by Rosenthal [2] as a more meaningful way to interpret clinical intervention data somewhere between 26 and 68 % more patients would be positively affected by this intervention than those not receiving it. Functional outcome effect sizes ranged from .35 to .78 [1] which would also be described as small to moderate effect sizes. Again, utilizing BESD [2] somewhere between 35 and 78 % more patients would be positively affected in terms of functional outcomes than those who received no treatment. While neurocognitive effect sizes, the largest effect sizes reported, ranged from .32 to 1.01 [1]. Using BESD somewhere between 32 % to all of the subjects would be affected. This would typically be described as small to large effect sizes. Across all of these domains cognitive training would be expected to affect anywhere from 26 % to all of the subjects positively. Given the rather strong narrative conclusions these investigators make it is attention-grabbing that the range of effect sizes is so broad from .26 (small) to 1.01 (large). The range of effect sizes specifically in the neurocognitive domain in particular is also quite wide from .32 to 1.01. These interpretative narrative comments and their relationship to actual effect sizes are instructive when considering other bodies of scientific literature and their effect sizes. In other words effect sizes from .32 to 1.01 were considered "efficacious"

in the neurocognitive domain for schizophrenics while effect sizes which ranged from .26 to .68 for symptom reduction were also categorized as efficacious.

With regard to computerized cognitive training specifically, Grynszpan et al. [3] conducted a meta-analysis of computer-assisted cognitive remediation (CACR) with schizophrenics. In the previous meta-analysis, Barlati et al. [1] did note that eight studies included computer-assisted programs and five that were not computer assisted [1] yet there was no comparison of the two in their analysis. Grynszpan et al. [3] in contrast, focused specifically on CACR and found an improvement in general cognition with an effect size of .38. They also found that this approach resulted in an improvement in social cognition with an effect size of .64 [3]. Additionally, significant improvements in several areas including verbal memory, working memory, attention/vigilance and speed of processing but each of those with small effect sizes [3] were noted. Interestingly, the narrative comments of Grynszpan et al. [3] are positive but certainly more restrained than Barlati et al. [1]: "The results lend support to the efficacy of CACR with particular emphasis on Social Cognition: The difficulty in targeting specific domains suggests a 'non-specific' effect of CACR." [3] This restraint makes some sense given the comparatively smaller effect sizes found. It is important to note here that an effect size of .38 was descriptively categorized as "efficacious". This is important to consider in other applications of computerized cognitive training.

Earlier in the literature there were hints that evidence was building in support of cognitive training for schizophrenics, but not without some mixed findings. As early as 2003 a review of cognitive training in schizophrenia by Twamley et al. considered some meta-analyses and concluded "the different types of approaches, whether computer assisted or not, all have effective components that hold promise for improving cognitive performance, symptoms and everyday functioning" [4] The basis for the meta-analysis by Twamley et al. [4] were 17 studies with 14 of them reporting positive findings for at least one variable. In their analysis they found effect sizes for neuropsychological performance (d = .32), reductions in symptom severity (d = .26) and improvements in everyday functioning (d = .51) [4]. Certainly, these effect sizes are smaller than the ranges reported by Barlati et al. [1] and again the narrative comments were more cautious, but clearly positive. These effect sizes ranged from .26 to .51 and were still considered, at minimal, promising. Earlier Kurtz and Moberg in 2001 [5] reported in a meta-analysis that there was mixed evidence on the training of attention with schizophrenics, but that "practice based attention drills can improve performance on measures of sustained attention in schizophrenia" [5]. They also reported that with "semantic and affective elaborate encoding strategies" that verbal memory could be improved with schizophrenic patients [5].

Interestingly, in contrast to the supportive findings for cognitive training for schizophrenics, Pilling et al. concluded that "Cognitive remediation had no benefit on attention, verbal memory, visual memory, planning, cognitive flexibility or mental state" [6] for schizophrenics. Yet, Pilling et al. only cited five studies for their analysis, whereas Twamley et al. [3] cite 17. Also, Pilling et al. [6] were based in England while Twamley et al. [3] were based in the United States. Although

Twamley et al. [3] used most of the studies cited by Pilling et al. [6] they also used several more studies. It is possible that Pilling et al. [6] did not have access to the same published data. Certainly within the research literature on cognitive training of schizophrenics there were some differences of opinion. Yet the accumulation of data appears to have outweighed the findings of Pilling et al. from 2002 [6]. One might interpret this shift as indicative of the impact of an accumulation of data over time that becomes more convincing.

A meta-analysis in 2011 by Wykes et al. [7] added a deeper understanding of how cognitive remediation can be more powerfully delivered. Interestingly, these investigators state that "No treatment element (remediation approach, duration, computer use, etc.) was associated with cognitive outcome" [7]. In this respect computerized cognitive training and non computer-assisted cognitive training had positive effects that were statistically indistinguishable from one another. Importantly, Wykes et al. [7] found that cognitive training "yielded durable effects on global cognition and functioning." However, Wykes et al. [7] added that cognitive remediation was more effectively delivered when patients were 'clinically stable.' Presumably some intervention must be delivered to get schizophrenic patients to the point where they are stable whether it is pharmacological or psychotherapeutic or both. Wykes et al. [7] also reported that they found "significantly stronger effects on functioning" [7] when cognitive remediation was not provided alone but along "with other psychiatric rehabilitation, and a much larger effect was present when a strategic approach was adopted together with adjunctive rehabilitation" [7]. Wykes et al. [7] cite McGurk et al. [8] who conducted additional exploratory analysis on psychosocial functioning effects of remediation and noted that studies which included psychiatric rehabilitation along with remediation cited effect sizes of .59 where as those using cognitive remediation alone reported effect sizes of .28 [7]. Similarly, when drill plus strategy was used the effect size reported was .47 whereas when drill and practice was used the effect size was .34, but this difference was not significant [8]. The term strategy includes the explicit focus upon learning and applying strategies [8]. Whereas the concept of the drill and practice approach is considered to be implemented when whether or not the subject engages in a particular strategy is left to the subject and chance [7]. Additionally, when evaluating only studies that did include the adjunct psychiatric rehabilitation and drills plus strategy significantly larger effect sizes were produced with an effect size of .8 for those studies compared to those only using drill and practice without psychiatric rehabilitation which showed an effect size of .3 [7]. These results are quite informative and suggest the possibility that cognitive remediation along with psychiatric rehabilitation are at least additive to one another. One wonders whether psychiatric rehabilitation along with cognitive remediation may be additive in other clinical areas as well.

There was also a rather heuristic clinical finding reported by Twamley et al. [4] of the predictive role that a number of investigators have found that neurocognitive impairment has in relation to the functional outcome of schizophrenia. Green et al. in 2000 asserted that 20–60 % of the variance in functional outcomes was predicted by neurocognitive impairment [9]. Conceptually this seems plausible. That is,

with greater neurocognitive impairment one would expect more functional deficits. Additionally these impairments are considered to play an important role in social deficits and struggles with daily living for schizophrenics [4]. These findings support the notion of at least early intervention when these symptoms emerge in higher risk individuals and what might be even conceptualized as prevention depending upon how early such an intervention was delivered. This is intriguing in light of ADHD in that often social deficits are reported in this population as well. Similarly, neurocognitive deficits are often found to relate to functional outcomes for TBI patients.

5.4 Computerized Cognitive Training with TBI

In the case of TBI, in 2005, Cicerone et al. [10] concluded based on their review of literature from 1998 through 2002 that there "is substantial evidence to support cognitive rehabilitation with TBI, including strategy training for mild memory impairment, strategy training for post acute attention deficits, and interventions for functional communication deficits."[10] Yet, as is noted in this conclusion there is a focus upon strategy training for both mild memory impairment and attention deficits. Their analysis included 118 studies initially and excluded 31 leaving 87 studies for their consideration. Obviously this is a sizeable number of studies. However, this was not a meta-analysis as they noted that the literature at that point lacked sufficient studies that reported effect sizes [10]. Yet, intriguingly, the article cites some professional organizations and their involvement in reviewing the literature which may be one reason as to why this database appears less contentious than that of ADHD. Cicerone et al. report that their review contributes to the recommendations of this organization: Brain Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine for cognitive rehabilitation of people with traumatic brain injury (TBI) and stroke [10]. They also cite the European Federation of Neurological Societies and state that that organization also came to the conclusion that there was:

> Substantial evidence to support attention training in the post acute phase after TBI (but not during the period of acute recovery) and compensatory memory training for subjects with mild memory impairments (10, p. 1681)

So, although Cicerone et al. focus upon strategy training this addition lends some support to attention training which is more along the interest of this chapter. However, there is no specific mention of computerized attention training. Yet, the conclusion by this European organization, according to Cicerone et al. [10] was based upon a review of similar studies using similar methods. So, interestingly, as of 2005, the subfield of cognitive training with TBI appears to make more forceful assertions than those treating schizophrenia despite not having cited a meta-analysis although they do not clearly specify computerized cognitive training.

Not long thereafter in 2009, Rohling et al. [11] did conduct a meta analysis of data on cognitive treatment of TBI and concluded more specifically "the meta analysis revealed sufficient evidence for the effectiveness of attention training after traumatic brain injury and of language and visual spatial training for aphasia and neglect syndromes after stroke" (11, p. 20). Importantly, the basis for this conclusion was not an effect size as large as one might expect. They found a small but significant effect size of .30 for studies which included active control groups [11]. It is critical to note here that an effect size of .3 is a smaller effect size of .3 was considered sufficient evidence for effectiveness, or 'efficaciousness' with this TBI meta-analysis. Using BESD one can argue that 30 % of the subjects that received this treatment benefitted more than the non-treatment control groups. However, Rohling et al. [11] make a critical methodological point related to studies that do and do not have control groups. What they actually found was an effect size improvement of .71 that was attributed to treatments, but no treatment control groups showed some improvement as well at an effect size of .41. They interpreted this improvement in non-treatment control groups to a combination of spontaneous recovery – which does occur in the case of TBI and practice effects. So, the effect size of .41 due to practice effects and spontaneous recovery was subtracted from the treatment effect of .71 to get the .30 effect size. This finding gives an interpretive context to effects sizes reported in studies with no control group, namely that studies without control groups would be expected to report notably larger effect sizes than those with control groups. An even higher standard would be to expect to find a significant effect size in relation to active treatment groups – possibly this might even be considered an unreasonable standard. This methodological point made by Rohling et al. [11] that practice effects (of taking and re-taking assessments) account for some of the effect size when one does not use a control group in a research design is a critical consideration in other databases.

Like cognitive training with schizophrenics cognitive training with TBI has met with some resistance and some negative findings. In terms of timing, the meta-analysis by Pilling et al. in 2002 [6] which reported no effects of cognitive training for schizophrenics was within 1 year of a similar finding by Park and Ingles in 2001 of attention training for TBI [12]. One might interpret this as suggesting that the synergy between technological developments and research may be affecting the growth of adoption of such approaches in a similar way across these two fields. Park and Ingles did a meta-analysis of a more delineated category of attention rehabilitation with TBI and reviewed 30 studies. Their results were even more extreme than those of Rohling et al. [11]. Park and Ingles found that studies which employed only one group with a test, re-test design reported significant improvement but either no significant gains or almost no significant gains were found when a control group was used in the research design. For example, with the pre-post only design attention improved with an effect size of .68 whereas studies that used a pre-post and a control group the effect size was only .15. They found similar issues with different aspects or components of attention like working memory with an effect size of .78 with a pre-post test design and .12 effect size when using a pre-post test with control design [12].

The Park and Ingles meta-analysis of attention rehabilitation is more clearly what here we are considering to be cognitive training [12]. In contrast, Park and Ingles describe an alternate approach used by a few studies called specific-skills training [12]. In other words training which has functional significance like learning how to drive may also result in improved attention. The rationale here is that the practice of a specific skill in a carefully designed sequence allows victims of TBI to relearn skills. They can compensate to develop that skill and in the process of doing so improve attention or other cognitive functions. This is a different rationale and tactic than the direct retraining of cognitive skills considered throughout this chapter. This is in the category of compensating for a deficit or developing a way around a loss of capacity as opposed to directly re-training a cognitive skill. Larger effect sizes were reported for that approach, using a specific-skills training approach with an effect size for attention behavior of 1.01 when a pre-post included a control group [12]. However, they did have a somewhat limited number of studies which applied this approach. Although this approach is not the focus of the present chapter it is noteworthy. If one is able to improve or directly re-train a cognitive skill like attention and follow that with skill specific training like driving it is likely to be an optimal way to complement that cognitive improvement and solidify the skill acquisition.

Lynch in 2002 did a review of the history of computer-assisted cognitive retraining with TBI reported that in the early 1980s personal computers and software for cognitive retraining was available [13]. He notes that there were critics at the origination of the field and some of that controversy has continued [13]. Yet, even in 2002, Lynch concluded "computer-assisted cognitive retraining can be an effective adjunct to a comprehensive program of cognitive rehabilitation" [13]. Lynch added that generalizability of skills remained a key issue [13].

5.5 Computerized Cognitive Training with Working Memory Deficits & ADHD

Computerized cognitive training of working memory began to achieve critical mass when it was developed in Sweden from the Karolinska Institute. In fact one can find a citation by Ryan from 1986 in the literature that describes a program called "Memory for Goblins": A computer game for assessing and training working memory skill [14]. However, this program received rather a limited following as Ryan again published a second article in 1994 [15] reporting that when the game was used by older adults that they found it interesting. Otherwise this approach never gained sufficient following from other investigators in the scientific literature. (It is important to disclose that the present authors of this chapter work for Pearson, the company that acquired Cogmed Working Memory Training or Cogmed in 2010.) Klingberg's 2002 rather small (seven children in each of the treatment and control groups) original randomized placebo controlled study [16] (RCT) was followed in

2005 by a larger multi-site RCT investigation [17] that included follow up measures at 3 months which the original study lacked in 2002. Strong results generated by both of those studies stimulated an onslaught of research which presently includes 50 peer-reviewed published studies in just over a decade with approximately 80 ongoing studies (www.cogmed.com/research). This rather generative rate of research of a specific intervention is unusual. As such, this program is worth detailed consideration to give a more in depth sense of the status of computerized cognitive training in possibly its most publicized, scrutinized and utilized present format.

Cogmed is a computerized massed practice approach to working memory training. In 2011 the program was characterized as a "core training" approach in contrast to "strategy training" by Morrison and Chein [18]. An essential component of Cogmed is that it is adaptive which means that it adjusts live to a person's performance getting slightly more difficult if one succeeds with a trial and slightly easier if a person fails a trial. Keeping the challenge level high has been found to be a critical factor in successful training. The most common research design includes students who get adaptive Cogmed versus those who get non-adaptive Cogmed with a low ceiling of two or three items. This research design has resulted in showing the efficaciousness of the program and it has emphasized the critical role of adaptive training while being able to rule out other aspects of training delivered in the non-adaptive version (e.g. computer time, individual attention, etc).

Cogmed is an integration of neuroscience, video game programming and psychology. The basis for the emphasis of visual spatial working memory within the program is a study by Westerberg et al. conducted in 2004 in which a group of boys between ages 7–15 who did not have ADHD was compared with a group who had ADHD on visual spatial working memory (VSWM) [19]. It was found that over childhood without any intervention that typically developing boys increased substantially in terms of VSWM capacity. See Fig. 5.1. This was not the case with boys with ADHD.

Westerberg et al. [19] are not the only investigators to note increases in the working memory capacity of typically developing children. In 2004 Gathercole et al. reported increases occurred over childhood from ages 4–15 that each component of working memory – phonological, visual spatial and central executive all show expansion during that time [20]. Others have made similar assertions about the growth of working memory capacity of typically developing children [21–24].

5.6 Psychology & Cogmed Coaching: The Role of Compliance

Once the original "RoboMemo" was developed by the collaboration of the neuroscientists and the game programmers Dr. Klingberg has explained that there were some families in Sweden who had been interested in help for their children with ADHD. So, the team sent the program home with 10 families to do with

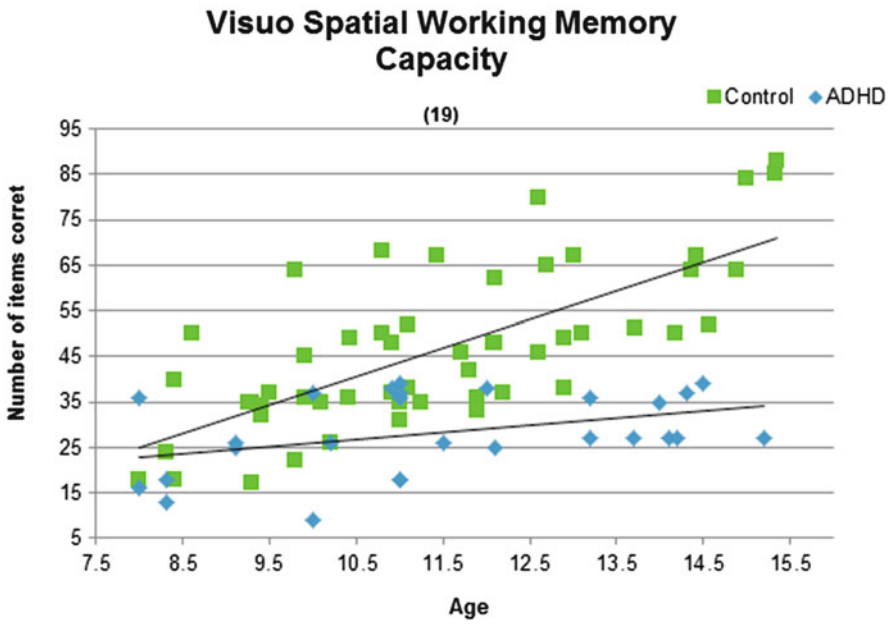

Fig. 5.1 Graph illustrating the research of Westerberg in 2004 [19]

their children. None of them actually completed the program. This was when psychologists were engaged to develop a coaching program. Once the coaching program was developed families began completing the program. This is important as compliance is a critical consideration in any form of treatment. Consider the fact that Oldham et al. as recently as 2012 in a meta-analysis of methods to increase attendance at psychotherapy noted that previous investigators had estimated that about 40 % of referrals refuse treatment [25]. Similarly, according to a meta-analysis earlier in 1993 by Wierzbicki and Pekarik [26] premature termination was found to be rather high in a meta-analysis of 123 studies at 46.8 %. Given these substantial challenges to compliance with traditional approaches to psychotherapy, compliance might be considered an even more challenging issue to address with computer-assisted approaches to treatment. In fact one wonders about whether such interventions can effectively be delivered without support. That is, is it likely that a person diagnosed with a mental health disorder would simply get online, find and complete a treatment program without any support from another person or a professional?

Newman, Szkodny, Llera and Preworski, in 2011 reviewed computer-based cognitive and behavioral interventions for anxiety and depression and concluded that these approaches were efficacious with what they categorized as 'sub-threshold' mood disorders – those which did not meet the full criteria for diagnosis, but did show some symptoms of the disorder [27]. However, with depression at a clinical level computer based *self-help treatments* were ineffective. In the case

of diagnosed mood disorders the traditional therapist treatment approaches were most optimal [27]. Similarly, deGraaf, Huibers, Riper, Gerhards, and Arntz in 2009 found that with depressed patients that computerized cognitive behavioral treatment was not confirmed in an RCT they conducted [28]. So they took a closer look at compliance. What they found was that when 200 subjects were given the codes for unsupported online treatment that a good number of them started the treatment but that dropout was high [28]. Their conclusion was similar to that of Newman Szkodny, Llera, Preworski in 2011, they found that although this computerized approach for depression was feasible there was a need to increase adherence for moderately to severely depressed subjects [28]. They also noted a significant number of users of internet interventions often use them only very briefly or a significant number of people may simply not want to engage in this approach. They point to the therapeutic relationship as potentially critical variable to consider as noted by Cavanagh et al. in 2010 [29]. More specifically, Cavanagh et al. describe the triad between the patient, internet intervention and the practitioner as potentially an important issue and if it were effectively addressed may improve this lack of compliance [29]. Cavanagh et al. characterize these practitioners as 'low intensity practitioners' who support clients who use internet interventions. In the context of Cogmed the 'low intensity practitioner' would be considered the Cogmed coach [29]. Certainly many clinical skills such as rapidly developing rapport, creating a supportive alliance, helping to select appropriate target behaviors to track as indicators of improved working memory capacity and identifying and ensuring the delivery of appropriate reinforcement would all be such skills. All of these skills are utilized by Cogmed coaches. The notion of low intensity practitioner might be considered in contrast to the high intensity of individual therapy or counseling.

5.7 The Cogmed Coaching Program

Consistent with the concept of a low intensity practitioner, the elements of the Cogmed coaching program are manageable, but are arguably more fluently implemented by a skillful practitioner. Cogmed coaching includes: an initial interview session, start-up session, weekly coaching calls of about 20 min in length and a wrap up session after the last training session. Through the course of the initial interview a Cogmed coach makes the decision of whether the potential trainee is appropriate for the program. The Cogmed coach will acquire salient information about the potential trainee to determine goodness of fit. It is important to note that Cogmed includes exclusion criteria for specific diagnoses such as ODD, CD, mental handicap, photo sensitive epilepsy. As these diagnoses are among those that are expected to interfere with completing the program. As such, studies which include these diagnoses are considered to be testing the limitations of the application of Cogmed. This typically includes rating scale data, direct assessment data, the interview session itself which includes several questions about symptoms and the potential candidates' personal background and presenting difficulties.

Actual data from the Cogmed Coaching Center, the online repository of Cogmed data, and statistics derived from that data provide some of the fodder for coaching sessions. Coaching sessions or calls play a critically supportive role in helping trainees to optimize training by helping the trainee to stay within a high challenge range and still persist until the completion of the program. We surmise that without such support it some trainees would give up to the inherent frustration of coping with such consistent cognitive challenge. The review of the individualized data points of a particular trainee is a critical component of Cogmed coaching. That is, each day of training is reviewed before a coaching call or session. Then 2 or 3 data points are chosen to discuss with the trainee. This can evoke what was occurring for the trainee during training. This can be processed. This helps the trainee to better learn to manage himself or herself in the midst of potentially frustrating cognitive challenge. For example, taking breaks after missing a couple items consecutively would be one method to manage frustration. This coaching method is specific and individualized to that particular trainee. It is driven by that user's data and does appear to help trainees to manage frustration and persist with difficult training. This data can be accessed by the coach, the training aide and the trainee. The data can be accessed through an PC, laptop or tablet computer. This approach keeps the coaching method data driven with the focus on completing the program. An additional element of support within the program is the training aide. In the context of private practice which typically uses a home training format the training is usually a parent. At schools the training aide is usually a teacher or teacher's assistant or other such staff member. The training aide is a person who is in the room when the trainee is actually doing Cogmed. In the school setting the same staff member may be both the training aide and the coach. Whereas in a private practice setting the coach is typically the professional offering Cogmed and the training aide is one or the other parent. Ultimately this support structure results in high compliance.

5.8 The Premise of Cogmed: Neuroplasticity

Our discussion of Working Memory (WM) training continues with a review of the concept of neuroplasticity. As the term may be unfamiliar to the reader, the term will be described, and examples from recent research will illustrate the importance of this concept. Neural plasticity is what happens when the brain responds to stimulation according to Pascual Leone et al. [30]. Brain structures do not remain impervious to demands placed upon them but rather the brain is sensitive to those stimuli and reacts by changing. Plasticity suggests the brain can be shaped by training. The brain is not rigid but instead it may alter its functioning. Neuroplasticity is the brain's reaction to intensive intervention. When parts of the brain are stimulated there may be an increase in activation in those areas [31].

The brain is affected by the environment, whether good or bad. For example, dopamine affects working memory, and WM training affects the number of dopamine receptors. The hippocampus affects memory consolidation, or the

formation of long term memories, and a stimulating environment and opportunities for exploration increase the functioning of the hippocampus [32].

Plasticity is an umbrella term that encompasses both synaptic plasticity and non-synaptic plasticity – it refers to changes in neural pathways and synapses which are due to changes in behavior, environment and neural processes, as well as changes resulting from bodily injury [31, 33]. Research by Maguire and Woolett, among others, have demonstrated that the brain continues to create new neural pathways and to alter existing ones in order to adapt to new experiences, learn new information and create new memories, even taxi drivers in training in London, create new neural pathways [34–36].

There are three essential questions about brain neuroplasticity that come to the fore with regard to computerized cognitive training [37, 38]. First, does computerized cognitive training change the brain? Secondly, do changes in brain activity suggest the possibility that behavior change might be sustained for a longer period of time? Third, do some groups show greater or less plasticity in their brains and as a result respond differently to computerized cognitive training?

With regard to the first question investigators have found that computerized cognitive training given its intensity and rigor does result in changes in the brain [39, 40]. However, even more pointedly, is the brain changed in the location one would expect given a particular deficit or disability? Furthermore, is the brain changed in a way that is normalizing? Pinpointing those activities that stimulate the brain in the location of deficit and engaging in such activities with correct 'dosing' or with sufficient intensity and duration that it is normalizing seems more likely to hold the possibility of sustaining more enduring change. In other words to engage in activities with sufficient intensity and rigor that results in changes in the brain is a rather hopeful proposition.

Some of the training-related changes that have been found in brain functioning will be elaborated below. However even those findings leave one with more questions than answers. Accepting that cognitive training actually changes the brain one then might put forth the idea that activities that result in brain changes may survive longer than if there were no changes in the brain. Also, the rate of change within the brain may vary depending upon the plasticity of different brains. Different diagnostic groups may vary in their level of plasticity. All of this evokes more questions many of which, as yet, are unanswered. One would expect that different groups would show different levels of plasticity in their brains [38]. One may presume that healthy brains of children or young adults might be among the more responsive to change [33].

Conversely, critics could argue that anything a person does changes the brain. This may be the case, but what is distinct here is computerized cognitive training is requiring the trainee to engage with persistence in intensive activities for which the challenge level must remain high to attain the desired effects. This is not the same thing as doing any activity with any level of intensity for a random time of duration. So, it is the combination of the specific activities with which one engages, the challenge level of them and persistence over time doing those activities that result in changes in the brain. Feedback from the brain in the form of changes of

activity levels and/or normalization can confirm that, yes, those areas representing the functions that were less active have now become more activated through rigorous work by the subject. Importantly, it is not something that was done to them or given to them. The engagement of the trainee is critical because challenge level must remain elevated over time for the desired effects. Studies of brain activity can confirm or disconfirm this in a way that is fairly unusual among psychological interventions. In short, it holds the possibility of suggesting that computerized cognitive training can change how your brain functions.

5.9 Brain Imaging & Cogmed: Does It Answer or Evoke Questions?

Is brain imaging valuable for understanding the effects of computerized cognitive training? Does it help us to better understand the areas of the brain that may be affected in children and adolescents with ADHD? Frith [41] and a number of other fMRI researchers would argue in the affirmative. Is there any evidence that brain development is different in children with ADHD? Again, Frith, Fassbender, [42] Cortese [43], McCarthy [44] Valera [45] and other researchers discuss this issue. These studies include the use of structural equation modeling to estimate genetic and environmental components relating to regional brain volumes measured by MRI in normal children and those with the diagnosis of ADHD. From this collection of studies, it is clear that brain imaging is helping to identify differences in brain morphology and functioning among those with ADHD.

In a meta-analysis of atypical brain morphology in children with ADHD, Valera and colleagues found a difference in the corpus callosum [45]. This is a brain structure that connects the two hemispheres of the brain, permitting communication between them. In a study done by Hutchinson et al. [46] in 2008 of ADHD children with co-morbid disabilities, they also explored gender differences and found the splenium of the corpus callosum was smaller in children diagnosed with ADHD compared to healthy controls, especially in girls with ADHD. The splenium connects the posterior parts of the brain, predominantly the parietal and temporal lobes of the brain; it also links the visual cortex of both occipital lobes. Boys also had a smaller rostral body than normal children. One might consider the brains of those with ADHD as having less well developed connections between the two hemispheres of the brain.

Ellison-Wright et al. [47] found what may be a marker for fronto-striatal circuits mediating cognitive control. As is well known cognitive control is a primary deficit in ADHD. Also, improvements in WM may be linked to the maturation of white and grey matter in the fronto-parietal network according to Darki and Klingberg [48].

In a comprehensive meta-analysis of 55 task-based functional MRI studies of attention deficit hyperactivity disorder relative to a comparison sample, by Cortese et al. [43], it was discovered that in children, hypoactivation in ADHD

was observed mostly in systems involved in executive function (fronto-parietal network) and attention (ventral attentional network). Significant hyperactivation in ADHD relative to comparison subjects was observed predominantly in the default, ventral attention, and somato-motor networks. Somatosensory and motor networks are correlated with planned activity or motor output in children. In adults, it was different. ADHD-related hypoactivation was predominant in the fronto-parietal system, while ADHD-related hyperactivation was present in the visual, dorsal attention, and default networks. Implications of these changes are a combination of less hyperactivity, but also less efficient problem solving among adults with ADHD. Subjects focused on different features and as a result different brain structures were recruited to problem solve. Significant ADHD-related dysfunction was detected even in the absence of co-morbid mental disorders or a history of stimulant treatment [43].

One of the most consistent findings exploring the neurobiological underpinnings of ADHD is the lack of activity in the left middle frontal gyrus, (McCarthy, 44). One would expect that working memory training likely would result in an increase of activity in the left middle frontal gyrus. There is also evidence of differences in cortical thinning, blood flow, and electrical activity [48]. Differences in IQ could be related to right caudate activity [44]. The caudate may be more involved in implicit learning [48]. A lack of specialization is noted in ADHD patients compared to controls, in a number of studies, as the left middle frontal area is more active in normals than patients with a diagnosis of ADHD, [42, 49–52].

The most consistent deficits in ADHD patients relative to controls in the study by Hart, Radua, Mataix-Cols, and Rubia [53] were reduced activation in typical areas of timing such as left inferior prefrontal cortex (IFC)/insula, cerebellum, and left inferior parietal lobe. The findings of left fronto-parieto-cerebellar deficits during timing functions contrast with well documented right fronto-striatal dysfunctions for inhibitory and attention functions, suggesting cognitive domain-specific neuro-functional deficits in ADHD [53]. “The striatum may play a role in predicting improvement later” (48, p. 7).

In studies of WM capacity it is argued that WM activity is localized to the intraparietal sulcus, the dorsolateral prefrontal cortex, and the superior frontal sulcus [32]. These are the areas identified on some fMRI studies with ADHD children as less mature. With working memory training one would expect an increase in activation in these areas, and potentially increased activation of the superior longitudinal fasciculus, the fiber tract or pathway connecting the parietal and pre-frontal lobes. This can be found in Diffusion Tensor Imaging [48].

5.10 Healthy Young Adults, Cogmed & Neuroplasticity

Research of the effects of Cogmed has included studies of functional resonance imaging (fMRI) that can begin to respond to some of the core questions about the effects of this training. Olesen et al. [40] measured the amount of brain activity

of healthy adults with functional resonance imaging (fMRI) before, during and following Cogmed training. ***Intriguingly post training activity in the middle frontal gyrus and superior and inferior parietal cortices*** increased. This was interpreted to be an indication that training resulted in changes in the neural system that undergird working memory. In fact, these changes were phrased as "training-induced plasticity" as if to say the training resulted in this plasticity [40]. This study was conducted on three adults in their early 20s.

Similar to Olesen et al. [40] study Westerberg and Klingberg [39] studied the effects of training in three young healthy adults. Also, like Olesen et al. [40] Westerberg and Klingberg ***found a change in the middle frontal gyrus, but also in the inferior frontal gyrus indicating WM-related brain activity*** [39]. Interestingly, the training for these young adults generalized to both a non-trained WM task, but also to a reasoning task [39]. What is intriguing to consider is whether that generalization may be evidence of their existing neuroplasticity given their age and health or whether one can attribute it all to the cognitive training or possibly an interaction of the two? In fact, Westerberg and Klingberg [39] assert that the changes in brain activity were due to Cogmed training and that they were "best described by small increases in the extent of the area of activated cortex". Furthermore, they explain that this is similar to what they call the "changes in the functional map observed in primate studies of skill learning, although the physiological effect in WM training is located in the prefrontal association cortex."

McNab et al. [54] in another study of healthy adults considered the biological foundation of working memory the density of cortical dopamine D1 receptors. What they found in 13 healthy adult males ages 20–28 was that after doing Cogmed that they showed a significant improvement in visual spatial working memory and that there was a change of density of dopamine D1 receptors in their brains. This change occurred in both the prefrontal and parietal areas of the brain. This shows a captivating interaction between the rigorous activity of working memory training and brain chemistry. ***More specifically change in WM capacity were found to be related to changes in the binding potential of D1 receptors:*** "larger decreases in D1 BP (binding potential) being associated with larger improvements in WM." [54] This is particularly potent since on a biological level changes in behavioral capacity are confirmed or undergirded. Again, the tacit assumption is that this would seem to increase the likelihood of sustained change.

5.11 Older Healthy Brains, Cogmed & Neuroplasticity

It does appear that younger brains show greater plasticity however, older more mature brains can still show signs of plasticity according to Brehmer, Westerberg, and Bellander, [55]. In studies of an older patient population brain oxygen levels (BOLD) changed as a result of activation in specific areas due to cognitive training. *Strikingly, the magnitude of cortical change in this case was also directly related to the amount of gains in scores within the training program* [56]. This suggests

further validation of the notion that the more you improve in the training within the program the more your brain changes. One further wonders whether this finding may have relevance for the degree of generalization of improved function related to the amount of improvement within the training itself. Brehmer et al. [56] found that there was a decrease in brain activity that was larger in the group with adaptive Cogmed than controls. They interpreted this finding to mean that the intervention resulted in "increases in neural efficiency" [56].

5.12 Cogmed Improves Working Memory?

In the domain of Cogmed working memory training the amount of peer-reviewed published research has substantial momentum with 50 peer-reviewed studies published from 2002 to 2014. Presently there are over 80 ongoing studies of Cogmed underway throughout the world. Yet, at the core of reviews of this research is the simple question: Does Cogmed improve working memory? For the purposes of this chapter we will divide research based upon age groups broadly. In particular, studies of brain plasticity have been primarily done with populations of typically developing adults. We will start with Preschool children. Keep in mind that an actual meta-analysis of the research literature on Cogmed is beyond the scope of the present chapter however there are thought-provoking observations which can be made and trends that can be highlighted in this body of work. We invite the reader to return to some of the source documents mentioned herein to pursue the present discussion in the literature on Cogmed.

In the domain of Cogmed working memory training research it is not a particularly controversial idea that one might improve upon tasks that are similar to the originally trained tasks. The controversy lies in two issues. The first is whether in fact it is working memory capacity that has improved or simply the more effective deployment of strategic approaches to the present tasks. The second more pragmatic question is whether such gains might be generalized. There appears to be less debate about whether subjects improve upon visual spatial working memory tasks after doing Cogmed. For example, as noted in Shinaver, Entwistle, and Soderqvist in 2014 [57] even some of the most enthusiastic critics of Cogmed have acknowledged that working memory training has resulted in reliable changes in what is termed working memory skills by Melby-Lervåg and Hulme [58]. Note the careful choice of words 'working memory skills' – not working memory capacity. Similarly, another group of Cogmed critics Shipstead et al. [59] admit that this approach to training does show evidence of improving what they call 'attentional stamina'. Others might call this construct 'sustained attention'. However, our focus in this work is particularly on the clinicians, the patients, their families and those who care for them. Certainly for a clinicians, parents, teachers, and children the ability to increase the amount of time on task is salient to school functioning and academic achievement as well as having implications socially and in the workforce. This is not a small gain on a practical level. The question of whether a child, after doing Cogmed is simply

better at deploying WM strategies or has increased his WM capacity doesn't look much different from the point of view of the patient. Either way the patient will function more effectively. Furthermore, can the change in brain activity indicate whether it was actually increased capacity or more effective strategy use? It doesn't appear so. In fact, if strategy deployment can be facilitated through training and it indeed generalizes does it matter for the client? How this debate moves from the theoretical to the practical is unclear. For our purposes, when measures show after Cogmed training a gain in how much a person can hold in their working memory, we will consider it a gain in capacity.

For the distinction between improved strategy usage versus increased working memory capacity to achieve substantially greater clarity will require more refined research and likely a large amount of it. On a practical level this debate is of more limited value although it may suggest the explicit addition of strategy focused training in addition to this massed practice method.

Although this source is not a meta-analysis of gains in working memory following Cogmed, it is a table of recorded effect sizes of peer-reviewed published studies of Cogmed of improvements in VSWM that can be found within the Cogmed website www.cogmed.com/research on a document called "Cogmed Claims and Evidence" [60] published online by Ralph, on page 18–19, Table 2 [60]. We suggest the reader scrutinize that document. The individual effect sizes are all the results of peer-reviewed published studies and that document provides an easily accessible way to review them. This data gives one reference points to consider in light of the aforementioned discussion of computerized cognitive training. As can be seen in that document, the effect sizes for visual spatial working memory (VSWM) primarily range from moderate to large for both children and adults ranging from a post-test effect range from .61 to 2.29 with the exception of the first study by Klingberg et al. in 2002 which found an effect size of .13 [16]. This includes 13 studies with 9 of children and 5 of adults [60]. Furthermore, two studies of children did have follow-up re-assessments. One such study reported an effect size of .81 [17] and the other was .65 by Dahlin [61]. There were also two follow-up studies of adults and those effect sizes were 1.36 for 20–30 year olds and 1.65 for 60–70 year olds [55].

Similar data on verbal working memory (VWM) can be reviewed at the Cogmed website www.cogmed.com/research in the same document in the same table of the "Cogmed Claims and Evidence" published online by Ralph, on page 18–19, Table 2 [60]. As is expected the effect sizes for verbal working memory (VWM) are smaller than those for VSWM given the emphasis of VSWM with the Cogmed training program. Yet, these effect sizes are also moderate to large. The range was from −.02 by Bergman Nutley et al. [62] to 1.07. An average effect size (uncorrected for sample size) was .69 (seven studies) for verbal working memory at the conclusion of the program and at follow up one study found it was .62 reported by Klingberg et al. [17] and .50 by Dahlin [61]. For adults, the range was from .33 to 2.21 (five studies). For adults the gain at follow-up was recorded at 1.04 for typically developing 20–30 year olds and −.08 for 60–70 year olds [55]. So, while these effect sizes for VWM are less than the effect sizes for VSWM they are still significant and at a moderate

effect size that stands up well to other domains of computerized cognitive training stated in the literature on schizophrenia and TBI reviewed here previously. Again, one is invited to do one's own analysis of this data at length as is desired.

Similarly, Ralph notes in the Cogmed claims and evidence [60] that studies that do involve a follow up assessment that gains in working memory have been sustained from 2 months to 1 year. Presently 10 studies have had 2–5 month follow ups, while nine studies have had 6–8 month follow ups and three studies have had a follow up of 12 months [33]. One might conceptualize this in vernacular terms in this way, if a student does Cogmed the benefits are likely to continue for a whole school year. Similarly, an adult who completes Cogmed might expect gains to persist for a full year of employment. Hence the claim in Cogmed Claims and Evidence states: "Gains in WM and behavioral outcomes are sustained over the long term." Given evidence of gains in WM this claim appears substantiated.

5.13 Cogmed, Preschool Children & Generalization

Consider Table 5.1, of Cogmed & Preschool Children, which captures data from five studies.

One point to note with Cogmed JM for preschoolers is that all of the tasks are visual spatial working memory (VSWM), whereas in the school-aged version of Cogmed (RM) and the adolescent/adult version of Cogmed (QM) there is a mix of VSWM tasks with verbal working memory tasks (VWM). In the study by

Table 5.1 Cogmed & preschool children

Study	Study design	Sample	Measures
Bergman Nutley et al. (2010) [62]	RCT-double-blinded, Pseudo-randomized, (stratified for sex)	Typical pre-schoolers	VSWM-complex memory span task (odd one out)
Thorell et al. [63]	RCT- double-blinded	Typical pre-schoolers	Attention – Auditory CPT
Grunewaldt et al. [64]	Stepped wedge design (waitlist control)	Very Low Birth Weight (VLBW) pre-schoolers	Auditory attention, phonological awareness, visual and verbal memory & sentence repetition.
Foy and Mann [67]	Randomized, waitlist control	Economically disadvantaged typical preschoolers	VWM, executive control- Heads-Toes-Knees-Shoulders (HTKS)
Söderqvist et al. [68]	Pseudo-randomized, (stratified for sex)	Typical pre-schoolers	WM, fluid intelligence, variation in DAT1 influenced improvement.

Here we refer the reader to a resource on the Cogmed website.

Bergman Nutley et al. [62] improvement was found on non-trained tasks of VSWM and thereby generalization of Cogmed. This gain was interpreted by the authors as not simply a reflection of the use of better strategy but by an "enhancement of underlying ability" [62]. However, Thorell et al. in 2009 [63] did find generalization on an auditory CPT measure of attention in this RCT double blinded study [35]. Similarly, in the study by Grunewaldt et al. in 2013 [64] auditory attention was also found to have been improved on a wait list control designed study of very low birth weight preschoolers [64]. Yet, Grunewaldt et al. also found that children improved upon phonological awareness, visual memory (memory for faces), and verbal memory – described as narrative memory and sentence repetition [64]. Obviously these findings are quite important as they relate to the acquisition of language and reading comprehension. This data is important preliminary results in that sentence repetition has been found to be associated with language skills while verbal complex memory has been associated with reading skill for children with learning difficulties by Alloway et al. in 2005 [65]. Similarly, phonological loop has been found to be correlated to vocabulary knowledge [20, 66]. Furthermore, these findings appear to be extended by Foy and Mann in 2014 who described improvements in VWM as a far transfer which is plausible because Cogmed for preschoolers is strictly comprised of VSWM tasks [67]. Foy and Mann also reported a significant improvement of executive control [67]. In total the impact across these studies for preschoolers suggests exciting potential.

Söderqvist et al. [68] reports rather interesting data regarding preschoolers variation in the dopamine transporter gene (DAT1) and improvements in WM and fluid intelligence following Cogmed in preschool children [68]. Söderqvist et al. found that genetic polymorphism of the DAT1 gene were related to the effects of training [68]. They noted that the single nucleotide polymorphism (SNP) rs27072 which they note has been indicated in genetic studies of ADHD as related to a higher risk for ADHD. They also highlight that the same allele which showed association with training gains has also been reported as having protective effect against ADHD [68]. This is rather intriguing in that it affords an explanation on a genetic level for why some may show either more or less benefit from training with Cogmed than others. It allows for a distinct interpretation for why transfer effects may be harder to achieve with some subjects.

5.14 Cogmed & Typically Developing Adults

We will only consider a couple of studies of typically developing adults with regard to the generalization of effects of Cogmed. A finding of interest by Bellander et al. in 2011 was of another single nucleotide polymorphism (SNP)(rs4657412) found to be associated with greater gains in verbal working memory after Cogmed [69]. Similar to the finding of Söderqvist et al. 2011, [9] this result suggests a potential limiting factor or beneficial factor affecting the generalization of the training effects of Cogmed [60]. The subject sample in this study was 29 healthy subjects between

ages 20–31 years of age. However, these were the same subjects who participated in the Brehmer et al. 2009 study [70].

In a study of healthy older adults with an average of 63.7 years Brehmer et al. [56] found that after Cogmed these adults also had made significant gains on attention and episodic memory compared to controls [56]. Unusually these improvements in performance were associated with fMRI evidence of a decrease of neocortical brain activity interpreted as an increase of neuronal efficiency that were interpreted as intervention-related [56]. Also, neocortical decreases and subcortical increases in activity were associated with the maximum gain score achieved during training. This was interpreted as being functionally related to one another. In this case gains within the training program were salient and related to these changes of activity suggesting the possibility that effort extended in training can make a difference in terms of outcome. The importance of gains within the program correlating to generalization will be discussed in other studies below.

In a study of younger (20–30 years old) and older (60–70 years old) adults who completed Cogmed, gains in sustained attention and a reduction of self-report of cognitive failure was reported [55]. The subjects in this study were subdivided into two segments of each age group and randomized to either adaptive Cogmed training or non-adaptive training. This study found that both gains acquired through training and transfer effects were a bit greater for younger than for older adults [55]. This might be considered a limit of plasticity based upon age whereas previously we have noted limits based upon genetic factors. Given the greater rigor of the methodology of this study it also provides data related to the generalization of training effects to increased sustained attention and reduced self-reported cognitive failure [55].

To summarize the data on healthy adults who have trained with Cogmed provides an additional possible limit of neuro-plasticity and delineation of transfer effects. The additional limit of neuroplasticity in this case is age, but what is interesting is that two different groups of older adults in their 60s do show neuro-plasticity with accompanying changes in brain activation that were associated with transfer effects. Two different studies that were controlled and randomized found improvements in sustained attention (PASAT – auditory attention) [55] and are submitted as transfer effects. Additionally, one study found an improvement in episodic memory [56] while another found a reduction of self-reported cognitive failure [56].

When the data on predominantly healthy preschoolers (including one study of very low birth weight children) and healthy adults are considered in conjunction there are a number of studies that are well designed and that show generalization. Interestingly, auditory attention was a transferred effect across both healthy preschoolers and among healthy adults. This area was found to have improved in an RCT-double blinded study by Thorell et al. [63] and in a stepped wedge designed (waitlist control) study by Grunewaldt et al. [64]. Whereas among randomized and controlled studies of healthy adults two different groups of adults in their 60s and a group of adults between ages 20 and 30 showed improved auditory attention [56]. On the basis of this data one would expect other patient samples to show improvements in auditory attention, but certain limits may apply. In the case of healthy subjects genetic factors for both preschoolers [68] and adults were found

[39]. In the case of adults age was a factor which suggested more limited neuroplasticity. With sample populations of subjects of diagnosable disorders one would expect to also find limiting factors, one of which may be the severity of the disorder while another could be the number of co-morbid disorders among subjects. In short, one expects there to be factors which limit transfer effects. However, as is seen among predominantly healthy preschoolers and adults Cogmed has shown to have resulted in transferred effects in well-designed studies. While in the case of preschoolers there have not been a sufficient number of studies that have used the same outcome measures to establish a stronger empirical trend. The same could be argued with healthy adults in these studies. Yet, the fact that two studies of preschoolers and two studies of healthy adults all found a transferred effect of improved auditory attention suggests this as a generalization of Cogmed.

5.15 Cogmed & Working Memory Deficit Children

It is important to acknowledge that studies that do not include control groups are still rather important in the context of an innovation as data is accumulated to determine its utility. However, in the present chapter there is not ample space to consider all of those studies. Yet, one such study will be considered due to it particular salience. With the noted exception of the Holmes et al. 2010 study [71] which was a single group with ADHD we will leave out a study by Mezzacappa et al. 2010 [72] which was a pilot of a single group of low income minority children with ADHD due to concerns about inflated effect sizes with single group designs [72]. A study conducted by Holmes et al. in 2010 with ADHD children [71] will be reviewed briefly. The key point of this study was the finding that stimulant medication combined with Cogmed resulted in an additive increase of VSWM. More specifically while VWM and verbal short term memory (VST) and visual spatial short term memory (VSST) were all unchanged on the automated working memory assessment (Holmes et al. 2010) when stimulant medication was given to ADHD children VSWM increased. Additionally, at the conclusion of doing Cogmed training these ADHD children were significantly improved in all four of those areas, VWM, VSWM, VST and VSST. That is, they made an additional significant gain in VSWM combined with the original significant gain after taking stimulant medication. This is important because it poses the possibility that there could be additive effects when one combines stimulant medication with Cogmed with ADHD children and possibly other populations. This is not unlike the finding that with schizophrenic patients that cognitive remediation along with psychiatric rehabilitation resulted in larger effect sizes. One might argue that this is consistent with the notion of clinically "stabilizing" a patient before doing Cogmed. This data provides preliminary support for the hypothesis that medication may provide an additive effect to Cogmed.

A working hypothesis in this chapter is the notion that there are limiting factors to neuroplasticity. As we have discussed previously there is some data that supports

both genetic factors and age may play such a role in the treatment gains seen in Cogmed. We propose that severity of disorder and the amount of co-morbidity among subjects are possibly other such 'limiting' factors. In the case of ADHD severity of disorder may in fact overlap with the amount of co-morbidity.

Consider data from a meta-analysis by Willcutt et al. [73] that differentiates the frequency of co-morbid disorders from both ADHD – Combined type (ADHD-C) and ADHD-Inattentive type (ADHD-I). This data supports the notion that ADHD-C is a more severe disorder in several areas of co-morbidity in which there was significantly greater frequency of the following disorders: Oppositional Defiant Disorder (ODD), conduct disorder (CD), Seasonal Affective Disorder (SAD), Bipolar disorder, and Tic Disorders. Interestingly the ratio of Oppositional Defiant Disorder (ODD) from the Willcutt et al. (2012) [73] meta-analysis data was essentially (2:1) for ADHD-C to ADHD-I, while the ratio for CD was about (3:1) between those two groups [74]. With ODD the estimated percentage of ADHD-C cases was 51.8 % while with ADHD-I it was only 24.9 %. Similarly with CD it was 21.6 % with ADHD-C while it was only 7.1 % with ADHD-I. With SAD it was 13.5 % with ADHD-C and 8.7 % with ADHD-I. With Bipolar disorder it was 6.9 % for ADHD-C and 3.2 % with ADHD-I. And finally, with tic disorders the frequency of those with ADHD-C and tic disorders was 15.8 % and 12.1 % with ADHD-I. As can be seen by these different frequency rates internalizing disorders were less skewed but they were still higher among ADHD-C as were the more severe externalizing disorders to an even greater extent.

There was an exception in which learning disabilities were more frequently comorbid with ADHD-I than with ADHD-C. This is particularly noteworthy in that a computerized cognitive training program that focuses upon improving working memory and through near transfer is expected to improve sustained attention would appear to have a more targeted impact upon these problems. This suggests such an intervention might be a more efficient strategy with this group. Learning disabilities were found among 29.1 % of those with ADHD-I versus 24.2 % of those with ADHD-C. Additionally, speech and language problems were found more often among 17.8 % of those with ADHD-I than those with ADHD-C 14.8 %, but the difference was not significant.

The data are illuminating, suggesting increased risk overall for those with ADHD-C than ADHD-I for serious behavioral and social problems whereas although ADHD-C children are at risk for learning disabilities the frequency of learning disabilities is even greater among those with ADHD-I. While in the areas of generalized anxiety disorder and major depressive disorder the groups were not significantly different. Additionally, given the role of excessive activity or the lack of inhibition of action plays in externalizing disorders one wonders whether distinct interventions are merited for these different aspects of functioning. That is, one type of intervention for inattention and learning disabilities and a distinct intervention for overactivity may be needed.

However, it may not only be the case that severity of disorder is greater based solely upon the amount of co-morbidity for ADHD-C compared to ADHD-I, but there is some evidence that this is the case across neuro-cognitive domains. Nikolas

and Nigg [74] found that *ADHD-C children were worse on all neurocognitive domains* measured in their study of 498 youth ages 6–17. The study included 213 in the control group, 107 ADHD-I and 137 ADHD-C. The cognitive domains measured included: "cognitive control (executive functions, working memory, and memory span), arousal, and response variability" [74]. Nikolas and Nigg (2013) [74] noted all of those areas provided uniquely incremental prediction of symptom dimensions and subtype presentation. In contrast, temporal information processing and processing speed did not do so [74]. Certainly this is only put forth as a hypothesis and the notion that ADHD-C is a more severe disorder than ADHD-I appears to be a fairly recent proposition. Certainly, one would require further data to confirm it, but we believe it is a useful framework from which to consider the transferred effects of Cogmed.

With reference to Cogmed research, consider Table 5.2 which includes the treatment sample co-morbidity of various studies and whether the children are working memory deficit, ADHD-I, ADHD-C or ADHD predominantly hyperactive (ADHD-HI). One way to think about the structure of this table is that it moves from the lowest level of disorder/disability to the highest from top to bottom. Yet, this is an inexact table due to the inconsistent reporting of data on co-morbidity in these published studies. However, although this table is inexact bear in mind our interest in delving this literature is clinical and applied in nature. In many respects analyzing this data conceptually from this vantage point provides a useful heuristic with which to inform both clinical applications and future research.

What is rather complicated about the Cogmed studies in Table 5.2 is that many of these studies do not report co-morbidity and often in the published papers they do not delineate whether a subject was diagnosed with ADHD-C, ADHD-I or ADHD-Hyperactive/impulsive (ADHD-HI). As such, one has to make some inferences about the ways in which samples were captured. As a result these two hypotheses about severity of disorder and amount of co-morbidity can only be posed rather tentatively. The data reviewed herein will neither confirm nor disconfirm them. Only further research can do that. However, we can point to the trends in the data which can inform both clinical practice and additional research.

5.16 Cogmed with Children with Working Memory Deficits

Neither Holmes et al. [75] nor Dunning et al. [76] note any additional co-morbidity in their published studies. Neither did they make note that any of these children were being medicated. They were selected based upon scoring low on a working memory test administered routinely in England in the case of Holmes et al. 2009. In the study by Dunning et al. [76] children were selected between ages of 7–9 on the basis of having a working memory deficit as determined by how they scored on two tests of the Automated Working Memory Assessment. As such, unlike ADHD which typically requires the endorsing of several symptoms and evidence of the

Table 5.2 Co-Morbidity with Cogmed training with children with working memory deficits, ADHD-I, ADHD-C, learning problems & learning disabilities

Study	WM deficit	ADHD-I attention problems	ADHD-C	ADHD-HI	Rx%	LD	ODD/CD
Holmes et al. [75]	100 %	NR[a]	NR	NR	NR	NR	NR
Dunning et al. [76]	100 %	NR	NR	NR	NR	NR	NR
Dahlin [61]	NR	33 % diag. 60 % rated inatt.[b]	NR	NR	NR	9.5 %[c]	0 %
Dahlin (2013) [77]	–	100 %	22 %	NR	NR	22 %	0 %
Klingberg et al. [16]	–	NR	100 %?	NR	43 %	NR	NR
Klingberg et al. [17]	–	25 %	75 %	0 %	0 %	NR	0 %
Hovik et al. [80][d]	–	0 %	100 %	0 %	**69.6 %**	NR	NA/0 %
Green et al. [79]	–	42 %	42 %	17 %	**67 %**	0 %	NR
van Dongen-Boomsma et al. [82]	–	7.7 %	**80.8 %**	**11.5 %**	**0 %**	NR	3.8 %/0 %
Beck et al. [83]	NA	71 %	29 %	NR	61 %	NR	46 %
Chacko et al. (2014) [84]	–	34 %	66 %	0 %	***27 %***	NR	50 %/9 %
Gropper et al. [87]	–	**51 %**[e]	**NR**	**NR**	26 %	57 %	NR
Gray et al. [85]	–	NR	**100 %**	**NR**	98 %	100 % Severe	100 %/0 %

[a]*NR* Not reported
[b]Dahlin [61] note 33 % were diagnosed with ADHD while more than 60 % were rated as inattentive by teachers. They only focus on the issue of inattention in this paper so they are presumed ADHD-I
[c]Dahlin (2013) [77] dissertation notes the number of subjects with Dyslexia that was in the study published in 2010 was actually a small number, but all the children were considered to have 'general learning problems'
[d]Hovik et al. [80] and Egeland et al. [81] were composed of the same subjects
[e]Gropper et al. [87] did not report whether the subjects in their study were ADHD-C or ADHD-I. They simply reported that 42 % were diagnosed with ADHD and an additional 9 % were both ADHD/LD

disorder in two settings, this appears to be a lower level of dysfunction. Screening for a working memory deficit does not require this level of scrutiny or dysfunction. As such, one presumes that more co-morbidity is not noted because it is likely not there. It can persuasively be argued that the level of disability and/or disorder among these groups is relatively mild – particularly compared to the population of ADHD-C as noted by Willcutt et al. [73]. T*hese two studies reported transferred effects or generalization.* Improvement in *mathematical* reasoning with an effect size of .49 was reported by Holmes et al. [75] after 6 months. Holmes et al. 2009 also reported an improvement in *following instructions* with an effect size at the conclusion of the program which was .83 but was maintained at .52 after 6 months had passed

since the completion of treatment. Furthermore, the gains in mathematics reasoning were not seen at the conclusion of treatment but 6 months later [75]. The gain in following instructions suggests a possible mechanism by which the mathematics reasoning was improved.

Dunning et al. [76] *reported significant training effects for VSWM, VWM and visuo-spatial short term memory along with significant improvements in sentence counting (a processing task) and written expression* at the conclusion of treatment. Then 12 months after the conclusion of treatment VWM was still significantly greater for the treatment group compared to the control group along with the processing component of the sentence counting task.

This second study by Dunning et al. 2013 might be considered a confirmatory RCT in relation to the original study by Holmes et al. 2009 and was conducted by the same group of researchers which are independent of Cogmed. Additionally, this *transferred effect of VWM maintained at 12 months is important given the verbally dominated environment of school classrooms* [76].

Dunning et al. [76] argued for the need of "scaffolding" or systematically layering in additional training or teaching following Cogmed to ensure more generalization of a new skill set [76]. This is a concept with which the present authors wholeheartedly agree. In fact, capturing and utilizing the gains in VSWM, VWM and/or attention made initially with a more systematic complement to training with scaffolding of skills building seems to be both more realistic and more likely to optimize the effects of training. However, there were still transferred effects reported in both of these studies while enhancing them is certainly the next step.

5.17 Cogmed with Children with Inattention and Learning Difficulties

Two studies by Dahlin focused upon children with inattention and learning difficulties found important transferred effects. In the 2010 Dahlin study [61] children showed significant improvement in *reading comprehension* with an effect size of .91 at 6 months post intervention. While in the Dahlin et al. [77] study the boys showed improvements on the *Basic Number Screening test (BNST) and in addition*. With addition the effect size initially was .59 while at 6–7 months post intervention it was .33 Dahlin et al. (2013) [77]. With BNST the initial effect size was .74 and at 6–7 months it was .90. The BNST is a screening test with a focus on number concept and number operation items. No time limit is involved in this test.

The far transfer of these studies by Dahlin is engaging, but sorting out the samples of subjects is rather complicated. Dahlin [61] included a mix of subjects with "special needs" all of whom were described as having "attention issues", but are not all diagnosed with ADHD. Among the subjects 33 % were diagnosed with ADHD while an additional 'more than 60 %' were described as rated as inattentive by teachers. As noted before, this a less severe standard than the diagnosis of

ADHD. As such, this group is considered less severe than a group in which all or the majority have been diagnosed of ADHD.

Also, these subjects were reported as having been diagnosed with 'general learning problems', but none in this document were specifically listed as having dyslexia. In fact, the Dahlin [78] dissertation notes the number of subjects with Dyslexia that was in the study published in 2010 was actually a small number (9.5 %), but all the children were considered to have 'general learning problems.' Again, arguably this is a less stringent standard than those diagnosed with specific learning disabilities. This Dahlin [61] study used a pretest-program-posttest-retention test design. However, they did use a control group in this study that received 'ordinary special education' within small groups. Yet, the subjects were not randomized which limits the generalizability of this study. However, gains in reading comprehension were maintained at 36 months [78], gains in addition and BNST are all noteworthy generalizations of Cogmed. These effect sizes range from moderate to large and all meet the established level of "efficaciousness" noted previously.

5.18 Cogmed with ADHD-C Without Co-morbidity

In the 2005 Klingberg et al. [17] study in the treatment group that was used for analysis there were 20 children and of those 15 were ADHD-C and 5 were ADHD-I. However, this was an unusual sample of ADHD-C children due to the comparative lack of co-morbidity and that the children were not being treated with medication. This suggests the possibility that this was a less severe group of ADHD-C children. One might infer this partly due to the fact that they were not medicated although there could be other factors at play like the beliefs of the parents. Secondly, ADHD-C has been found to have higher co-morbidity than ADHD-I, yet this group did not have comorbidity. Having ODD was one of the exclusion criteria. Note Cogmed is not recommended for those with ODD or CD. In the original Klingberg et al. 2002 study three subjects in the treatment group were on medication [16].

In the case of the 2002 Klingberg et al. [16] study it is not clearly reported within the text of the published paper that all of those subjects were ADHD-C. However, since in the discussion of the paper it was noted that the training on WM tasks significantly reduced the number of head movements and that improvements in WM was shown to correlate with a reduction in movement this revealed a clue as to how cognitive deficits might be related to impulsivity. In our table we are assuming that all the children in that study were ADHD-C.

From the Klingberg et al. 2002 study transferred effects of Cogmed were improvements on VSWM, Stroop test (an inhibition task), Ravens progressive matrices, a fluid reasoning task and a reduction of head movements indicative of a reduction in hyperactivity. The 2005 Klingberg et al. study *replicated the finding of improved VSWM and added a measure of VWM* which was improved and maintained at a follow-up of 3 months. However, the finding of improved inhibition

(Stroop) was not replicated, nor was the reduction in movement captured by an infrared camera. The finding of improvement on the Raven's was replicated.

Keep in mind that this was, a comparatively mild sample of ADHD-C with no Comorbidity. Additionally, in the 2002 study, 43 % of the students were medicated. In hindsight one wonders whether medication may have played an 'additive' role in conjunction with Cogmed in the finding of reduced head movements and improved inhibition.

5.19 Cogmed with ADHD-C School-Age Children with a Majority Medicated

First both the study by Green et al. [79] and Hovik et al. [80] are RCT's. One can draw more definitive conclusions from their results. Green et al. 2012, in their description of their study explains that their sample did not have a lot of comorbidity or oppositional behavior. As is seen in Table 5.2 previously the sample in Green et al. 2012 included 42 % ADHD-I, 42 % ADHD-C and 17 % ADHD-HI. Also, 67 % of the Green et al. sample was medicated. The Hovik et al. 2013 study included 100 % ADHD-C with 69 % medicated. The averages of both studies were similar with those in Green's treatment group at an average age of 9.9 years old and those in Hovik et al. 2013 study with an average of the treatment group was 10.5 years old. In the Hovik et al. [80] CD was one of the exclusion criteria. Comorbidity was not reported in these studies. So, like the Klingberg, studies this appears to be a milder ADHD-C group at least in terms of comorbidity.

Green et al. [79] found a reduction of off task behavior on the restricted academic situations task (RAST). This is a structured task in which a child engages in academic work and is videotaped through a one-way mirror to determine whether she stays on task. The reduction in off task behavior coincided with improvements in VWM. Similarly, Hovik et al. 2013 with this mild ADHD-C group with the majority medicated also reported transfer effects of gains on all outcome measures (VWM, VSWM & manipulation WM) while gains in the visual domains were greater than the auditory. Six measures of these three areas of WM were made. At 8 months these gains were maintained. So, again, gains between these two studies of VWM, VSWM, manipulation WM and a reduction in off task behavior.

In addition to the near transfer effects noted by Hovik et al. 2013 a separate publication by Egeland et al. [81] using the same subjects details the far transfer effects. Egeland et al. 2013 did find far transfer effects in improvements in LOGOs which was reading fluency, % correct, and Word decoding quality (% correct). Yet, they did not find improvements on ADHD rating scales, the BRIEF (Behavior Rating Inventory of Executive Function), or Strengths & Difficulties Questionnaire. However, Egeland et al. 2013 did find a significant improvement on psychomotor speed after Cogmed. The increases in reading scores remained 8 months after the intervention. Interestingly, in contrast to what is posed here Egeland et al. 2013 in

their discussion considered the possibility that medication may have "exhausted the possibility for further improvement" (81, p. 7). They did not find improvements on the neuropsychological tests, but on the Conners' continuous performance test they did find the improvement of psychomotor speed. They did pose the explanation that the lack of change on the Conners' may have been because the majority of subjects were in the normal range at pretest due to medication. However, these investigators make a point which we think is critical in Cogmed studies moving forward, which is that medication should be controlled in investigations.

5.20 Cogmed with a Majority of ADHD-C Preschoolers – Un-medicated

In 2014 van-Dongen-Boomsma et al. [82], published a study of ADHD-C preschoolers who completed Cogmed and were not medicated. These were not a group with high comorbidity yet there were 3.8 % in the treatment group who were diagnosed with ODD. 80.8 % of the treatment group was ADHD-C, 7.7 % was ADHD-I and 11.5 % were ADHD-HI. Given the majority of ADHD-C on a pragmatic level one wonders whether hyperactivity and impulsivity would interfere with training. The average age of the children in the treatment group was 6.5 years old.

Importantly van-Dongen-Boomsma et al. did find for the active training group that they made significant gains in VWM [82]. However, according to van-Dongen-Boomsa et al. this gain did not survive their statistical correction for multiple testing. This finding is still interesting, partly because these 6 year old children were training with JM which is all VSWM. So, although the statistical correction removed the significance of this finding it was a transfer of VSWM training to VWM. This brings up another important pragmatic issue. In the applied context of Cogmed the age ranges describing programs are not strictly applied. For example, for some 6 year old children the JM version of Cogmed may be less rigorous than it could or possibly should be. That is, there are fewer exercises and no VWM tasks. This amounts to less time spent training also or a lower 'dose' of training. So, in the applied setting of individual trainees doing Cogmed a child who is 6 years old may do JM, but it may be more appropriate for her to do RM instead. This reality emphasizes the importance of a clinician or educator-mediated model of delivery of this program. Clinicians and educators can more effectively make this distinction. Deciding whether to use RM instead of JM is a rather important decision because it could increase the intensity of the training and quite likely the impact. Additionally, van-Dongen-Boomsma et al. study investigators found that their index improvement significantly contributed to the ADHD-RS and Behavior Rating Inventor of Executive Function scores both rated by the teacher, but revealed no significant group differences. This further supports two issues. One is that coaching that was not blinded (see discussion below) would have been more likely to result in a greater index improvement and could have revealed significant group

differences. Secondly, greater time on task which would have been afforded by Cogmed RM could have also tipped the scales in this area to greater transfer of effects.

There was an unusual twist to the van-Dongen-Boomsma et al. study from 2014 which was it was 'triple blind'. What this meant was that it was a RCT designed study, but that children, parents, teachers, ***training coaches***, and investigators were blind to treatment assignment. Having 'blinded' coaches meant that coaching was not based upon actual performance on the tasks of individual trainees. In our view this is significantly different than how Cogmed is normally delivered. As noted before training data is critical grist for the coaching process. Investigating actual training sessions of individual trainees is a critical way in which a coach can motivate a trainee. How the child or adult manages errors, what he was thinking, did he have a strategy for managing himself if frustrations arose, etc. The actual experiences of frustration in training which can be pinpointed in the data and discussed are too necessary for the coaching process to be discarded. All of these issues are part of the coaching process. With blinded coaches this meant that the support was more general and generic and quite likely less effective. This is a substantial departure from typical training. As was noted in our previous discussion of compliance the motivational role of the coach in training is very important, not just for compliance, but for keeping the trainee motivated to maintain a high challenge level in the training through his or her training sessions. van-Dongen-Boomsma et al. highlight other possible explanations for the lack of transfer in this study such as time effects which were not controlled for due to a lack of a passive control group. From our perspective of the pragmatic application of this program coaching with blinded coaches is simply a different program. Furthermore, although the compliance in this study was not sub-par, the fact that there was a significant difference between completers versus non-completers independent of group assignment supports the possibility that the level of hyperactivity and impulsivity may have interfered with the treatment effectiveness such that comparing a group that was on medication to one that was not would have allowed researchers to test whether there was an additive effect of combining medication with Cogmed.

5.21 Cogmed with High Co-morbidity

This set of studies moves into groups with high co-morbidity, with Beck et al. [83] and Chacko et al. [84]. Yet, if one accepts the notion that ADHD-C is a more severe disorder than ADHD-I then the Chacko et al. 2014 study is composed of more severely disordered children with 66 % of them being ADHD-C and 34 % ADHD-I. In contrast, the Beck et al. 2010 study has a majority of ADHD-I trainees at 71 % and only 29 % ADHD-C. See Table 5.2 previously. However, the Chacko group is more severe also on the level of comorbidity with 50 % with Oppositional Defiant Disorder (ODD) and 9 % with CD. Beck et al. 2010 had 0 % with CD and 46 % with ODD. So, at each level the Chacko et al. 2014 group was more

severely disordered, but additionally only 27 % of the Chacko, et al, 2014 students were medicated while 61 % of the students in the Beck study were medicated. One would not be surprised if these differences affected the transfer effects of these two studies and it appears that they did. However, other issues could be argued to be contributing as well. Beck et al. 2010 used a wait list controlled design in which raters were not blinded whereas Chacko et al. used an RCT design. However, as seen in this comparison to simply dismiss significant findings by Beck in favor of those by Chacko based solely on the designs of these studies appears disingenuous. Also, importantly Beck's study provided a 4 month follow up. Chacko did not provide any follow up. This is an important oversight because other studies have found effects to emerge post training.

Beck et al. 2012 found several transfer effects for Cogmed. On ADHD symptoms parents' ratings of ADHD index, cognitive problems/inattention, DSMIV-TR Inattentive Scale were all significantly reduced. At post-treatment Beck et al. 2012 found significant improvement on the BRIEF as rated by parents on Metacognition Index, Working Memory, and Initiate all had effect sizes over .90 and Plan/Organize with an effect size of .42. At post-treatment among teachers there was a trend toward those in the treatment group as significantly worse on oppositional behavior. One reason this is interesting is given the challenging nature of the program one could imagine that those with a tendency to be oppositional and defiant could be evoked. This is one plausible reason on a practical level that students with high co-morbidity – especially those with ODD may have more difficulty finishing this program or working hard in the face of challenge that is required to make greater gains on index scores. Additionally, as noted previously Cogmed is not recommended for those with ODD or CD for this very reason.

Similarly, Beck et al. 2012 found that at a 4 month follow up that these gains were maintained with the addition of some other improvements: metacognition Index (ES = .83), WM (ES = .94), Initiate (ES = .76), Monitor (ES = .42), Organization of Materials (ES = .43) and Plan/organize (ES = .72). Another change emerged at 4 months which was an improvement on the teacher rating of the BRIEF on Initiate (ES = .25). At follow up parents rating of the ADHD Index was significantly reduced, cognitive problems/inattention, hyperactivity, oppositional behavior and the DSM-IV inattention scale all made significant improvements. Teacher ratings did not.

In contrast to the findings by Beck et al. 2012, Chacko found that the treatment group did show significant improvements in verbal and nonverbal WM storage, but not in WM storage plus manipulation or processing. Chacko et al. 2014 conclusion is particularly critical and appears to base the forcefulness of the conclusion upon the fact that this was an RCT. Yet, as the aforementioned analysis shows there is much more going on here than simply a rigorous comparison. As has been noted before other Cogmed studies have used an RCT design and found significant transfer effects [79, 81, 17] with ADHD samples. It might be more apt to say that no other study has attempted to do Cogmed with a population that had 50 % ODD and 9 % CD students with 66 % who were ADHD-C and 34 % ADHD-I with only 27 % of the sample taking medication. In fact with this severe of a population and only

27 % medicated it would be interesting to see what behavioral interventions are effective. Finally, the fact that there were no follow up assessments further limits the generalization of this study. As noted it is often the case that Cogmed effects emerge over time. With no follow up evaluation this possibility was not explored.

5.22 Cogmed with ADHD-C and Learning Disabilities

Among all the Cogmed studies with children with ADHD to date Gray et al. [85] captures the most severely disabled children. Not only were they severe LD and ADHD, but also ODD. In that study Gray et al. 2012 used the Iowa Conners Rating scale for teachers and parents to assess oppositional defiant disorder (OD) and inattention/overactivity. On the OD scale based upon the recommended cutoffs as suggested by Waschbusch and Willoughby in 2008 [86] for ODD for both parents and teachers of the children were rated above the 90th percentile in both treatment and control groups. Additionally, these are children that, to be eligible for the school they attended, had to be diagnosed with both ADHD/LD along with severe problems in behavior and learning ***AND*** they had to have already had a poor response to both medication treatment and special education treatment. The children in the treatment sample were an average of 14.4 years old which means that oppositional behavior is further complicated by peer interactions with what is often maladaptive peer groups. This also means that they have gone for several years in the school system without successfully acquiring academic skills.

Similarly, the Iowa Conners does not differentiate between inattention/overactivity with its IO scale which is somewhat confusing. However, based upon the cutoffs for that scale as suggested by Waschbusch and Willoughby [86] all the children were likely ADHD-C. Their level of elevation is only likely if both questions addressing inattention and hyperactivity were significantly elevated. Not surprisingly, given the elevated comorbidity, this was a group of severe ADHD-C children.

The level of learning disability was also severe. These students were full time students in this residential facility. Not only severely impaired in working memory, but these subjects as stated by Gray et al. 2012, were severely struggling academically "Notably, all academic scores were more than two standard deviations below the mean (WRAT-4) at baseline." [85]. Given the averages of these students of 14.2 years old for the control group and 14.4 years old for the treatment group these were students that for the majority of their academic life had had very severe behavioral and academic problems and were at risk for poor social as well as academic outcomes. The implication of this is that they have had several years of missed opportunity to develop social and academic skills which has led to their placement in this school.

With all this severe disability, what was intriguing about Gray et al. 2013 results was that they did find that there was a subset of WM criterion measures upon which this group improved significantly compared to the control which was a math-training group. Additionally, they found that "those who showed the most improvement on

the WM training tasks at school were rated as less inattentive/hyperactive at home by parents." This theme has arisen in other studies that there is a trend toward greater increases on the training index or the training tasks result in greater improvement. A trend like this was seen with the preschoolers in the van-Dongen-Boomsma et al. study. Where the index significantly correlated to an ADHD rating scale and the BRIEF by the teacher, but there were not significant group differences. One wonders whether more severely disordered subjects needed more training time to accomplish greater gains?

Gray et al. 2013 notes that further development of Cogmed would be needed to result in transfer effects to other domains of function, but other explanations are also plausible. For example, a complicating factor in this study was the reality that both treatment and control groups were in a setting with intense remedial school along with psychopharmacological treatment that resulted in gains for both groups of children. This included attention, reading, math and behavior. Not only that, in this case the control group was also receiving a math intervention. So, it would seem illogical to expect that the Cogmed treatment group would make gains in math while not receiving that math treatment. One issue was that the difference provided by adding Cogmed did not result in additional significant benefit, which arguably is a very high standard in this setting. Possibly most captivating was the discussion point that they made which was that "A possible explanation for these findings is that longer and more intensive training may be required to ameliorate severe difficulties in WM" [85]. This is a matter of dosing which in other areas of computerized cognitive training has been explored in more depth. This notion of dosing and adjusting the 'dose' of Cogmed by increasing the number of training days for more severe populations is an as yet unexplored undeveloped method of inquiry which the present authors believe is rather important to consider. A longer period of Cogmed training or 'dosing' with more severe groups seems a highly plausible place to consider modification with such populations.

The subjects in the study by Gropper et al. [87] while having both issues of ADHD and learning difficulties are still quite distinct from those in the Gray et al. 2012 study in terms of severity. Gropper studied ADHD/LD college students who were registered with disability services at a Canadian college and who did Cogmed. The fact that these students made it to college shows a comparatively high level of adaptation in contrast to their counterparts in the Gray et al. 2012 study who had to have failed in the community before being placed into that residential facility. To be eligible for inclusion in the study, Gropper trainees had to have a previously confirmed diagnosis of ADHD, or a learning disability or both [87]. However, Gropper et al. note that those that were not diagnosed with one disorder still had sub-threshold levels of that disorder. As such Table 5.2 in this document is somewhat misleading for this group due to this sub-threshold overlap. Gropper's 2013 study included 26 (42 %) students that were diagnosed with ADHD, 30 (48 %) diagnosed as LD and 6 (9 %) diagnosed as both of a total of 62 students. To make comparison easier in the Table 5.2 noted above 9 % was added to both the ADHD category giving 51 % with ADHD and to the LD category to give 57 % in that category. Gropper et al. 2014 did not explain whether their ADHD group was ADHD-C or

ADHD-I. However, the original dissertation by Gropper discussed the reduction in hyperactivity and impulsivity in adults with ADHD, but also notes the discussion in the meta-analysis by Willcutt et al. [73] that since ADHD changes presentations over time categorizing it as simply ADHD is more appropriate. Also, given the small number on medication here we will infer that these subjects were more likely ADHD-I although that is a judgment call.

Still given the amount of dysfunction in the sample of Gropper et al. 2014 study they found several transfer effects including WM, self-reported fewer ADHD symptoms, and a reduction in cognitive failures which might be characterized as an indicator of attention in daily life activities. At a 2 month follow up the students had maintained gain in WM and the reduced cognitive failures. This was a randomized wait list control group study. Additionally student comments from the study are important to consider. The students reported that they were better able to recall verbal information including phone numbers, names, appointments, etc. They were better able to recall information from lectures, reading material without rereading. The students said that they could stay alert for longer periods of time [87].

5.23 Summary/Conclusion

After having reviewed all this data comprehensively we conclude that one finds that in all three of these areas, schizophrenia, TBI & ADHD regarding the usefulness of computerized cognitive training with these clinical populations one comes to a similar conclusion. It is effective. Computerized cognitive training does result in improvement in the targeted areas. Certainly a meta-analysis of transfer effects especially in the area of attention would further bolster the empirical case for Cogmed working memory training with ADHD. That is beyond our present scope. Yet given that much of the debate in the working memory literature is conceptual in nature we do not expect this would wholly quiet the critics – even with sizeable effect sizes. However, based upon the existing data and the larger scope of computerized cognitive training reviewed here the effect sizes for Cogmed training in peer reviewed published research in the areas of visual spatial working memory and verbal working memory certainly fit the minimal standard discussed previously in this document of exceeding an effect size of .3. In fact in the majority of studies that are not testing the limits of the Coaching method or that are applying Cogmed to non-recommended diagnostic groups the effect sizes far exceed this minimal standard. In this way the argument for its efficaciousness is well-founded. The exceptions are in the minority and are essentially consistent with more severe cases of ADHD or an atypical way of coaching Cogmed.

Numerous transfer effects are associated with Cogmed training. The most consistently found transfer is an improvement of attention. There are other areas that are also gaining support like reading comprehension and mathematics. One should keep in mind the primary target here is working memory. Cogmed has been found to improve visual spatial working memory and verbal working memory on untrained

tasks. Transfer would be to increased attention. An additional "far transfer" would include areas like reading comprehension or mathematics. Yet as noted by Dunning et al. 2013 it is more reasonable to employ scaffolding with more systematic layering in of training in these areas of desired far transfer. In fact we consider this a way to optimize Cogmed training. That is, after a reasonable break at the conclusion of Cogmed training we suggest new learning opportunities which will continue to challenge working memory of the trainee. Without scaffolding to facilitate far transfer to desired areas one is expecting working memory training to magically make up for deficient skill development over a portion of a school year, an entire year of school or in some cases several years or possibly even a decade. How could an increase in working memory that is transferred to improved attention make up for 1 year of academic training in math or reading comprehension let alone several years? This appears to be an unreasonable standard. However, we reiterate that computerized cognitive training is not typically considered to be optimized when it is delivered in isolation as a solo intervention with TBI or schizophrenia. Why would one expect this to be different with Cogmed working memory training with ADHD or any other population? In the context of severity of disorder it is important to keep in mind that computerized cognitive training has been found to be effective with schizophrenics. Obviously by anyone's standards schizophrenia is a more severe disorder than any representation of ADHD. However, children with ODD and CD certainly have disorders that are considered severe, but more importantly the nature of those disorders themselves directly interfere with compliance in a computerized cognitive training program in which not only compliance is critical but persistence under cognitive challenge is necessary. The very nature of these disorders include defiance and rule breaking.

Throughout this chapter we have proposed various possible limiting factors of neuroplasticity that may affect the transfer effects of Cogmed. Both genetics and age are among such factors consistent with existing research. However, we have posited additional possible factors for consideration such as the notion of severity of disorder and the amount of comorbidity. Although our review and analysis of data appears to support these hypotheses, at this time they are only hypotheses. Research that compares ADHD-C to ADHD-I directly in otherwise matched samples would begin to answer this question. Additionally, studies with groups of ADHD-C that receive medication and one that does not would address other questions. Well-designed, well-controlled studies could start to address the issue of the role of medication in conjunction with Cogmed in the case of ADHD-C as well. Also, the role of medication should be controlled in research whenever possible. In more severely debilitated populations medication may be helpful to facilitate transfer effects and also to increase both compliance within training and to maximize benefit. For example, in the case of schizophrenia 'stabilizing' the patient is considered a prerequisite for computerized cognitive training. Most typically this includes a pharmacological intervention or psychiatric rehabilitation [7]. In fact, larger effect sizes were noted when this was done [7]. One would expect the same may be the case with working memory training with ADHD-C. Could it make sense that 'stabilizing' ADHD-C patients requires having hyperactivity/impulsivity under

better control? Studies considering comorbidity versus no comorbidity could be conducted. Finally studies which include ODD specifically could help to resolve what seem to be particularly muddy issues with this category of comorbidity with ADHD-C.

The more recent studies of Cogmed represent the more extreme end of the severity continuum provide an opportunity to reflect upon "use case" scenarios that can inform effective implementation of this program. We will briefly consider practical implications here. In the cases of both van-Dongen-Boomsma et al. [82] and Gray et al. [85] these investigators themselves suggested that dosing issues could facilitate expanded transfer of effects. Also, in the case of van-Dongen-Boomsma etc., the use of 'blinded' coaches is not advised. The Chacko et al. [84] study brings together other concerns. We believe both dosing issues as well as medication issues may be complicating factors to consider here. The fact that a high rate of ADHD-C children with rather elevated rate of comorbidity and only small minority of these children were medicated in the Chacko et al. study [84] is a concern. In other words there are questions about whether better 'stabilization' might have occurred with more children being medicated. These are some of the important considerations when attempting to understand the effects of that study, not simply that it was a more rigorously designed study. In fact, the Chacko et al. [84] study was of a more severe sample with 66 % ADHD-C, 50 % of whom were ODD while another 9 % were CD. ODD may provide a unique challenge for a computerized cognitive training program as one would presume may be the case with CD as well. However, even though the conclusion of Chacko et al. [84] was critical they did find found that the children who completed Cogmed showed significantly greater improvements in verbal and nonverbal working memory storage, but not in storage plus processing or manipulation. Similarly, van-Dongen-Boomsma et al. found that the active training group that they made significant gains in VWM that was only lost with statistical correction for multiple testing [82]. This suggests that if larger sample sizes were used which would increase statistical power then these differences may have been captured, but instead they were lost.

In the case of the study by Gray et al. 2013 certainly the severity of disorder and level of comorbidity were at the extreme, but the fact that all the children had to have failed their community placement which already combined psychopharmacology with special education gives one pause [85]. Furthermore, all the children were getting active treatment in addition to the control group getting a math intervention. In this case one wonders about the level or neuroplasticity of these children. Clearly the most plausible adjustment that could be made with this population would be to increase the dosing of Cogmed so they did the program longer. Yet, also interesting was that Gray et al. 2012 found that working memory training resulted in greater improvements of a subset of criterion measures [85]. Additionally, those children who showed the greatest improvement on the WM training tasks at school were rated as less inattentive/hyperactive at home by parents. Like the critical studies of Chacko et al. [84] and van-Dongen-Boomsa et al. [82] this finding suggests that the possibility that a longer term of training may have increased the possibility of transfer effects.

There is an interesting conceptual matter to entertain. There continues to be work to understand the mechanism of generalization for Cogmed effects. Increased activity in the brain is one way to think about this. Also, the construct of improved attention partly satisfies this issue, but the matter still seems somewhat unresolved. Here we will submit what we will call the "executive control hypothesis". For example, in a study by Foy et al. 2014, of economically disadvantaged preschoolers they found that after Cogmed that the preschoolers had improved on an executive control task, the Head-Shoulders-Knees-Toes task [67]. This was considered to be a far transfer measure. Importantly this task has been found to be predictive of academic achievement in kindergarteners. Children significantly improved on this task after doing Cogmed. Keep in mind that other than economic disadvantage these children were otherwise typically developing. Consider this in light of the fact that the Holmes et al. 2009 study of working memory deficit children found improvement in following instructions both at the end of training and at follow up 6 months later. They also observed improvements in mathematics at 6 months. One wonders if this finding might relate to the "executive control hypothesis". Similarly, other studies of ADHD children hint at what might be something with conceptual overlap with the notion of executive control. For example, in the Klingberg (43 % were medicated), et al. 2002, study of ADHD investigators found a reduction in impulsive movement. The Green et al. 2012 RCT (67 % medicated) found a reduction in off task behavior. Possibly most interesting is that in the Hovik et al. [81] study of ADHD-C children ages 10–12 with a majority of the children medicated (69 %) found that the children significantly improved upon processing speed and reading in terms of fluency, and word decoding quality [81]. One wonders whether utilizing a variety of measures which might assess executive control could contribute to understanding the conditions for generalizing gains from Cogmed.

Finally, there are a few other hypotheses to consider in the context of transfer effects of Cogmed. First there is the notion of "mind set" that involves the extent to which a person believes skills like working memory can be changed. According to Dwek [88], the subject's mind set, or approach to the Cogmed program may be influenced by their belief about how their effort can impact the outcome. If subjects believe that actually working with vigor on a task may result in improved working memory capacity, attention, and improved ability to remember, then that may influence how hard they work and thereby their outcomes. If a child or an adult does not hold this mindset they may think their effort will be useless and of no benefit. Consequently, one would expect limited transfer to result. Mindset may influence outcomes. Similarly, it should also be noted that students actually do vary in ability and this lack of balance among individuals that varies by chance can result in samples which vary in their ability to learn. This in turn can affect the ability of a study to find differences in transfer effects among these samples as noted by Moreau [89]. As such, there may be a learning curve and students with a disability may actually encounter a greater challenge that other subjects in doing Cogmed. This may result in smaller gains within the program and thereby less transfer of effects. This variation itself also noted by Moreau [90] that may result in heterogeneous outcomes, and that is to be expected as Cogmed clients do

not start at the same place, even if they are of similar ages. Finally, as noted by Rast [90] in the context of verbal learning of older adults that three factors predicted such learning: verbal knowledge, working memory, and processing speed. As such, there is some complexity to the notion of transfer effects. Different subjects arrive at training with varyingly levels of development in these areas. This is expected to affect the level of transfer. As is seen here, these various factors of individual differences be considered when evaluating transfer effects of Cogmed.

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Chapter 6
Clinical Communication Technologies for Addiction Treatment

Richard N. Rosenthal

Abstract This chapter provides a review and framework for the technological and clinical approaches to helping those who suffer from substance use disorders. Clinical Communication Technologies, Self-Management Technologies, and Device based support for treatment and recovery are discussed. International Efforts at reducing the disease burden of substance use disorders are reviewed and a peak at future innovations is summarized.

Keywords Adaptation • Addiction • Adolescent • Alcohol drinking • Analgesics • Anxiety • Behavior • Cannabis • Cocaine • Cognition • Cognitive therapy • Clinical assessment • Depression • Digital health • Heroin • Methadone • Motivational enhancement • Motivational interviewing • Opioid • Psychological • Recovery support • Self-management • Sensors • Social support • Street drugs • Substance use disorders • Telemedicine • Text messaging

The development of digital communications is continuing to have a profound effect on the development of the health care delivery system. As the technology matures, it is becoming increasingly clear that in addition to providing a platform for the efficient and rapid exchange of health data through EHRs, microprocessor-based technology is providing a platform for the evolution of behavioral health care, including treatment of substance use disorders (SUD). These advances are being designed both in the academic research community and in the private sector. They take the form of applications and devices for clinical assessment, monitoring and process innovation as well as treatment interventions such as computer- or Web-based psychosocial interventions, recovery management and self-management support. Computer-based applications are typically run at clinical sites and serve as adjuncts to the clinical treatment program delivered on-site. Other programs may be run on patients' home computers, again as an adjunct to the care received in the clinic. Web-based interventions are typically available on various platforms

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in addition to desktop or laptop computers, including tablets and smartphones, allowing for greater *in situ* use of the technology when patients are in their natural environments and at greatest risk for relapse.

Researchers have described the domain at hand as "computer-based" or "technology-based" [1, 2], but these labels are either too narrow or too expansive. Computers are involved as servers or hosts along the electronic communications chain, thus describing the range of functionality as computer-based is technically accurate, but as the end user may be on a smartphone or tablet it is not descriptive in a way that generally matches user experience. Conversely, describing the target as "technology-based" may be overinclusive and lacking in specificity, since other technologies such as transcranial magnetic stimulation or deep brain stimulation are being explored in the treatment of SUD as well as other diagnostic groups of mental disorders, but are clearly not yet in the same domain as automated delivery of psychosocial treatment and recovery support for SUD. What the technologies targeted by this chapter have in common are that, regardless of the particular platform, device or software, they support the transfer of clinical information, often bidirectionally, between patients (through active interaction or through passive sensors) and host applications, servers, and/or clinicians, and thus are best described as *clinical communication technologies* or CCT (see also Johnson) [3].

What Are the Benefits Over Traditional Treatment of Using CCT to Support Clinical Assessments and Interventions?

CCT may offer certain critical advantages over traditional face-to-face clinical exchange, that when taken together make a strong argument for broader adoption:

1. Patients' access to care is improved through 24 h/7 day availability, and availability in a range of physical settings [4].
2. Patients may access specific services on their own time and acquire rehabilitative training at their own pace.
3. Those who otherwise would not seek face-to-face treatment may access it in this modality [5].
4. CCT-based platforms may support more accurate self-disclosure of sensitive clinical information than face-to-face [6, 7].
5. Care continuity can be extended beyond the traditional acute treatment cycle [3].
6. Empirically based treatments can be readily converted to digital formats [8].
7. Standardized treatment interventions can be delivered with high-fidelity across treatment settings, with less vulnerability to program or clinician bias.
8. More precise control of treatment exposure can be delivered [4].

(continued)

9. Patients may review repetitive but necessary skills training or educational tasks without clinician involvement [9].
10. Application modularity may allow patients to more rapidly and precisely access and acquire pertinent information or instruction [10].
11. Treatment may be tuned more precisely and individually to patient feedback.
12. Clinicians' capacity to treat increases by decreasing time spent per patient [11].
13. Given the expense and time to train staff to reliably and competently deliver evidence-based psychosocial interventions, and then to supervise them, CCT-based interventions are generally robust to staff turnover.
14. Interventions delivered through CCT are likely to be cost-effective [12].

6.1 Computer-Based Psychosocial Interventions

A major barrier to patients' access for evidence-based individual or group psychosocial interventions for SUD is that these effective interventions are costly, requiring trained staff, and as such a majority of community-based SUD treatment programs operating on narrow margins are unable to offer them [13]. Similarly, in primary care settings, evidence-based screening and brief interventions for alcohol and other substance use problems are infrequently applied due to clinicians' lack of time or enthusiasm, or due to downright skepticism [14, 15]. There are a host of evidence-based psychosocial interventions for SUD that have been demonstrated to retain their efficacy after translation to the electronic platform with process automation to enable patient interaction. A recent meta-analysis of studies to 2006 of Internet-based psychotherapeutic interventions for a broad array of mental disorders covered 9,764 clients in 92 studies and demonstrated a medium effect size of 0.53, not dissimilar to that of face-to-face therapy [16]. The Community Reinforcement Approach (CRA) [11] and Contingency Management (CM) [17, 18], Cognitive Behavior Therapy (CBT) [19, 20], and brief motivational therapies such as Motivational Interviewing (MI) and others [21–23], are psychosocial interventions for SUD with a substantial evidence base that have been tested with demonstrated efficacy in the CCT format on various platforms and with different subpopulations.

6.1.1 Self-Management and Predominantly Administered Technologies

For people with drinking problems of less severity and duration than those with DSM-IV alcohol dependence, motivation-based interventions have a significant

evidence base, such as behavioral self-control training (BSCT) that teaches participants how to change their drinking behaviors towards a goal of non-problematic, moderate drinking [24]. BSCT teaches establishing one's goals, self-monitoring (logging the date, time, and quantity before each drink), controlling the drinking rate and drink refusal, setting rewards for goal achievement, functional analysis of drinking situations, assessing overdrinking triggers, learning alternative methods of coping, and relapse prevention [25]. In a randomized controlled trial among 40 participants with mild to moderate drinking problem severity and follow-up to 12 months, Hester & Delaney [24] tested 8 weekly sessions of a computerized version of the behavioral self-control training program for Windows (BSCPWIN), which incorporated the participant's drinking levels and assessment scores and was begun immediately after assessment, compared to a lagged control condition that began the intervention only after the 10-week follow-up to the initial randomization. The study was not conducted in the context of typical face-to-face clinical treatment, although the computers were at the research site offices. At the 10-week follow-up, the BSCPWIN group had a significant reduction in total drinking from baseline with a moderate-to-large effect size, and significantly greater reduction in total drinking compared to the control group that had not yet been exposed to the intervention. The significant reductions in alcohol intake that were achieved by 10 and 20 weeks respectively in the immediate and delayed groups were sustained at 12 months [24]. This is an early and striking example of the robust efficacy of a self-help oriented CCT-based application after only a maximum of 6 h exposure.

Hester et al. [26] then developed a brief motivational interview, the Drinker's Check-up (DCU) both as a Windows program for clinical use in the treatment context and a web application that the general public could use independently of clinical contact (www.drinkerscheckup.com). The DCU application assesses the quantity and frequency of alcohol use, drinking patterns and consequences, severity of dependence, and motivation for change, and then it offers the participant clinical feedback about consequences of drinking based on the individual information that the participant has entered. Once the feedback is completed, the program begins the decision-making module, which uses Motivational Interviewing techniques to support tipping the patient's decisional balance toward deciding to change his/her drinking behavior, after which the application negotiates the patient's goals for change. The investigators tested the DCU intervention on 61 non-treatment seeking adults with risky drinking using a randomized design of immediate intervention after assessment versus a delay of 4-weeks when the DCU assessment and feedback intervention was applied [26]. As expected, the immediate intervention group had significant reductions in the main alcohol use measures at 4 weeks (with a large effect size) and both groups sustained their reductions at 1-year follow-up for a net 50 % reduction in quantity and frequency of alcohol use. The DCU seems to be effective in increasing problem drinkers' motivation for change, and can be considered highly likely to be cost-effective given the minimal amount of time (35 min) and support necessary to deliver the intervention. A subsequent study optimized the DCU assessment and feedback modules for college age drinkers and their typical drinking situations, the College Drinker's Check-up (CDCU), for both

a Windows and web-based platform [21]. The authors conducted a randomized trial in 82 college students between the ages of 18–24 who were episodic heavy drinkers, comparing the effects of the CDCU in one 35 min session to a control group that had an assessment visit that was delayed to the 1 month follow-up visit to control for previously demonstrated effects of assessment alone on reducing drinking behavior. The CDCU showed significant impact on all tested alcohol indices compared to the control group at the 1 month follow-up assessment [21].

In a strategy to reach a wider, more diverse, non-clinically engaged population, Hester et al. [27] used the behavioral self-control training concept behind the DCU as the foundation for a new, more structured and individualized web-based application, ModerateDrinking.com (Hester, Delaney & Campbell, 2011). Eighty non-dependent heavy/problem drinkers were recruited into a randomized study of comparing Moderatedrinking.com (MD) along with the online resources of Moderation Management (MM; moderation.org), both web applications, to a control group of using MM alone, with follow-up assessments at 3, 6, and 12 months. MM is a web-enabled mutual help group and listserv for learning how to moderate drinking behavior, and all subjects were asked to read the listserv and/or post to it at least twice a week for at least the first 12 weeks of the study. While both groups demonstrated significant reductions compared to baseline in alcohol consumption and alcohol-related problems over the 12-month study interval, the MM + MD group experienced a greater increase than the MM group in Percent Days Abstinent at follow-up [27].

Clearly, self-administered interventions should have the greatest reach and acceptability of any CCT, and make sense especially for those with lower severity of substance-related problems. However, for those with sufficient severity or impairment to warrant a diagnosis, Newman et al. (2011) reviewed the literature up to 2010 on computerized treatments for SUD by disorder and by degree of therapist contact, concluding that self-administered and mostly self-administered computer-based cognitive and behavioral interventions are efficacious [28]. However, they also found that having some therapist contact supported greater reductions in substance use for a longer interval, suggesting that, at this stage of development, self-administered recovery support may be best used as an augmentation strategy for traditional clinical treatment, rather than as a replacement.

6.1.2 Clinician/Program-Supported Technologies

Several CCT-based interventions have demonstrated efficacy when delivered as an adjunct to standard treatment of SUD. Carroll and colleagues [19] adapted the evidence-based and manualized CBT intervention for SUD [29] to a six-module *computer-based training in CBT* (CBT4CBT) and conducted an 8-week randomized clinical trial in outpatients with SUD (n = 77) comparing treatment as usual plus biweekly access to CBT4CBT at the clinic with standard treatment alone [19]. Based on simple computer learning games, the application modules were presented

in multimedia format with graphics, video examples of the concepts, narration, minimal text, interactive assessments, verbal instructions and practice exercises that addressed basic CBT topics such as understanding one's substance use routines and how to change them, how to cope with craving, to learn and practice drug refusal skills, to exercise problem-solving skills, to recognize and derail thinking regarding drugs and alcohol, and to improve decision making skills. Compared to the control group, the group receiving CBT4CBT had significantly more negative urine specimens and proportion of specimens that were negative over the study, a moderate effect size, suggesting that adding an automated 45 min CBT4CBT session to weekly individual and group sessions of general drug counseling can have important clinical impact on SUD without much added clinical burden [19].

Marsch and colleagues [9] developed a self-directed and interactive Web-delivered HIV and sexually transmitted infectious disease prevention program for high-risk adolescents and tested it in a randomized trial among adolescents (n = 56) in two outpatient SUD treatment programs, where the standard group received a traditional 1 h small-group prevention intervention and the enhanced group received the traditional 1 h prevention intervention plus access to the 25 Web-based program modules. The Web-based prevention program is fluency-based in that it has interactive exercises with graphics and animations, and quizzes participants at feedback-adjusted levels of required response speed and accuracy as they increase their mastery and retention of the skills being taught [30, 31]. At study follow-up assessment, the Web-based intervention group had significantly greater prevention-related knowledge and greater intentions to choose partners carefully and they also perceived the intervention to be significantly more useful [9]. Because this Web-based application is browser-based, it may be able to be more broadly disseminated if optimized for mobile devices.

Although much of the relevant research has been on computer-based psychosocial interventions adjunctive to clinic-based treatment, more recent trials have included designs in which the CCT-based intervention is tested directly against treatment as usual or time matched controls. For example, a recent randomized 12-week trial among opioid treatment program patients who had Internet-capable computers received either Web-based videoconferencing intervention "eGetgoing" at home or traditional face-to-face individual weekly counseling in the clinic [32]. Although a formal non-inferiority analysis was not performed, results of the two interventions were comparable regarding counseling attendance and positive drug screens, treatment acceptability and therapeutic alliance, suggesting overall feasibility of at-home video counseling, and all else being equal, the potential for increased access to care [32].

Screening and brief intervention is a well documented MI-based procedure for patients with mild to moderate problems with alcohol and other substances that places them at risk for medical and other sequelae, even without meeting formal SUD diagnostic criteria. Schwartz and colleagues [22] tested illicit drug-using adults (N = 360) in a primary care setting with a tablet-based brief intervention delivered on-site, compared to a traditional brief intervention delivered by a masters-level behavioral health counselor. Both interventions had comparable

content based on Motivational Interviewing, including personalized feedback and empathic reflection. The tablet-based application was self-directed and delivered synchronous feedback via headphones that was tailored to the patient's motivation to change (measured interactively) and presented by an animated narrator who asked questions based on the patient's responses, just as would be done in the in-person intervention. While overall follow-up at 3 months did not demonstrate differences in global drug use using the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) [33] ratings, there was a significant difference in drug problem scores for marijuana and cocaine at 3 months favoring the computerized intervention [22]. These findings suggest that automated delivery of brief interventions for problem substance use may a feasible alternative to in-person interventions in busy primary care settings. Similarly, Ondersma and colleagues [23], who developed the Motivational Enhancement System (MES) used in the ASSIST study [22], conducted among 143 women who self-reported illicit drug use in the month before becoming pregnant, a randomized trial in the immediate post-partum period of a single 20-min tablet–delivered screening and brief intervention to facilitate self-change, against a time-matched control condition. The intervention content and process was as described above in Schwartz et al. [22], –subjects were not required to use the keyboard and provided all answers by touching a visual analogue scale or by selecting from a list, and again, the animated narrator behaved in much the way as a clinician trained in brief intervention would. Intention to treat analysis of follow-up data demonstrated a significant impact of the intervention on past-week abstinence for illicit drugs at 3 months ($p = 0.01$) after childbirth compared to the control group, but not at the 6 month point, although the intervention group maintained a higher rate of abstinence [23]. Taken together, these studies suggest the efficacy of motivation-based screening and brief intervention delivered by the MES application on a tablet computer on patients with risky substance use.

Several psychosocial interventions for treatment of diagnosed SUD have been conducted using Web-based applications. The Community Reinforcement Approach (CRA) to treatment of SUD entails teaching skills to patients and supporting pro-social behaviors that lead to reinforcement that is not related to drug use [34]. When paired with a system of vouchers of increasing value to reward continuing provision of drug-free urine samples, a version of contingency management (CM), CRA plus vouchers became the foundation of a CCT-based intervention called the Therapeutic Education System (TES) that has been tested against both the face-to-face version and treatment as usual [34]. Bickel and colleagues [11] conducted a three-arm randomized trial of CRA treatment with vouchers delivered by therapists, mostly computer-based CRA treatment (provided at the clinic) with vouchers, or treatment as usual among $N = 135$ outpatients being treated with buprenorphine for opioid dependence. Both CRA with vouchers groups had significantly greater weeks of abstinence from opioids and cocaine than the standard treatment group ($p < 0.05$) demonstrating their efficacy, yet those the computer-based TES intervention achieved these results with about one sixth of the contact time spent with their counselor [11]. This suggests that the computer-assisted intervention may be cost-effective. Similarly, in a 12-week non-randomized trial,

Budney et al. [35] compared a therapist-delivered 9-session treatment combining elements of motivational enhancement therapy (MET), cognitive-behavioral therapy (CBT), and abstinence-based contingency-management (CM) including vouchers, against an on-site computer-assisted version of the same combination treatment in 38 cannabis dependent adults seeking treatment and found comparable results for retention in treatment and cannabis use outcomes between the two groups.

In a sample of depressed adults (n = 97) with risky alcohol and or at least weekly cannabis use in New South Wales who were given one brief MI, advice and rapport-building intervention, Kay-Lambkin et al. [36] conducted a randomized controlled 12-month outcome study comparing no further treatment (control), a manualized 9-session MI/CBT therapy focused on mood and substance disorder, and an on-site computerized version of the MI/CBT therapy, *S*elf-*H*elp for *A*lcohol and other drug use and *De*pression (SHADE) delivered on-site in the clinic with a brief (10 min) therapist check-in after sessions. Both of the MI/CBT interventions demonstrated significant reductions in hazardous alcohol and other drug use over the 12-months compared to the control group ($p < 0.01$), and the computer-delivered treatment group had a significant ($P < 0.01$), threefold reduction in cannabis use over the 12 months compared to the control group [36]. A multisite replication study of similar design with 274 subjects demonstrated that both the therapist-delivered and computerized versions of the MI/CBT intervention were superior to a control group given nine sessions of manualized supportive counseling in reducing depression and alcohol and cannabis use at 3 months, and the computer-delivered therapy was associated with significantly greater reduction in alcohol use than the therapist-delivered treatment [37, 38]. The computer-delivered SHADE intervention required an average of 16 min of clinician time per session compared to 57 min per session for the therapist-delivered CBT/MI treatment, suggesting again the probable cost effectiveness of this approach.

Marsch et al. [39] conducted a 12-month randomized trial to test the effectiveness of the Web-based Therapeutic Education System (TES) without contingency management (CRA without vouchers), substituted for 30 min of the 1 h regularly allotted weekly or biweekly for standard counseling, compared to 1 h standard counseling only among 160 subjects newly admitted to a community-based methadone maintenance treatment program. The TES group demonstrated significantly greater rates of opioid abstinence across all study weeks ($p < 0.05$), and participants were twice as likely to be abstinent than those receiving standard counseling [39]. Interestingly, poorer cognitive function predicted poorer opioid abstinence in the standard counseling group, but not in the TES/reduced counseling group, suggesting that the Web-based TES intervention, which is based on a cognitive, skills-based approach, mitigated the effect of poor cognitive function on abstinence outcomes [40]. This is further evidence that properly configured and delivered CCT-based interventions may have differential efficacy compared to treatment as usual. Overall, these studies suggest that CCT-based psychosocial interventions have demonstrated efficacy as good as or better than evidence-based behavioral treatments provided by trained clinicians.

6.2 Smart Phones

In 2014 it is estimated that there are 6.9 billion cell phone subscriptions in the world, which is equivalent to 95.5 subscriptions per 100 inhabitants and 2.3 billion mobile broadband subscriptions, an 800 % increase over 7 years [41]. Thus, mobile phones are nearly ubiquitous and as such may offer distinct and novel advantages over traditional bricks and mortar requirements for interventions for reducing addictive behavior. Smart phone platforms enable several different CCT modes that are of potential clinical utility, such as traditional live voice conversations, text messaging, access to Web-based information and applications, native applications, GPS functionality, and a host of intrinsic (e.g., accelerometer) and plug-in (e.g., Bluetooth-enabled sensor) devices. The potential advantages for treatment of SUD include: the ease of use anywhere at anytime; cost effective delivery and scalability to large populations regardless of location; the ability to tailor messages to key user characteristics (such as age, sex, ethnicity); the ability to send time-sensitive messages with an 'always on' device; the provision of content that can distract the user from cravings; and the ability to link the user with others for social support. The efficacy of mobile phone-based interventions is demonstrated in a recent Cochrane meta-analysis of five studies with >9,000 participants, which showed that text messaging smoking cessation programs increased 6-month quit rates by 71 % when compared to controls, a strong effect [42].

6.2.1 Interactive Voice Response in SUD Assessment and Treatment

Once the province of home phones, interactive voice response (IVR) technology is accessible now through any device, including mobile ones, which can at least carry audio information to and keypad information from the end user. As questions of end users can be formatted in simple yes/no, multiple choice, or numeric values from a keypad, IVR technology lends itself readily to data gathering, assessment and monitoring for patients in clinical treatment for problems and disorders related to substances. The platform allows for easy coupling of data collection and population of those data into a database for statistical analysis. In SUD research, daily process methods have been developed, as getting more assessment time points increases one's clinical knowledge, as well as power to capture trends for research purposes. Other than seeing patients in traditional weekly clinic visits or more frequently in intensive or opioid treatment programs, monitoring daily intake of substances such as alcohol for treatment or research purposes used to rely on paper and pencil diaries or retrospective assessments, which were not easily verified [43]. By the mid 1990's, it was demonstrated that IVR-based daily assessment was a valid method for measuring instances of daily alcohol and tobacco use, especially in frequent, heavy drinkers who tended to underreport using traditional methods [44, 45]. Such IVR systems can be call-out, or call-in (if intrinsically motivated or

externally incentivized), or both. The data captured at a higher frequency by this method more easily supports analyses of longitudinal health-related data that are more problematic to obtain by other means, such a conducting time-series analysis to reveal behavioral patterning and rhythmicity that might not otherwise be apparent [46]. In addition, the use of IVR can explore behavioral correlates of SUD that might not easily be captured through traditional methodologies. For example, Cranford et al. [47] used IVR to assess daily drinking behavior, marital interactions and depressed, anxious, angry, or good moods or fatigue in patients with alcohol use disorders and their spouses ($N = 54$ couples). In addition to anxious mood and marital conflict predicting daily non-compliance with calling in to the IVR system (which triggered an automated reminder call), and intoxication predicting next-day noncompliance in the patients, the strongest predictor of non-compliance was the spouse's compliance [47]. Thus, the data that can be gathered through IVR sampling may be used in new ways that can potentially augment treatment outcome. Although in this study, anxiety predicted noncompliance and generated an automated call, an IVR system could just as easily record urges and cravings, and after further exploration using branch-chain logic, initiate a support call in response, etc.

Although IVR has been historically used for assessment and reminder purposes, more recent studies have attempted to add more complex treatment components to the applications, such as self-monitoring, setting goals and rehearsing coping skills, in order to create a therapeutic IVR. In a randomized, controlled 4-week trial in methadone maintenance patients who continued to use illicit opioids and cocaine ($n = 46$), Moore et al. [48] tested treatment as usual (TAU; one mandatory individual counseling session/month with optional daily groups), against TAU plus "The Recovery Line," an automated, IVR-based 24 h-accessible telephonic treatment based on CBT theory and principles. The IVR treatment modules (<15 min each) covered typical CBT topics such as self-monitoring, recognizing triggers, coping with urges and cravings, avoiding high-risk situations, and dealing with stress and negative moods, offered direct guidance and role-playing for exercises that accompanied the didactic portions, and also contained a section that provided encouragement. Although experimental group subjects patients used fewer days on average (<10) of that recommended (daily), they were significantly likely to abstain from illicit drugs on the days they did ($p = 0.01$) [48]. One benefit of The Recovery Line IVR system is that, compared to the time patients are involved in recovery activities in a clinical environment, patients may access the system while they are in their regular environment, thus up to and during a time of and in a location of high risk for use of illicit drugs. Given that patients may not be compliant with calling in to an IVR system, in an add-on substudy to a cocaine abstinence trial, Lindsay et al. [49] tested what type of incentives might improve subjects' adherence to calling in daily to answer questions about craving and use of cocaine, and compared a consistent $1 reward against a contingency management fishbowl drawing for prizes of varying values. The odds of the variable prize group calling in were 4.7 times greater than that of the fixed payment group, demonstrating that evidence-based behavioral interventions (i.e., CM with intermittent reinforcement) can also be used to shape behavior regarding CCT [49]. Across groups, the percentage of IVR calls was associated with achievement of cocaine abstinence.

What Are the Benefits of IVR?

1. Increases the population with SUD that can be reached through landlines or mobile phones.
2. Automated calls can remind patients to adhere to treatment, such as taking medications.
3. Potential to gain clinically relevant information from patients not constrained by being present in a traditional treatment setting
4. Increases accuracy through reduction in patients' recall time and bias [50]
5. Allows for verification of the date and time of daily reports [47]
6. Has the flexibility to capture data at specific times of day for particular analyses.

6.3 Monitoring: Asynchronous and Real-Time (Synchronous)

Other than when a clinician directly observes or elicits symptoms from a patient during a face-to-face examination, the bulk of clinical assessments monitor clinical events in an asynchronous fashion, that is, at a time other than when the event occurred. This time lag between the event and the documenting of it increases the likelihood of failures of recall, biased interpretation by the patient or clinician, loss of information, and so on. The availability of portable CCT on the platforms of palmtop computers, smartphones and tablets allows for ecological momentary assessment (EMA)—a record of a patient's *in vivo* response, that is, while in their natural environment and going about their normal activities. Data gathered through EMA methods should, by definition, have greater ecological validity than data gathered in a treatment clinic or research setting, and thus revealed behavioral patterns more generalizable to both specific individuals and to target populations. EMA on handheld devices moves beyond traditional daily process methods in that it can sample patient responses at multiple times during the day on a fixed or random schedule, inquiring about events and experiences since the last assessment, and can also be responsive to pertinent events in real time [51]. For example, SUD patients can report exposure to conditions likely to induce substance craving or otherwise putting them at high risk for use, and can be followed up at intervals to record whether use occurred or not. Adherence to the assessments are also tracked and recorded as clinical information [52], since non-adherence with the program is a likely indicator for relapse in SUD patients. EMA procedures have facilitated a more precise determination of antecedents to relapse to substance use [53], elucidated characteristics of drug withdrawal with higher resolution and accuracy [54], and are clearly more accurate than patients' recall of events [55]. As with IVR, EMA multiple daily sampling allows for longitudinal data acquisition that lends

itself to analyses of temporal patterning and sequencing such as cyclic or cascade phenomena [56, 57], determinations that would not otherwise be available with cross-sectional or typical clinical information. For example Schiffman & Waters [58] determined using EMA that negative affect on preceding days did not predict lapse to smoking during quit attempts, but that negative affect did increase in the 5–6 h before a lapse, shortening the window for potential clinical interventions. Similarly, in using EMA to study the precedents to cocaine or heroin use in methadone-maintained patients, Epstein et al. [59] demonstrated that at 5 h prior to the onset of cocaine use, there were significant linear increases in 12 of the putative relapse triggers, such as having a good mood, seeing the drug, being tempted out of the blue, and wanting to see what happened with using a small amount. While initial electronic versions of EMA assessment initially relied on devices such as handheld computers that needed to be physically downloaded at intervals, newer versions of the technology are available on smartphone platforms adding significant functionality and reducing the barriers to access [60]. One of the evolving strengths of the CCT platform is the ability to capture and examine clinical data that otherwise would remain unanalyzed and unused in the treatment of patients. For example, the presence of GPS data on smartphones allows that those data can be paired with EMA data for novel analyses and determination of correlates of addictive behavior [61]. Epstein et al. [62] collected random EMA mood, stress, and drug craving responses on PalmPilot PDAs along with concurrent GPS data on no-display GPS loggers (geographical momentary assessment, GMA) over 16 weeks in a cohort study of 27 methadone maintenance patients who were abusing other illicit drugs, and demonstrated that, when compared to measures of physical and social disorder and drug activity by neighborhood blocks in Baltimore City, that contrary to hypothesis, more drug activity in the neighborhood was associated with less cocaine craving, heroin craving, and stress. In addition, more social disorder was associated with lower cocaine craving and more neighborhood physical disorder was associated with lower cocaine craving, heroin craving, negative mood, and stress [62]. Regardless of the ultimate explanation for these counter-intuitive results, without EMA and GMA technology, generating these linked clinical and geospatial data for analysis would be improbable.

What Are the Benefits of EMA on Smartphones?

1. Given the ubiquity of smartphones, patients are typically carrying them most of the time.
2. Programmable operating systems allow development of applications that tap intrinsic resources.
3. Obviates the need for separate, often expensive other devices with high replacement costs.
4. Because it is “the phone,” participants are more likely to respond.

(continued)

5. Real-world monitoring in the patient's own environment increases the ecological validity of potential clinical interventions derived from those data.
6. Random and event-driven sampling diaries allow for patient-specific determination analysis of behavioral patterning [63].
7. Prevents back- or forward-filled responses and batching of responses as seen in paper diaries [51].
8. The time and location information can be captured when the EMA is enacted and when it is responded to [60].
9. Qualitative data may also be captured, such as verbal descriptions of the context of a relapse event [64].
10. Information not otherwise captured clinically can be assessed by the EMA application, such as response time, and in parallel such as data from the phone's built-in sensors.

6.4 Sensors

The pairing of location data using geospatial technology, with human experiential or behavioral data, is but one of the real-time opportunities available using increasingly available devices included in smartphones (e.g., motion sensor/accelerometer, gyroscope, digital compass, magnetic field detector, proximity sensor, touch sensor, barometer, ambient light sensor) as well as wearable wireless peripheral sensors that either feed to smartphones or other platforms. For example, the combination of geospatial information coupled with an increase in sampled heart rate could trigger an intervention based in the patient's identified pattern antecedent to relapse to substance use. Either way, the trend is towards the use of sensors with frequent or continuous sampling, which, in addition to being unobtrusive, could bring the highest level of ecological validity to the integration with more traditional self-reported behavioral health event data.

Sensors can passively gather data when the subject is unwilling or unable to respond. Transdermal electrochemical sensors have been in use for several years, which allow for relatively accurate non-invasive monitoring of alcohol consumption through sampling at intervals from 30 s to 10 min, but some versions may have variable performance and they also are not inexpensive [57]. As part of a system designed for use in CBT for patients with SUD and PTSD, Fletcher and colleagues [65] used wearable analog sensor wrist/ankle bands that contained circuits to measure electrodermal activity, temperature and 3-axis motion and sent the data to a mobile phone via Bluetooth radio, or cached it on a 2 GB MicroSD card. The 4 Hz sampling rate (adjustable) data fed into an application resident on a mobile phone running Android 2.1 or 2.2 that could deliver just-in-time CBT-based

messages to a patient that related to the sensor data that was processed locally on the phone. eHealth is quickly adopting the use of sensors in logging health activities for general consumers. Given the traditional lack of attention to treatment of SUD among primary care clinicians, this presents a novel opportunity to capture important clinical data in people with SUD and make it available for the electronic health record.

6.5 Future Research and or Trends Regarding Future Innovations

Much in the way that smart phones and tablets are platforms for digital communication that are increasingly convergent, the future will bring an integration of the various components described above into systems of CCT assessment and treatment. As the modalities integrate, clinical intervention will be linked more closely in time to key patient events. The opportunity for ultra short-loop feedback of patient information and tightly linked clinical response has rarely existed in most of healthcare save for patients in obviously high-risk situations: for surgical patients during anesthesia, during "codes," and for those in intensive care, postoperative recovery, and cardiac monitoring units. The technological advances presented here offer the promise of extending this clinical responsivity outside of traditional acute care environment, through the domain of outpatient care and into the rest of patients' environmental context. For example, in response to an episode of craving identified by EMA or by algorithms of sensor data in a patient who is walking towards an area where he used to buy drugs (an individual "hot-zone" identified by GPS), a responsive text reminder about avoiding high risk locations or situations, or specific video support from a skills module on coping with urges could automatically be sent to the patient's smartphone. The patient's successful management of the craving episode and/or change in route can be given immediate reinforcement, or in the case of symptom escalation or increased risk as predicted by the patient's own history and geospatial data, the system cues a movement to a higher level of intervention.

The boundaries between gathering data for research purposes and the gathering of data to be used for treatment of individual patients are narrowing as the CCT-based procedures that used to be solely in the realm of research are being used to improve the quality of treatment.

Currently, most of the published research applies technology to augment assessment and treatment interventions for SUD that have originated in the bricks-and-mortar clinical realm, and have first established an evidence base in that realm. However, the potential exists for the development of novel assessment protocols and clinical interventions that are fully native to the microprocessor-based realm. A bridging strategy should be to use current CCT to explore the relapse and recovery process in a more defined and complete way, which, in addition to capturing patient behavior in a potentially more rigorous fashion, might be elucidated from the more

precise contextual (time, interval, antecedent stimuli, location) information derived from CCT-based evaluation, intervention and feedback.

Finally, the movement towards data integration using the output of continuous devices and wearable sensors that capture location, activity and physiological responses, in addition to registration of subjective states, should transcend even EMA to create powerful new contextual arrays whose analyses will guide ever more individualized and comprehensive clinical interventions.

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Chapter 7
Technology and Adolescent Behavioral Health Care

Todd E. Peters, Theresa Herman, Neal R. Patel, and Harsh K. Trivedi

Abstract The interface between adolescence and technology offers both the greatest need for increased clinical caution as well as the greatest opportunity for future exploration. Where else can the seasoned clinician feel like a mere novice compared to the tech-savvy adolescent patient? Where else can the tech savvy adolescent, who in the prime of invincibility and curiosity, find easy access to situations and dangers once only the subject of science fiction? With this, consider the limitless potential of technology-based solutions powered by the ever-connected adolescent. Imagine a world where electronic gadgets can track clinical data points, such as a smart phone that monitors sleep patterns, or can provide real time clinical guidance, such as a guided relaxation module when the patient's heart rate starts to climb. In this chapter, we review the interface of technology and adolescent behavioral health care with an emphasis on how technology also impacts access to information, parenting, and maintaining patient safety.

Keywords Adolescent psychiatry • Bullying • Depression • Divorce • Legal guardians • Obesity • Shame • Social media • Social networking • Students • Substance-related disorders • Suicide • Text messaging

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The interface between adolescence and technology offers both the greatest need for increased clinical caution as well as the greatest opportunity for future exploration. Where else can the seasoned clinician feel like a mere novice compared to the tech-savvy adolescent patient? Where else can the tech savvy adolescent, who in the prime of invincibility and curiosity, find easy access to situations and dangers once only the subject of science fiction? With this, consider the limitless potential of technology-based solutions powered by the ever-connected adolescent. Imagine a world where electronic gadgets can track clinical data points, such as a smart phone that monitors sleep patterns, or can provide real time clinical guidance, such as a guided relaxation module when the patient's heart rate starts to climb. In this chapter, we review the interface of technology and adolescent behavioral health care with an emphasis on how technology also impacts access to information, parenting, and maintaining patient safety.

7.1 Background/History

The area of clinical documentation is one which clinicians struggles with issues regarding how much document, how to maintain confidentiality, which parent/guardian can access the record, How much to share with other treatment providers, and how to vary the response based upon the specifics of the case and the developmental age of the youth. Documentation of clinical work has always served many purposes: to serve as an internal record of interactions with patients, to provide the details of these interactions and diagnostic assessments for other providers, to monitor progress and treatment plans, to provide a record of care externally to others in times of litigation, and to allow for justification of billing. Historically, the medical record has been considered to be the property of the provider or care system and was shielded from patients. Over time, this view has transitioned to the present day concept that an adult patient has the right to freely access their records when requested and are the true "owners" of the medical record. How does one consider the rights of a minor in regards to access their medical record? Who 'owns' the record of a minor child in cases where parents/guardians are embroiled in litigation regarding custody and medical decision-making?

7.1.1 Federal Policy Implications

Electronic health records (EHR) have allowed for more rapid dissemination of information, but have also brought concerns regarding safety and confidentiality. While concerns exists regarding all electronic records, both medical and psychiatric, they are often magnified in the views of mental health providers and patients seeking mental health care. Recognizing these confidentiality concerns, the Health Insurance Portability and Accountability Act (HIPAA) of 1996 sought to create regulations for "covered entities," defined as any practices and/or institutions that

transfer information electronically including via the use of facsimiles. This ruling has emphasized the importance of signed disclosure policies detailing who has access to one's personal information and treatment record, including what elements may be shared with other providers and insurance companies [1].

Further complicating issues have been technological advances that make it possible for more providers to utilize electronic data entry and secure electronic communication over recent decades. Through the Health Information Technology for Economic and Clinical Health (HITECH) Act, under the American Recovery and Reinvestment Act, over $20 billion of incentive bonuses have been made available to Medicare/Medicaid providers who adopt EHR-based systems that meet meaningful use criteria. With increasing use of EHRs, there has also been a greater development of health information exchanges (HIE) that seek to migrate clinical data across EHR programs. HIE increases the risk for security breaches or inadvertent disclosure of protected/private information, particularly through release by other non-mental health providers. Despite these efforts, recent studies indicate barriers to information continue and prevent optimal information sharing both within and across organizations [2].

For example, many mental health providers were initially excluded from the incentives due to Social Security Act definitions of the term "physician" that excluded some mental health providers and clinics. Some mental health providers have side stepped this issue by incorporating their practice into the "medical home" model as part of the Accountable Care Act (ACA) of 2010. Within this model, rapid collaboration and information sharing will be essential to coordinate the most efficient, cost-saving care model. Many advocates of EHRs for integrated mental health care report improvements in care coordination, patient engagement within the treatment system, fewer medication errors and improved medication compliance [3].

7.1.2 Clinical Concerns Urge Caution

Many mental health providers are confronted with the current challenge of incorporating EHR systems into their practices. A major struggle is concerns about private, at times intimate, information being easily accessed by others either within or outside their practice. It has become imperative for health record companies, individual providers, and treatment centers to balance appropriate access to the EHR while maintaining privacy of patient information [4]. The balance of access versus confidentiality is tenuous surrounding documentation of mental health visits. It is further amplified when working with children and adolescents.

In the medical setting, parents have access to their child's medical record until the child turns 18 years old or becomes emancipated. In the psychiatric setting, however, access to the child's protected health information becomes much more complicated. For some children and adolescents, allowing the parent(s) to have access to protected health information could expose the minor to potential psychiatric or physical trauma. The question becomes, "When do parents/legal guardians not have the right to view protected health information?"

First, if state law allows a minor to seek mental health treatment without parental consent (even if parental consent is given), the minor also has the right to refuse parental access to protected health information for that specific treatment. Next, access to protected health information by parents/legal guardians can be restricted or refused if the licensed provider, in his/her professional judgment, feels that sharing the information would not be in the minor's best interest. Finally, any reasonable belief that the parent(s)/legal guardian is abusing or neglecting the minor or that access to protected health information would endanger the minor allows the provider, in their professional opinion, to refuse access to the medical record [5]. In addition, psychotherapy process notes that are not utilized for care planning, medication management, or billing may be kept separate from the main medical record and remain exempt from disclosure in the legal medical record, based on a US Supreme Court ruling (Jaffee v. Redmond). It is imperative to learn the specific state laws in which you practice that pertain to protected information and access to the EHR.

Given these concerns, psychiatrists and mental health providers have been delayed adopters of EHRs [6–8] and have some of the lowest overall rates of EMR use [9]. Some previously identified barriers to global EHR use, as reviewed by Stewart [10] include: limited time with patients, diminished eye contact, disruption to workflow, missed non-verbal cues, and current issues with interoperability between most EHR systems [11–15]. Several peer-reviewed research studies have sought to examine health care provider's concerns for EHR use. The first known article, published in 1998, studied beliefs of providers after the implementation of an EHR system. Many providers in this study felt that the quality and content of patient interactions were improved with an EHR system. However, the article did not formally address any other concerns with this study [16]. Another post-implementation survey study explored psychiatric providers' views and beliefs after transitioning from paper records to a sequestered psychiatry database as part of a hospital-wide EHR at Vanderbilt University. One year after this transition, outcome metrics including confidentiality/stigma of mental illness, quality of the EHR, release of information, reporting behaviors, and providers' views of patients' responses in light of this change were measured [17]. The results demonstrated perceived maintenance of therapeutic communication with patients. Providers also noted that their records were more complete and legible. However, a majority (63 %) of providers remained wary to include highly confidential information in the record and most providers (83 %) hoped their own psychiatric records would not be included in the more accessible EHR system.

7.1.3 Dangers of Technology Use in Youth

Outside the discussion of documentation, there are also very real dangers with technology and adolescents. Not only are impressionable youth exposed to cyber-bullying and sexting, they have the world available at their fingertips with access to a host of seedy and unscrupulous individuals.

Sexting

The "sending, receiving, or forwarding of sexually explicit messages, photos, or images via cell phone, computer, or other digital device" constitutes sexting [18]. In a study conducted by the Pew Research Center, 4 % of teens have sent a sexually suggestive nude or nearly nude image of themselves to someone via text messaging and 15 % of teens have received a sexually suggestive nude or nearly nude image of someone they know by text [19].

Sexting usually occurs in three situations: between romantic partners; with images forwarded to friends or classmates; or with images sent between two people in which at least one is hoping to become romantically involved [19].

Depression has been associated with sexting. Adolescents who feel depressed or alone may be more willing to sext due to peer pressure and wanting to fit in. Likewise, feelings may surface after sending a sext message of shame or guilt which can lead to a depressive episode. In a study conducted by The Educational Development Center at Boston University, 36 % of students who had "sexted" reported feeling depressive symptoms in the past year. More importantly, those who had "sexted" were significantly more likely to have a suicide attempt in the previous year. Of the 23,000 high school students interviewed, 13 % of those who have "sexted" reported a suicide attempt in the past year as compared to only 3 % of students who had not "sexted" [20].

Cyberbullying

Cyberbullying is defined as "an aggressive, intentional act carried out by a group or individual, using electronic forms of contact, repeatedly and over time against a victim who cannot easily defend him or herself" [21]. Cyberbullying reaches a peak in high school. In children aged 12–14, victims of cyberbullying are three times more likely than non-victims to report depressive symptoms, self-injury, and serious consideration of suicide. Adolescents, aged 14–17, who are bullying victims are four times more likely to report attempting suicide in the past year [22].

Social Media

Social media use is extensively covered in Chap. 10 of this publication. As stated by the American Academy of Child and Adolescent Psychiatry *Facts for Families*, "over 60 % of 13–17 year olds have at least one profile on a social networking site, many spending more than 2 h per day on social networking sites." Social media can help children stay connected to friends and family around the world. It also can help youth express their interests and form their identity, connecting with other like-minded peers. However, terms such as "Facebook depression" [23] and "iDisorders" [24] have become a part of the nomenclature of mental health treatment, recognizing the correlation between excessive technology use and mental health issues.

Growing research has demonstrated the ability to associate certain trends seen in underlying mental health disorders [25]. Social media provides a concrete, objective way for a child to compare oneself to peers – having less friends or followers than other friends can cause some teens to become demoralized and ridiculed. Social media also serves as a platform for bullying and taunting throughout the day and night without relief.

Chat Rooms

Chat rooms expose children to unknown people – potential bullies, predators, and mentors. The ability for people in chat rooms to remain anonymous allows untold possibilities to arise. Parents would never allow their children to open the front door for a stranger, yet may be completely unaware of the multiple hours their child is chatting with a sexual perpetrator on the Internet. Chat rooms also expose children to experiences that they may not otherwise be exposed to: drug parties, new ways to hide cutting, graphic sexual discussions, and other risky behaviors.

7.2 The Path Forward: How to Effectively Document, Treat, and Innovate

7.2.1 Balancing Confidentiality and Transparency

The fear that many child and adolescent providers have is that safety must be maintained for both the pediatric patient and their caretakers/family members [26]. Valuable historical information, such as family history of mental health issues and details regarding family dynamics, outcomes from separation/divorce, and family legal issues, can have damaging implications if accessed inappropriately or in accordance with the law, such as a shared custody situation. Secondary to these fears, many providers have altered their documentation styles in light of EHRs.

Recent publications have sought to discuss strategies for navigating these ethical issues in the digital age. Nielsen et al. [27] detailed several preventative measures for providers and organizations to best safeguard personal health information (PHI) and avoid privacy concerns when working with pediatric patients. It is imperative to release the least amount of data possible in an effort to coordinate care [28]. It is also essential to avoid practicing outside of one's scope of practice, avoiding discussion of topics/disorders that you are not directly treating and avoiding release of other providers' notes [27]. Documentation should occur with the expectation that the child or family member will eventually see the record [27, 29, 30].

Some providers and institutions have taken the push for transparency further, giving patients full access to their medical record, including notes regarding mental health care. One of the largest studies to date, entitled OpenNotes, allowed the patients of over 100 primary care providers (PCPs) from three separate clinical

settings to elect to have access to their entire record. The PCPs directly invited more than 20,000 patients to enter the study [31, 32]. During the 1 year study period, 13,564 patients accessed at least one note through a web-based patient portal [33]. At the end of the study period, patients could decide to continue with open access or to terminate access. In post-intervention studies completed by 41 % of patients in the study, a majority of patients felt that they had more control of their care and reported improvement in medication compliance/clarity of regimen. Between 20 and 42 % of patients shared their notes with others. However, 26–32 % (dependent on clinical site) of patient responders had concerns about their privacy and 1–8 % reported that this access heightened their worry or confusion regarding their care. From a provider standpoint, there was no discernable change to the number/frequency of electronic messages sent from patients who were in this study. Most providers felt that this change had minimal effect on their practice or documentation methods. A minority of providers noted an increased time duration of documenting notes (up to 21 % based on site) and changing the content of their documents (3–36 %). The four major topics that providers noted change in documentation style were: mental health issues, substance abuse issues, obesity, and cancer [34]. At the end of the study, almost all patients included wished to continue their access (99 %), whereas no providers withdrew their access [33, 34].

These positive findings have led a group of providers from Harvard Medical School to recommend that behavioral health notes have the same open access, given that these notes are often excluded from patient portals or kept in a separate database in the electronic record [35]. They speculate that the hesitancy to include these records from a clinician/institution standpoint often stems from concerns that patients will find the information "devastating" and/or may feel unable to question or challenge information listed in the note, such as aspects of the examination or diagnosis. They argue that giving patients' access allows for the chance to review their clinician assessments in an unpressured, home environment, providing time to digest the presented material and potentially dissipate defense mechanisms seen in subsequent appointments. However, they support the idea that some notes should be able to be excluded by providers if deemed potentially harmful for that patient. They state: "By writing notes useful to both patients and ourselves and then inviting them to read what we write, we may help patients address their mental health issues more actively *and* reduce the stigma they experience." [35].

7.2.2 Maintaining the Doctor Patient Relationship

Does the use of technology during the patient visit negatively affect the patient-provider or caretaker-provider relationship from a patient perspective? Studies over the last 30 years have demonstrated that computer use within the examination room has not been seen as a barrier to patient care or satisfaction in the medical arena [36–42]. However, several researchers and psychiatric providers have speculated that the changes in room design and interaction style when actively using EHR

systems during the appointment may have a negative impact when working with patients with mental health issues [11]. Distancing of the therapeutic interaction by a computer or electronic device has been likened to having an extra person in the room, which may disrupt the quality of the therapeutic connection and overall care. A recent research study sought to explore this topic further, utilizing a pre- and post-test survey study of psychiatric patients after implementation of an EHR system. The non-validated screening tool utilized in adult psychiatric clinics did not demonstrate a statistically-significant difference in pre- and post-data when examining eight facets of patient care, including communication, interpersonal interactions, and confidentiality [10]. Despite the study being conducted on adults, data conferred may also be applicable to child and adolescent patients who often demonstrate a preference for multitasking with electronic devices and for utilizing these devices as a major form of communication.

The potential power, both positive and negative, of the electronic medical record does not end with the patient/provider interface when working with patients with mental health issues. Studies demonstrate that the transparency of EHRs is essential to targeting psychiatric issues that are often underreported, such as substance abuse issues. Studies have shown that patients with substance use issues often delay care for more than 10 years after initial substance use [43], which often first occurs in adolescence. Utilization of an EHR system may allow for better tracking of substance use in youth across multiple providers [44]. It may apply that there is benefit in tracking other internalizing mental health disorders, such as anxiety/OCD, eating disorders and depression as they may have a similar pattern of delay with reporting.

7.2.3 Effective Documentation for Child/Adolescent Patients

Given the push for broader EHR use, patients' wish for more transparency, and governmental requirements for improvements in interoperability between record systems, mental health providers are faced with the challenge of potentially altering their practice models and documentation techniques to meet these needs [45]. Some practitioners in the field have lobbied for replacing highly medical jargon with more common, everyday language in a push for a more patient-centered care [46]. As more patients have access to their notes, this change may help to avoid extended discussions regarding diagnostic terms during appointments.

In parallel with current media trends, working to move toward summarizing care in a "medical tweet," in which care/formulations are synthesized into a more easily digestible summary for both adolescent patients, their caretakers, and other providers alike [46]. Clinicians providing a nonjudgmental, descriptive summary of care can demonstrate a clear understanding of one's underlying issues and struggles [35]. This may help to reduce rogue cutting and pasting seen in many EHR system notes that unnecessarily lengthens notes and opens channels for confusion about care provided [46].

Studies have demonstrated that mental health professionals also include uncertainty terms, called "hedge phrases," in clinical documentation [47]. Hedging can lead to greater ambiguity and misinterpretations by patients and their caretakers, which may lead to more negative patient-provider encounters or impressions [48, 49]. This may partly be due to difficulties in the construction of DSM diagnoses as clinician attempt to re-apply adult definitions of disorders to youth patients. In addition, providers are also less likely to formally diagnose a potentially chronic and debilitating diagnosis in childhood (i.e. schizophrenia) without having some level of certainty. Being more transparent in our notes surrounding diagnostic uncertainty may improve communication and involvement with diagnostic discussions [50] and improve patient satisfaction [51].

A commonly excluded portion of medical and mental health care documentation is notation of patient strengths. Detailing these strengths, such as resiliency despite multiple adversities, support systems, attitudes, participation in care, academic performance, awards, and faith/spirituality, can be an effective message of validation for our patients [35]. This is especially important when working with children/adolescents, who often feel "trapped" in situations where control is marginalized or are forcibly brought to treatment by others when they "feel normal." Balancing the message of pathology and health to our patients gives them a clearer roadmap for overall health and lets them know that we are viewing them as an individual, not just a "patient with issues."

7.2.4 Tracking Longitudinal Safety and Risk

An often missed opportunity in many clinical encounters is the structured risk assessment. Technology can aid in documenting the discussion of safety with each clinical encounter by detailing evaluation of suicidality and self-harm. Suicide continues to be one of leading cause of death for the pediatric population, ranking second or third (based on the study/timeline) behind only unintentional injury. Suicide accounted for 5,104 deaths in the United States among persons 10–24 years of age in 2011 [52]. However, Milton et al. [53] demonstrated that a physician completed and documented a risk assessment 38 % of the time in patients who later committed suicide. Use of EHRs can better help to systematize safety assessments into each clinical encounter. Alerts can be built into the medical record to prompt providers to screen for safety issues with each visit, especially for patients who are at highest risk. Many EHR systems allow for screening to occur in the waiting room on electronic tablets or personal computing devices and be uploaded into the medical record. These screening forms can be very helpful with the pediatric population, as patients may be uncomfortable discussing issues of safety with their caretakers present. Transparency of safety issues in the record are important to decrease risk for legal action in an unfavorable outcome and to best collaborate with other providers, who share these inherent risks. Since elicited safety issues require breaking confidentiality between a pediatric provider and their caretakers, clear documentation of risks should not be problematic when reviewed by a patient or their family.

7.2.5 Role of Increased Functionality and Improved User Interface

As seen in these studies, harnessing the power of the EHR has been an exciting yet daunting task for mental health providers, especially in the field of child and adolescent mental health care. This fear has likely contributed to the delay or avoidance of use by many providers in the community. Giving providers a resource to efficiently track clinically-relevant information, such as vital signs, growth charts, labs, medication dosing, and information from self-reports, will undoubtedly augment the care of our patients. Some providers also note concern for "data overload," which has prompted some clinicians to advocate for tailored dashboards for psychiatric providers [54].

7.2.6 Discussing Technology Use with Youth and Their Parents or Guardians

As providers working with children and families, we are often asked questions by families regarding technology and media use by youth. Questions include how much cell phone or Internet use is appropriate, how to limit usage if excessive, how to manage tantrum or defiant behaviors when limits are set, and how to keep up with the latest technology or app that the youth are using? The Pew Research Center found in 2013 that 78 % of teens have a cell phone and almost half own smartphones. Approximately one in four youth utilize his or her smartphone as the primary access to the internet. 93 % of children have a computer or access to one in the home. In turn, 95 % of youth in the US have access to the Internet on a regular basis [55].

Screening for technology use has become vital in working with children and adolescents. The American Academy of Pediatrics recommends asking as least two questions regarding media use with each visit/intake: (1) How much recreational screen time does your child or teenager consume daily? and (2) Is there a television set or Internet-connected device in the child's bedroom? [56]. The findings from these questions can stimulate discussion regarding technology use and determine potential maladaptive use patterns that may interfere with sleep hygiene, school performance, socializing with peers, physical activity, and other spheres of functioning. It is important to assess a child's ability to limit use of technological devices in the home and caretakers' awareness of the amount/type of media use.

Providers are encouraged to take a developmental perspective on media and technology use based on the age of the patient [57]. For preschool-aged children, limiting screen time (television, mobile/portable devices, etc.) to less than 1 h per day in 15–30 min increments is recommended. For school-aged children, discussion of internet and media safety is imperative. Counseling children and parents on the fact that technology use is a "privilege, not a right" is important when balancing other demands (school, exercise, time with peers/family). Development of a "Family

Media Agreement" (found at: www.commonsensemedia.org) can be helpful to teach children not to disclose personal information online without parental support along with not sharing passwords or account information with others. Development of a family home plan can be vital, establishing clear rules regarding technology use, storing of devices, acceptable websites or forums, and rules and regulations with certain sites [56]. As children attempt to assert their independence in preadolescence and early adolescence, encouraging parents to take interest in their children's online activities and having children teach them about their favorite sites and devices can be helpful. Parents can also help with troubleshooting and problem-solving should unsafe situations arise. Establishing regular family meetings to discuss online topics and reviewing online activities, accounts and profile settings can be very helpful during this age [23]. Development of open discussion regarding media use can pay significant dividends in future years. In mid-adolescence to early adulthood, it is important for caretakers to monitor for warning signs of misuse and problematic, high-risk behaviors with technology/media, such as sexting [57].

Many youth have become dependent on technology as the primary form of communication. Limiting the use of mobile devices can cause heightened levels of anxiety and distress for high users. This is seen clinically in patients that we treat, but has also been examined by researchers who found statistically significant elevation in State/Trait Anxiety Inventory (STAI) scores after 1 h of limited cell phone access in high utilizing young adults [58]. Multitasking has become more of the norm in children and adolescents [59]. It is often perceived as a strength of the current generation and is felt by many youth to help them be more efficient. However, growing data suggests that youth who prefer to multitask or task-switch spend minimal time on a task prior to switching (6 min in one study), which may directly impact GPA/academic performance and impair study strategies [60].

7.3 Utilizing Technology with Behavioral Healthcare in Youth

Most pediatric patients will not know of a time without the availability of mobile devices. They have always had the internet at their fingertips. This availability has affected all aspects of life, from data searching, to research, to schooling, and to communication with others. Given the extensive use of online resources and mobile computing devices in the pediatric population, it is important for child and adolescent mental health providers to be aware of emerging technology and trends. As stated above, families will often look to providers for assistance with identifying maladaptive technology trends and overuse, which may potentially exacerbate or cause mental health issues. Youth often feel estranged from their caretakers, demonstrating an inability to effective communicate needs given the wide chasm in technological awareness that exists between their generation and their parents' generation. Helping patients and their caretakers' bridge this gap is an essential aim in effective care.

It is important to model techniques described in the previous section when working with youth. Asking questions about their favorite applications and sites can open doorways of discussion for even the most internalized and withdrawn patient. It is helpful to review each patient's preferred means of communication and interaction with peers and family. Reviewing potential dangerous online activity can be helpful as part of a thorough safety assessment for impulsivity. It is also helpful to review online activities by close peers, which can positively or negatively impact safety.

Some mental health providers have become more comfortable with the idea of employing patient-centered applications ("apps") or other technological advances into their practices [61]. There are thousands of medical applications, most of which are not systematically reviewed or approved by medical societies or the Food and Drug Administration (FDA). It is recommended that a provider fully review and explore a medical app prior to clinical use to determine issues of confidentiality, data sharing, and access to data. If apps are utilized in patient care, the risks and benefits should be fully reviewed with both the patient and parents/guardians prior to implementation, much like medication initiation [62]. Apps focusing on charting mood may be valuable in determining factors that contribute to worsening mood or mood lability (sleep, stressors, etc.). Some apps provide information on medications and treatment, allowing for reminders to take medication, chart mood, or perform therapeutic homework. Other apps target internet-based therapy, which will be covered in a separate chapter in this book. Due to the lack of research evidence to date coupled with active discussions on directions for clinical oversight [62, 63], these applications should not be viewed as a standard of care but may be helpful for augmentation of care in the right clinical situation [62].

Practical Scenario

An 10 year old male and his mother present to your outpatient child and adolescent clinic due to concerns about his recent behaviors over the last several weeks. Mother states that he is more irritable and short-tempered. His grades have recently declined as well. He has been more isolative in his room and asking to avoid interacting with the family, including not wishing to come to family meals or events on the weekend. He has become more preoccupied with using the computer and becomes very upset when his parents attempt to engage with him on his activities. In meeting with him individually, he reports opening a social media and social messaging account recently to connect with his friends. He reports that several older children at school have found out about this and began teasing him on these sites. Since this time, others have joined, which has caused him to be more upset and overwhelmed. He reports that his family does not know of his accounts, stating that his parents feel he is just working on schoolwork or watching videos while on the computer.

The first recommended goal of treatment would be to open up a dialogue about the child's recent online activity, since it has likely contributed to his worsening mood and behaviors. Given his age, he must have misrepresented his age to sign-up for these accounts, which may pose a risk if accessing adult-like content.

Additionally, he may not have fully understood recommended security features or the inherent risks of social media. Given the potential safety concerns, it would be important to work on making his family aware of these activities to gain support and guidance.

Despite the age restrictions on social media sites, some families are open to children misrepresenting their age to create accounts. This is strongly not recommended, since younger children may not have the emotional and social maturity to handle topics routinely discussed on these sites. However, if patients/families chose to do so, it is imperative that the parents monitor these accounts and have the log-in names/passwords to routinely check the accounts – being "friends"/contacts may not provide enough monitoring based on safety settings. It is important for the provider to work with the family on establishing rules around electronic devices in the home. We would recommend that a child of this age not have full access to the Internet and media sites in his room for extended periods of time, particularly overnight. We would recommend having the child use the computer or mobile devices in a more public setting and that family work to set-up parental controls to the internet. It would be helpful for the child to understand risks involved with these sites, including cyberbullying and inappropriate content that may be easily available, and for the family to closely monitor for changes in behaviors. Helping the child to disengage with these online peers will be important. Prioritizing schoolwork and other activities before allowing access to multimedia accounts will also be important in an effort to better balance functioning in all settings.

Discussion of appropriate technology use and safeguards is just as important as discussing sex and drug/alcohol use with children during this digital age. Opening dialogue early with children will help to avoid pitfalls in later adolescence. Additionally, parental modeling of appropriate technology use will be important. Avoiding use of mobile devices during family engagements (dinner, family functions, etc.) will help to model appropriate use for children. Joining with children's interest in multimedia sites will also stimulate dialogue and discussions with the child, opening doorways of communication in even the most reserved child.

7.4 Summary and Future Research/Trends

We are firmly entrenched in the electronic age. The use of electronic devices has altered the way we do business, communicate, travel, and interact. For years, medicine has lagged behind other areas of business with adoption of technology, especially in the area of computerized health records. Due to governmental standards and regulations, there is strong push for standardized use of EHRs across all providers – this train has left the station. Despite this, many mental health providers are still waiting to decide whether to jump aboard and run the risk of being left behind. It is important that all providers educate themselves on EHRs and the policies surrounding implementation. Both the American Academy of Child and Adolescent Psychiatry (AACAP) and American Psychiatric Association (APA)

have information on their websites for choosing the correct EHR system for your practice. We will need efficient and secure systems to connect with other providers in this multidisciplinary environment or risk being excluded from the discussion.

Psychiatrists have already been asked to change the way we treat patients over the years in all settings of care. Altering the way we document and communicate in this digital age is another necessary change. Historically, mental health providers have been wary to allow access of our treatment notes to our patients or other providers within the medical field, as seen by studies on providers after transitioning to an EHR system or before enrolling in a health information exchange. Transparency will be an essential part of care moving forward. Providers should review information listed in progress notes, including diagnoses and rationale for treatment. Based on multiple studies, our patients will welcome this transparency and the dialogue it brings. As mental health providers, we work to de-stigmatize mental health illness and treatment – sequestering all aspects of this treatment from the rest of medical record will not help to break down these barriers.

Future areas of research should include follow-up studies on provider perceptions of EHR use and need for sequestration of all psychiatric records, especially in the field of child and adolescent psychiatry. While policies are forming regarding regulation of patient portals and health information exchanges, especially as it pertains to access of records by minors, child and adolescent mental health providers need to continue to advocate for inclusion in these discussions. Interoperability of medical records for minors will be difficult to manage between different facilities due to the independent policies in each organization and laws regarding access to care in each state. Further research on the effects of additional transparency of child/adolescent psychiatric notes with patients and their caretakers would be ideal. Development of a study in psychiatry similar to the OpenNotes study would undoubtedly help our field move closer to our partners in medicine and help to identify issues to effect necessary change.

Child and adolescent providers also need to remain salient in the field of technology. We are seen as experts in childhood development – recognizing the intricate role that technological advances play in this development is vital. The families and caretakers of minors are often relying on us to assist them in this arena. Continued education in the area of technology should remain a focus in professional conferences and online learning modules for psychiatric providers. Discussion of technology in session can open doorways of communication with our patients and give us access to their social and emotional development. It can also help to identify early risk behaviors that may manifest in the future if left unattended. There is a growing field of research surrounding computer-aided psychotherapy tools and techniques, which will be an invaluable tool to augment the care of the child and adolescent patients we treat.

Overall, child and adolescent psychiatry must embrace technology as a field. During this time of healthcare transition, we must align ourselves with other technological advances in the field or risk endangering our seat at the table with other medical specialties. This will help us stay relevant, not only in the healthcare field but with our patients as well.

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Chapter 8
An Overview of Practicing High Quality Telepsychiatry

Donna Vanderpool

Abstract Providing psychiatric services remotely via telepsychiatry can be an effective care delivery model. Given the increasing need for psychiatric services, utilization of telepsychiatry is expected to increase for both consultation and treatment purposes. There are currently regulatory constraints, such as licensure, in-person examination, and prescribing requirements that pose significant barriers to the widespread adoption of telepsychiatry. However, these regulatory barriers are being evaluated by the states and are slowly being resolved. The steps to practicing quality telepsychiatry are: determine exactly what type of telepsychiatry you want to practice; determine how you want to practice and what technology will be used; address licensure requirements in the patient's state; address in-person examination and prescribing requirements in your state and the patient's state; address other relevant legal issues such as fraud and abuse, credentialing, and reimbursement requirements; determine the standard of care and how to meet or exceed it when practicing telepsychiatry; and evaluate the quality and effectiveness of the services rendered via telepsychiatry.

Keywords Adolescent psychiatry • Continuity of patient care • Controlled substances • Electronic mail • Liability legal • Malpractice • Medical informatics • Mental health services • Patient satisfaction • Social media • Suicide • Telefacsimile • Telemedicine • Teleradiology • Videoconferencing • Wireless technology

8.1 Introduction

The use of telepsychiatry has grown remarkably in recent years. Telepsychiatry refers to the delivery of psychiatric services via telemedicine. Telemedicine very broadly defined means the use of technology to enable the practice of medicine delivered remotely, with the physician and the patient in different locations, or the physician consulting remotely with another provider.

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8.2 History of Telepsychiatry

The earliest form of telemedicine utilized the telephone. The military, space programs, and various governmental organizations are credited with the development of telemedicine applications. Massachusetts General Hospital in Boston was instrumental in the early use of telemedicine by establishing a microwave link to a medical clinic at Logan airport in 1968, and then expanding services in the 1970s to schools, courts, and a prison. The first psychiatric application of telemedicine was employed in 1959 and involved the use of a two-way, closed circuit microwave television. This linked the Nebraska Psychiatric Institute of Omaha with the state mental hospital 200 miles away to provide consultations, education, training, and research [1].

In the 1990s, telemedicine expanded with greater adoption in healthcare systems and networks and within specialties such as teleradiology and teladermatology. Technology continued to expand, allowing the public to access more broadband and wireless technologies. So the use of telemedicine grew from large settings such as hospital systems to private practices.

The use of telemedicine, and specifically telepsychiatry, is expected to continue to expand given:

- Advances in technology that allow for improved patient assessment
- Increased technology options at decreased prices
- The value of consultation from remote experts
- The increase in patients with insurance seeking care under the Patient Protection and Affordable Care Act
- The shortage of psychiatrists, including sub-specialists such as child and adolescent psychiatrists
- Convenience, for both the patient and psychiatrist

8.3 Current Status of Telepsychiatry

8.3.1 Evidence Supporting Telepsychiatry

Evidence supports the efficacy of telepsychiatry, including research finding that telepsychiatry may be better than in-person treatment for some patient populations, particularly children and adolescents. After completing a review of outcomes across patient populations and diagnoses, Hilty et al. [2] concluded that telepsychiatry services "are unquestionably effective in most regards, although more analysis is needed. They are effective for diagnosis and assessment, across many populations (adult, child, geriatric, and ethnic), and in disorders in many settings (emergency, home health), are comparable to in-person care, and complement other services in primary care."

8.3.2 General Delivery Models

While there are many different telepsychiatry delivery models for providing treatment, they fall into three general models:

1. The patient is seen remotely at a facility or other formal telemedicine program. This can be with or without another clinician present for the session. This option typically presents the least professional liability risk as there are other clinicians available for emergencies, facilities tend to have policies and procedures, etc.
2. Direct to consumer, but via a third party company selling telepsychiatry services. Typically in this model, the company schedules the appointments, provides the equipment, may have control over the clinical record, etc. With this model, it is important to be alert for corporate practice of medicine concerns (see section "Corporate Practice of Medicine").
3. Direct to consumer, outside of a third-party selling telemedicine services. With this model, care can be delivered with or without a commercial telemedicine platform. Regardless, the psychiatrist needs to ensure the choice of technology is appropriate and does not violate any regulations under state or federal law, such as the Health Insurance Portability and Accountability Act (HIPAA).

8.3.3 Regulation of Telemedicine

Governmental regulation of telemedicine activities, while sometimes unrecognized, is extensive, but often inconsistent. This lack of a coordinated regulatory infrastructure is currently a significant obstacle to the implementation of telepsychiatry.

Practice of Medicine

The practice of medicine is regulated by the states, specifically by the legislatures (via statutes), as well as by state agencies, such as medical licensing boards, (via regulations, policies, guidelines, and position statements). This has resulted in a patchwork of regulations, with individual states varying widely in telemedicine requirements. There basically are only two points about which all states that have addressed telemedicine agree: (1) services are rendered where the patient is located, and (2) the standard of care for telemedicine services is the same as for in-person visits. Beyond that, there is no consistency in what is telemedicine. Most, but not all, states exclude telephone, e-mail and fax communication with patients, defining telemedicine as secure videoconferencing or store-and-forward technology.

Licensure

States' early regulation stemmed from online prescribing, whereby individuals went to a website, filled out an online questionnaire, and requested medications. The history was reviewed by a physician and the prescription was usually filled by the online pharmacy.

Case Example
In 2006, a Colorado psychiatrist was charged with a single felony count of practicing medicine without a valid California license. He had prescribed an antidepressant over the internet to a 19-year old college student in California. The student committed suicide, and the medical examiner found the prescribed medications in the patient's system. The psychiatrist was criminally prosecuted, but argued that California had no jurisdiction. After the California appellate court ruled that California did have jurisdiction, the psychiatrist pled no contest and was sentenced to 9 months in jail. The patient's parents also filed a civil lawsuit against the psychiatrist, the online company, and the pharmacy that shipped the medication. The parents settled their claims against the online company and the pharmacy, and dropped their suit against the psychiatrist [3].

As illustrated by this case, it is the patient's state where services are rendered, and states require physicians to be licensed in the patient's state; however, the specific license required varies by state. According to the Federation of State Medical Boards (FSMB) in its *Telemedicine Overview*, [4] the majority of medical and osteopathic licensing boards require a full license in the state where the patient is located; a few of these states have an exception for physicians licensed in bordering states. Some state boards require a special purpose or telemedicine license rather than a full license. And one state merely requires out of state telemedicine physicians to register with the licensing board to treat patients in its state.

Prescribing

While the issue of where telemedicine occurs is clear – where the patient is located – there are other regulatory issues that are much less clear. In reaction to the early internet pharmacies that were providing medication based solely on online questionnaires, states enacted laws and regulations requiring an in-person physical examination prior to prescribing. Congress also reacted to internet prescribing based on a questionnaire by passing the Ryan Haight Online Pharmacy Protection Act (Act) in 2008, which amends the federal Controlled Substances Act (CSA). Ryan Haight was a 17-year old male who easily acquired narcotics from an online website simply by filling out a questionnaire. The physician, without ever seeing

him, wrote the prescription and the drugs were mailed directly to Ryan's house. He overdosed on the narcotic and died. The Act bans the selling or dispensing of prescription drugs via the internet when the online pharmacy has referred the customer to a physician who then writes the prescription without ever seeing the patient. The Act also amends the CSA's requirement of an in-person evaluation (with the patient in the physical presence of the prescriber) to allow an exception for telemedicine, *as defined by the CSA*. Under the CSA's definition of telemedicine, the remote treatment must occur with the patient in a hospital or other facility registered with the DEA and by a prescriber with a DEA license in the patient's state. There are exceptions to the licensure requirement, such as providers in the Veterans Health Administration, and other situations where the government does not require licensure in the patients' state.

Not all states have moved on from online questionnaires to embrace appropriate telemedicine models that allow for a remote evaluation that is the equivalent of an in-person evaluation. State requirements for in-person visits are not always explicit, much less consistent. Some states' requirements can be found or may be implicit in provisions relating to the physical examination or establishment of the physician-patient relationship, even when they have not been explicitly stated in relation to the practice of medicine.

Licensing Board Discipline Example
The Idaho Board of Medicine disciplined an Idaho-licensed physician for an antibiotic prescription after a telephone consult. This was done through an online company "Consult-A-Doc" which was subsequently acquired by Teladoc. Teladoc had to stop servicing its more than 20,000 members in Idaho because of this Board decision. In its opinion, the Board stated that a telephone patient encounter is telemedicine. The physician was disciplined for, among other things, failure to do an appropriate physical examination of a patient complaining of a respiratory tract infection, and for being part of the company's ads in Idaho (she was found to be assisting the company with the corporate practice of medicine, discussed further in section "Corporate Practice of Medicine") [5].

Documentation

Physicians are required under state law to create and maintain appropriate treatment records. However, specific documentation requirements can vary by state. When treating patients out of state via telepsychiatry, psychiatrists must be familiar with and comply with both states' documentation requirements.

Ownership and control of the clinical record from a telepsychiatry session must be clarified to ensure the record's availability in the future, whether for subsequent

treatment purposes, or in the event of litigation related to the treatment. Use of a delivery model involving a facility should not be problematic from a documentation retention perspective, as the facility will likely maintain the records as with any encounter in the facility. Similarly, use of a direct delivery model, without the involvement of any third party vendor, should pose no documentation retention issue, as the treating psychiatrist will maintain the record as is done with patients seen in the office. However, if there is a third party vendor involved, either a company through which telepsychiatry is provided or an internet platform to allow direct to patient communication, the issue of documentation needs to be addressed. If the third party retains the documentation, how can you be assured it will be available if needed in the future? If so, will it be in a format that you can use, or in the third party's propriety format? What if the third party goes out of business?

Confidentiality and Security of Patient Information

HIPAA, the Health Information Technology for Economic and Clinical Health (HITECH), and state confidentiality, data security, and consumer protection laws are highly relevant to electronic patient information. All breaches of confidentiality can have significant consequences under state confidentiality and consumer protection laws. Covered entities under HIPAA and HITECH face additional penalties under federal law for breach of electronic protected health information (basically medical and billing records). Federal civil penalties for HIPAA violations include up to at least $50,000 for each violation, up to a $1.5 million maximum for identical violations per calendar year. Federal criminal penalties for HIPAA violations can reach $250,000 and 10 years imprisonment.

Fraud and Abuse

Fraud and abuse issues comprise another regulatory concern. Initially created to prevent increased costs to federal healthcare programs, such as Medicare and Medicaid, states have enacted similar laws with broader applications. While a comprehensive legal analysis is beyond the scope of this chapter, there are several areas for which legal advice should be sought to prevent violations. Such areas include, but are not limited to:

- Anti-Kickback Statute: Prohibits the offering, inducing, or paying for referrals. For example, it is illegal for a hospital to pay a physician providing telemedicine services more than the fair market value to induce the physician to bring patients to the hospital.
- Anti-Trust Law: Prohibits, among other practices, price-fixing between providers. For example, physicians within a telemedicine network could violate anti-price fixing laws.

- Physician Self-Referral/Stark Law: Prohibits physicians from referring patients to entities in which the physician, or the physician's family, has an ownership interest.
- False Claims Act: Prohibits false or fraudulent claims from being submitted to the government for payment. For example, telepsychiatrists could violate this law by submitting a claim for telepsychiatry services rendered to a patient in a state where the psychiatrist did not have a license, or otherwise failed to comply with the law in the patient's state.

One practical tip is to very carefully analyze, or have an attorney analyze any arrangement involving telemedicine equipment or services for free or for less than fair market value for potential fraud and abuse concerns.

Credentialing

If you will be providing telepsychiatry services through a hospital, the Centers for Medicare and Medicaid and The Joint Commission allow credentialing by proxy. This permits the credentialing and privileging decisions by the distant-site hospital to be relied upon. While eliminating duplicative credentialing, the process is involved and time-consuming.

Reimbursement

Compliance with governmental payment requirements is yet another obstacle. Medicare has coverage for certain telemedicine services, currently limited to patients at a medical facility (not the patient's home) in specific geographic, rural locations. Each state's Medicaid is different in terms of coverage for telemedicine. Most states provide some type of reimbursement for telemedicine services. As illustrated by the Oklahoma discipline example discussed in Sect. 8.4.2, each state's Medicaid program can have rules related to telemedicine, such as requiring informed consent to telemedicine, use of only approved telemedicine networks, etc. Failure to comply with these requirements can lead to discipline by the licensing board. As noted by the American Telemedicine Association (ATA) in its *State Telemedicine Legislation Tracking,* [6] reimbursement for telemedicine services by private insurers varies by insurer, and is required by a number of states.

Corporate Practice of Medicine

Many states prohibit corporations from practicing medicine and from hiring a physician to provide professional services. The rationale behind this prohibition is that only a physician can make medical judgments and corporations should not be

allowed to control clinical decision-making. There are narrow exceptions, such as for licensed hospitals. Moreover, physicians may be disciplined by the licensing board for aiding a corporation in the practice of medicine. See the licensing board discipline example in section "Prescribing".

8.3.4 Professional Liability

Patient safety and patient satisfaction are key concerns in telepsychiatry, consistent with all care delivery models. As evidenced by the examples in this chapter, licensing boards are disciplining physicians for telemedicine activities. Currently there is a paucity of reported medical malpractice lawsuits involving telepsychiatry. Two legal database searches revealed only one relevant reported telepsychiatry lawsuit, which is the *White v. Harris* case [7] discussed in Sect. 8.4.1. Of course, other telepsychiatry lawsuits could have been brought, but they may have been dropped or settled, so they are not publicly reported. Even expanding the search to telemedicine lawsuits, no reported lawsuits were found addressing either the general appropriateness of telemedicine or the appropriateness of the specific telemedicine services provided. There were older cases involving internet prescribing based on online questionnaires (as examples, see the *Hageseth* case [3] in section "Licensure" and the *Holzhauser* case [8] in Sect. 8.4.6).

The laws related to telemedicine, and specifically telepsychiatry are developing at a much slower rate than technology is developing. Plaintiff malpractice attorneys, typically working on a contingency fee basis under which they only get paid if they win, do not like to take cases that they are not confident they can win. So cases with non-existent, developing, and contradictory law are not attractive to the plaintiff's bar.

Once the relevant law develops, producing court guidance for telepsychiatry, there will be more malpractice cases involving telepsychiatry. Plaintiffs will have to prove the same four elements as in any medical malpractice case – the psychiatrist owed a duty to the patient, the psychiatrist was negligent (failed to meet the standard of care), the patient suffered damages, and the damages were caused by the psychiatrist's negligence. Given that plaintiff has to prove all of these elements in litigation, but not in a licensing board complaint, board complaints will continue to be a risk faced by telepsychiatrists.

It is also important to confirm coverage for your specific telepsychiatry activities under your professional liability insurance policy. The American Medical Association (AMA) recommends, in its *Coverage of and Payment for Telemedicine Report* [9] "that our AMA encourage physicians to verify that their medical liability insurance policy covers telemedicine services, including telemedicine services provided across state lines if applicable, prior to the delivery of any telemedicine service."

8.4 How to Practice Telepsychiatry

8.4.1 Step 1: Determine Exactly What Type of Telepsychiatry You Want to Practice (Fig. 8.1)

This determination requires an examination of many questions pertaining to potential telepsychiatry services, as shown on Fig. 8.1. What exactly do you want to do? Do you only want to provide consultations? If so, to whom? Providing consultations to other psychiatrists is the least risky in terms of professional liability. With a true consultation, the consultant does not prescribe or write orders, and the psychiatrist receiving the consultation is free to accept or reject the consultant's opinion. Providing consultations to other physicians, such as pediatricians and primary care physicians is still very low risk. Maybe you are interested in providing consultations to non-physician providers such as nurse practitioners, psychologists, and social workers. True consultations are still low risk, but with non-physicians, the issue is whether they can truly ignore your opinion. The relationship may be viewed as a supervisory one, which increases your liability risk. Or maybe you want to provide consultations to patients. This is riskier, as it may be difficult for patients to understand that you are rendering services, but not treating. You should manage expectations and make your limited role clear so the individual understands that you are not treating. However, even when steps are taken to clarify your role as a consultant, there is no inoculation against potential professional liability risk.

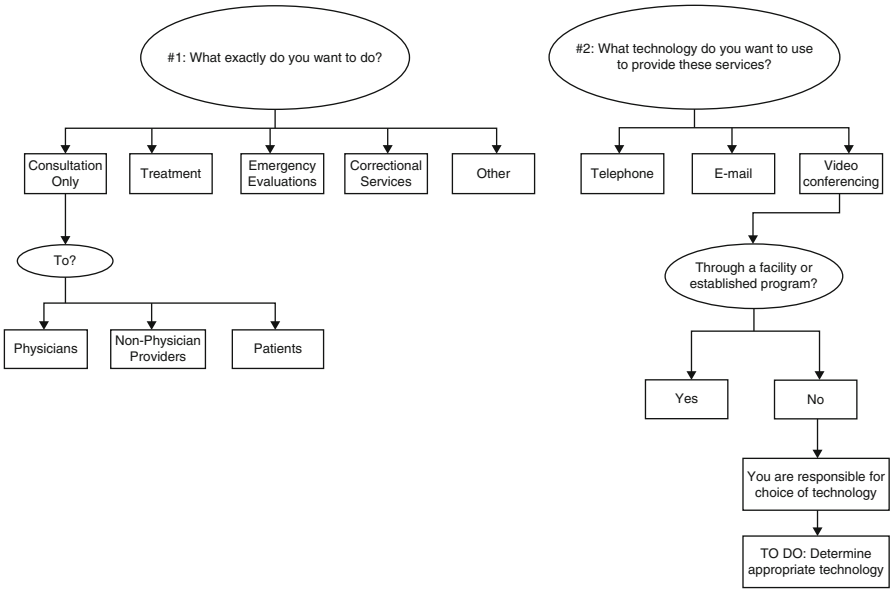

Fig. 8.1 Preliminary determinations for telepsychiatry [10]

Case Example
At the request of a 14-year old patient's treatment team, the psychiatrist performed a 90 minute consultation via telemedicine. In the signed informed consent document, the psychiatrist explicitly stated that the scope of his services was limited. At the conclusion of the consult, the psychiatrist offered recommendations for the patient's treatment, specifically regarding medication, as requested by the treatment team. Ten months later, the patient suicided by a variety of medications, none of which had been recommended by the psychiatrist. The psychiatrist was among the many defendants named in a lawsuit subsequently brought by the patient's family. Prior to trial, the trial court granted the psychiatrist's motion for summary judgment, holding that no duty existed on the part of the psychiatrist at the time of the death. The patient's family appealed this dismissal of the consulting psychiatrist from the lawsuit. The state Supreme Court reversed the trial court, holding that through the consultation, a limited doctor-patient relationship was established, and therefore the psychiatrist assumed a duty to act in a manner consistent with the standard of care and to not harm the patient. The Court noted that it was too early in the case to determine the scope of the psychiatrist's duty and the standard of care, and left it to the trial court to continue with the case against the psychiatrist and the other defendants [7].

Do you want to treat patients? Patient selection is key, as telepsychiatry is not appropriate for every patient. Technology's suitability for a specific patient will depend on the needs of that patient. There are many options for treating patients, including remotely seeing patients who are in a facility, such as a clinic or hospital. In this model, there may or may not be another clinician in the room with the patient. At the other end of the spectrum, the patient may be sitting alone at home. Telepsychiatry may be the only contact, or the telepsychiatry visits may be supplemented with in-person visits. If the patient is not seen through a facility, how will the patient's needs be met remotely? Does the patient have access to other local mental health professionals? How will the full continuum of care be provided?

Do you want to provide emergency evaluations? You will need to be familiar with all applicable laws. State laws may prohibit telepsychiatrists in different states from evaluating for civil commitment. Even remote evaluations done by a psychiatrist in the same state as the patient may not met legal requirements, such as those requiring two psychiatrists to perform in-person evaluations (see *Pinal County Mental Health* [11] in 8.4.6).

Do you want to provide telepsychiatry services to jails and prisons? This is a well-established use of telepsychiatry. Or do you have a different type of telepsychiatry practice in mind? You will need to check the applicable state

law – statutes, regulations, and licensing board policies. For example, for those considering remote supervision, some states do not allow out of state physicians to supervise in-state providers.

8.4.2 *Step 2: Determine How You Want to Practice Telepsychiatry (Fig. 8.1)*

As shown on Fig. 8.1, you'll also need to determine what method you want to use. Most – but not all – states define telemedicine to include videoconferencing, but exclude treatment delivered via e-mail, telephone, and fax. If you want to practice telepsychiatry via videoconferencing, is it through a relationship with a healthcare facility or other established telemedicine program (university, correctional facility, etc.)? If so, there may be less risk, as facilities tend to have greater resources and policies and procedures, addressing, for example, continuity of care and emergencies. If you are not practicing via a formal telemedicine program, there are basically two delivery models to consider. The first is to provide services through an established online telepsychiatry provider, and the second is to do it on your own.

When considering utilizing an online telepsychiatry provider, there are additional concerns related to the service that need to be addressed. As always, the technology used must be appropriate for clinical and regulatory purposes. You would need a Business Associate Agreement, by which the vendor agrees to have administrative, physical, and technical safeguards to protect patient information. Also, the FSMB, in its *Model Policy for the Appropriate Use of Telemedicine Technologies in the Practice of Medicine,* [12] has extensive requirements when online services are utilized. These requirements include disclosures (related to services provided, financial interests, qualifications of physicians, ownership, etc.), as well as mechanisms for patients to access personal health information, provide feedback, and register complaints. The FSMB model policy also includes a prohibition of "advertising or promotion of goods or products from which the physician receives direct remuneration, benefits, or incentives (other than the fees for the medical care services)."

When utilizing telepsychiatry without the involvement of a technology vendor or company that offers telepsychiatry, the psychiatrist is responsible for the choice of appropriate technology that is effective for providing the intended care. In determining what the appropriate technology is, there are standards that must be reviewed. Ensure that the clinical and legal requirements for telepsychiatry can be met so that you will meet the standard of care with that particular type of technology. For example, confirm that the bandwidth and resolution are sufficient to allow an adequate assessment and evaluation of side effects such as tics. The ATA has issued *Core Operational Guidelines for Telehealth Services Involving*

Provider-Patient Interactions [13] which includes many technical standards, such as bandwidth, resolution, and frames per second. The ATA guidelines include other useful recommendations, such as ensuring the telepsychiatry platform used does not include social media functions that notify users when anyone on a contact list logs on.

Compliance with HIPAA and state law requirements for the security and confidentiality of patient information is essential. To ensure the appropriateness of the technology to be utilized, know and comply with:

- HIPAA and similar state confidentiality law
- State telemedicine statutes
- State telemedicine regulations, policies, guidelines
- Payer requirements, including those of state Medicaid programs

Licensing Board Example
The Oklahoma Board of Medical Licensure and Supervision had a telemedicine policy that required, among other things, use of a telemedicine network that meets all technical and confidentiality standards as required by state and federal law, and written consent from the patient stating their agreement to participate in telemedicine. The state Medicaid program provided for reimbursement of telemedicine visits if, among other things, HIPAA and state privacy requirements were maintained and followed at all times, and the network used was on the list of Medicaid-approved telemedicine networks. Three different individuals complained about Dr. Trow to the Oklahoma licensing board. Two complained about his prescribing, and the third complainant, from the state Medicaid program, alleged that the physician was practicing telemedicine via Skype on Medicaid members but Skype is not a Medicaid-approved network. Dr. Trow admitted this, but said he thought it was his employer's responsibility to ensure these requirements were met. The Medicaid representative also complained that he prescribed controlled substances without an in-person evaluation and that he failed to get patients' consent to the use of telemedicine. Dr. Trow was found guilty of nine counts of unprofessional conduct, but nothing in terms of inappropriate use of technology. However, following this case, the medical board issued rules stating that internet contact such as web-based video does not meet the equipment requirements, and therefore an actual face-to-face patient encounter is required, and the technology used must be HIPAA compliant [14].

As previously mentioned, HIPAA's Privacy Rule requires a Business Associate Agreement from any third party that creates, receives, maintains, or transmits patient-identifying information. Note that some technologies never store the data,

but are a mere conduit, and are therefore not a Business Associate under HIPAA. It is important to read the fine print related to any specific technology, such as the privacy policy, to ensure messages are not stored if a technology vendor claims to only be a conduit. If messages are stored for any amount of time, no matter how brief, the vendor is not a conduit and must sign a Business Associate Agreement. In addition to the Agreement promising to protect the security, confidentiality, and integrity of patient information, HIPAA also requires business associates to notify physicians of any breach of their patient information, utilize encryption, have audit trails, etc.

Also be aware of and comply with pertinent professional organizations' standards and guidelines as they are part of any standard of care determination. Such professional organizations include the AMA, American Academy of Child and Adolescent Psychiatry (AACAP), American Psychiatric Association (APA), FSMB, and the ATA.

Given the complicated and extensive nature of these legal requirements, it is likely that consultation with a health information technology professional and a healthcare attorney will be necessary. Taking the proper steps before getting started will benefit you as well as your patients.

8.4.3 Step 3: Address Licensure (Fig. 8.2)

Once you have determined what you want to do and how you want to do it, you can move to the legal hurdles (Fig. 8.2), the first one being licensure. Will you be providing telepsychiatry services to patients located in a different state? If so, contact the medical board in the patient's state to determine if you need a license from that state. Why is it so important to determine if licensure is required in the state where the patient is located? The New York State Office of Professional Medical Conduct in its *Statement on Telemedicine* [15] answered it best by stating "The practice of medicine in New York State by someone not authorized to practice in New York state may constitute the illegal practice of a profession, subject to investigation and prosecution by the state attorney general."

8.4.4 Step 4: Address In-Person Examination and Prescribing Requirements (Fig. 8.2)

Even if you are only providing care via telepsychiatry to patients in states in which you are already licensed, you must understand the boards' position on remote treatment and evaluation, as shown on Fig. 8.2. As mentioned above, states and licensing boards reacted to online prescribing from questionnaires by enacting

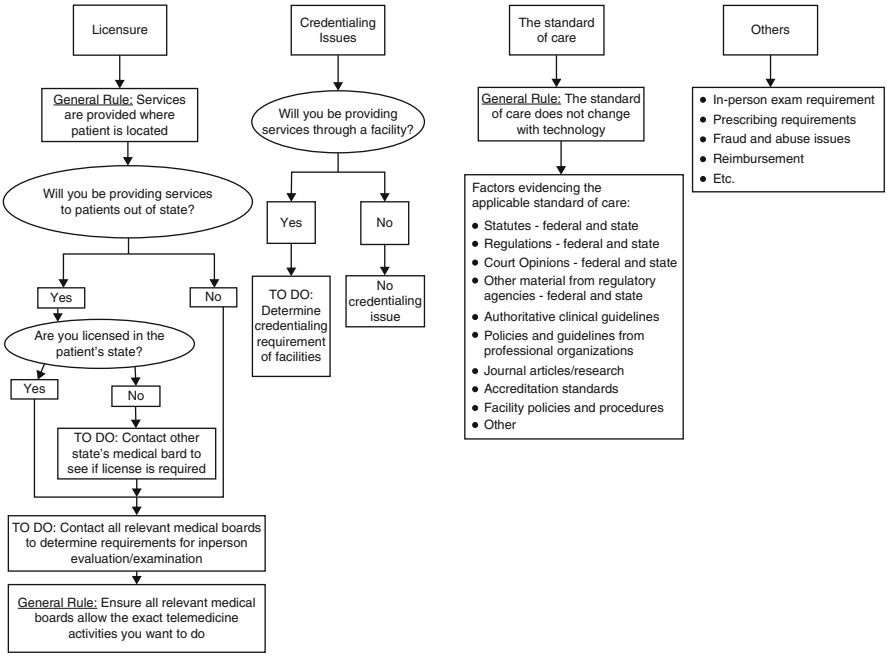

Fig. 8.2 Legal hurdles for telepsychiatry

laws and regulations requiring an in-person examination prior to prescribing. Some boards are starting to acknowledge that telemedicine is different from internet prescribing. Some boards state that an in-person examination is not required. For example, North Carolina Medical Board in its *Telemedicine Policy Statement* [16] states the following:

> "Licensees using telemedicine technologies to provide care to patients located in North Carolina must provide an appropriate examination prior to diagnosing and/or treating the patient. However, this examination need not be in-person if the technology is sufficient to provide the same information to the licensee as if the exam had been performed face-to-face."

Other states say it depends, for example on where the patient is located. According to the Texas Medical Board's Rule §174.4, if the patient is not at an official medical site, such as a hospital, there must be a face-to-face evaluation by some physician. Or it could depend on prescribing. For example, the Rhode Island Board of Medical Licensure and Discipline in its *Guidelines for the Appropriate use of Telemedicine and the Internet in Medical Practice*, [17] states "the board specifically highlights that prescribing controlled substances without an established in-person physician-patient relationship is prohibited."

8.4.5 Step 5: Address Other Relevant Legal Issues (Fig. 8.2)

As previously discussed, other potentially relevant legal issues include understanding and complying with the requirements for appropriate credentialing and privileges, complying with reimbursement standards, and avoiding fraud and abuse problems, as shown on Fig. 8.2.

8.4.6 Step 6: Determine the Standard of Care and How to Meet or Exceed It When Practicing Telepsychiatry (Fig. 8.3)

Technology does not change the standard of care. As stated by the Florida Board of Medicine in its Rule 64B8-9.0414, "Telemedicine equipment and technology must be able to provide, at a minimum, the same information to the physician . . . which will enable them to meet or exceed the prevailing standard of care for practice of medicine."

There are many practical issues to be considered related to use of the technology and meeting the standard of care, such as framing yourself in the video display, and gaze angle. Shore [18] has written on this topic and has compiled useful guidance for many of the practical issues to ensure a professional telepsychiatry encounter. The ATA, in its *Practice Guidelines for Videoconferencing-Based Telemental Health,* [19] offers additional practical advice for the room setup (avoid a distracting

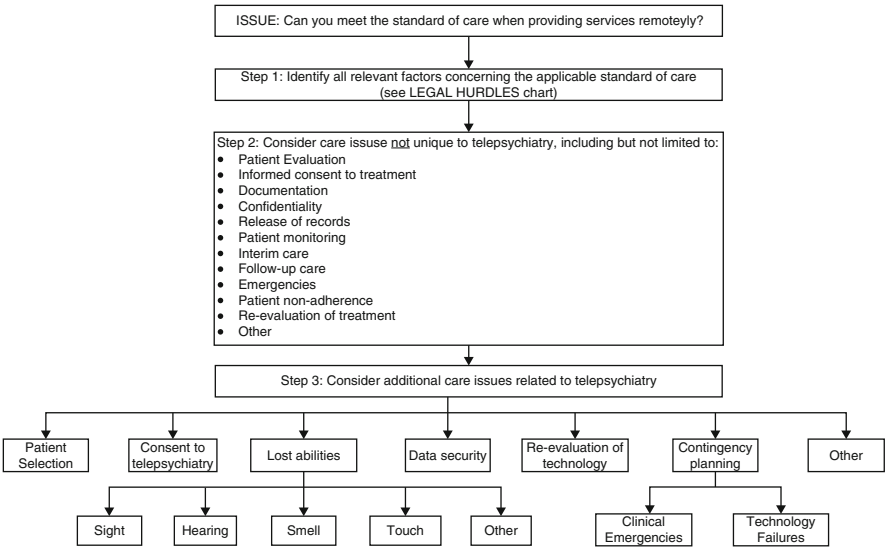

Fig. 8.3 Clinical hurdles for telepsychiatry [10]

background), and lighting (ensure a well-lit room but do not position yourself in front of a window). Also, your professional presentation (your appearance, language, and demeanor) should match that utilized in a psychiatric office.

State licensing boards have been unanimous in stating that the standard of care is the same whether the patient is seen in-person, or through technology-enabled patient care. The physician retains the same responsibilities of obtaining informed consent, ensuring the privacy of medical information, etc. While there is no single standard of care for any given patient, there are factors that can evidence the applicable standard of care for any clinical care issue, including:

- Federal and state laws, promulgated by legislatures
  - Examples: HIPAA, CSA
- Federal and state regulations, promulgated by agencies
  - Examples: HIPAA's Security Rule, state regulations for prescribing via telemedicine
- Federal and state court opinions
  - In one example, the physician saw an advertisement for a company providing prescriptions over the internet. Patients were required to provide prior medical records for the past 2 years and a photo ID. This information was provided to the physician who normally reviewed it the day before her telephone consultation with the patients. The physician would consult with each patient, typically for 20–30 minute. The licensing board permanently revoked her license for prescribing controlled substances without personally examining patients. The board specifically wrote in the decision that the physician failed to contact anyone with the board to determine whether prescribing over the internet was permissible in the state. The physician appealed, but the board's decision was upheld by the trial court and the appellate court [8].
  - In another case, the appellate court held that a psychiatrist's evaluation of a patient via a remote video-conferencing system did not comply with the state's statutory requirement of conducting a complete physical examination for involuntary treatment [11].
- Other materials from federal and state agencies
  - Examples include prescribing guidelines and guidelines for utilizing telepsychiatry in civil commitment evaluations
- Authoritative clinical guidelines; relevant examples include:
  - AMA: *Coverage of and Payment for Telemedicine* [9]
  - AACAP: *Practice Parameter for Telepsychiatry with Children and Adolescents* [20]
  - APA: *Telepsychiatry via Videoconferencing* [21]
  - FSMB: *Model Policy for the Appropriate Use of Telemedicine Technologies in the Practice of Medicine* [12]

  - ATA:
    - *Core Operational Guidelines for Telehealth Services Involving Provider-Patient Interactions* [13]
    - *Video-Based Online Mental Health Services* [22]
    - *Practice Guidelines for Videoconferencing-Based Telemental Health* [19]
    - *Evidence-Based Practice for Telemental Health* [23]

- Policies and guidelines
- Research and journal articles

Once you are familiar with all the relevant standard of care factors, then consider the care issues common to all care – services rendered in-person or via telepsychiatry. As indicated on Fig. 8.3, some of these common care issues include:

- Patient evaluation, including history and physical examination to establish the diagnosis
- Informed consent to treatment
- Documentation
  - There may be extra documentation for telepsychiatry sessions, such as the location of the patient and the psychiatrist, type of equipment used and any malfunction, who was present during the visit, etc. [21]
- Confidentiality – compliance with federal law and the law of both patient's and psychiatrist's state
- Patient monitoring
- Follow-up care
  - From the New York State Office of Professional Medical Conduct's *Statement on Telemedicine* [15]: "The physician, having established a relationship, has the duty to be available for care when it is needed or to see that there is reliable provision for care and advice. The fact that the advice or treatment occurred via electronic media does not change the requirement for follow-up care." How will your telepsychiatry patients reach you between scheduled visits? How does your patient report adverse effects of medication?

You also need to think through the additional patient care issues unique to telepsychiatry:

- Patient selection
  - Psychiatrists must evaluate whether telemedicine is an appropriate care delivery mechanism for a given patient. While children and adolescents may be very comfortable with the technology, telepsychiatry may not be appropriate for those with cognitive impairment. Moreover, technology is only a tool that can address lost abilities (sight, smell, etc.) when treating patients remotely. But not all abilities can be restored, so telepsychiatry will not be appropriate for every patient.

  - Questions to ask yourself:
    - What conditions do I routinely treat?
    - Which of those conditions can I treat remotely?
    - Will lost abilities be a problem?
    - Is there someone local to assist as needed?
    - Where is the patient receiving services?
    - Can I treat this condition in this environment?
  - Questions to ask yourself about an individual patient:
    - Is he sufficiently tech-savvy?
    - Is he stable?
    - Do I trust the patient?
    - How will the use of telemedicine impact the patient?
      - Create distance?
      - Put patient more at ease?
      - Will there be sufficient privacy?
    - Would it be difficult to terminate the treatment relationship?
- Informed consent to telepsychiatry
  - According to the APA, patients must be given the option of not participating in telepsychiatry [21]
- Lost abilities, including possibly:
  - Sight
  - Depending on your telepsychiatry model, you may not know where your patient is physically located. Uncertainty about patient location can pose significant challenges for responding to emergencies. Unless patients are in a telemedicine facility, the patient should disclose their exact location at the outset of every telepsychiatry session in case emergency services need to be called.
- Data security – federal and state law must be complied with (e.g., 42 CFR Part 2 regulating the confidentiality of drug and alcohol treatment information)
- Contingency planning, including:
  - Clinical emergencies – identify potential local collaborators to help with managing emergencies, as well as being familiar with commitment procedures.
  - Equipment failures – protocols are needed to identify specific steps to deal with equipment failures and alternative methods should be available to complete the session, such as by telephone.

Note that while this is a comprehensive list, it is not necessarily an exhaustive list due to all the possible variables that may be involved in specific circumstances with specific patients and situations.

8.4.7 Step 7: Evaluate the Quality and Effectiveness of the Services Rendered via Telepsychiatry

As with psychiatric services delivered in-person, the appropriateness and efficacy of treatment must be constantly considered. Part of this determination involves evaluating the patient's satisfaction and your satisfaction with the delivery of care via telepsychiatry. As always, you should focus on ensuring that your treatment will help the patient progress toward treatment goals.

It may be necessary to terminate if you determine that telepsychiatry is not meeting the patient's clinical needs or the patient is dissatisfied with the remote treatment. In the event termination of the psychiatrist-patient relationship is necessary, the patient should not be abandoned. Rather, the standard termination process would need to be utilized – discuss the need for termination and treatment recommendations with the patient, provide sufficient notice for the patient to find a new provider, provide resources or referrals for future treatment, confirm with termination letter, and offer to forward records at the direction of the patient.

8.5 In the Future

The use of telepsychiatry will continue to expand in the future, and we can expect to see additional regulation, but also increased reimbursement.

8.5.1 States Will Continue to Address Telemedicine

States will continue to address the need for an in-person visit as a requirement for a valid patient-physician relationship and as a requirement for prescribing medications, including controlled substances. The issue of state licensure may become moot if the FSMB's draft Interstate Medical Licensure Compact [24] is adopted by the states. Such a compact is not a national license, but rather an agreement between many states allowing a physician licensed in one state to seek an "expedited license" from one or more additional states. Licensing boards would share disciplinary information and licenses can be revoked by any state in the compact where the physician is treating patients.

8.5.2 Telemedicine Will Be Utilized More to Meet the Needs of an Increasing Number of Patients with Insurance

The increase in telepsychiatry will be as a result of, among other things:

- Increased reimbursement for telepsychiatry services by Medicare, Medicaid, and private health plans.

- Continued promotion of telemedicine companies by health insurers for use by their insured members [25].
- Promotion of telemedicine by non-physician providers, including allowing supervision across state lines.

8.5.3 Telepsychiatry Programs Will Be Accredited

The ATA will be launching its accreditation program for physicians providing online, direct to consumer healthcare consultations. Accreditation will be based on guidelines codifying best practices [26].

8.5.4 Telepsychiatry Will Continue to Move Beyond National Borders

As more telepsychiatry is done internationally, there are additional regulatory concerns to be addressed, such as licensure, privacy, and data protection. United States-based physicians that are covered entities under HIPAA are responsible for patient information sent to all Business Associates, whether in the United States or abroad, but HIPAA is only enforceable in the United States. Also, be sure to understand professional liability insurance coverage, or lack of coverage, when treating patients located outside of the country.

8.6 Pearls of Wisdom – Risk Management Advice (Figs. 8.4 and 8.5)

Figure 8.4 provides a summary of the risks associated with telepsychiatry that have been discussed above. Figure 8.5 provides an overview of strategies to manage telepsychiatry risks. Before you start doing telepyschiatry:

- Determine what you want to do and how you want to do it, including the choice of technology.
- Be sure you understand all of the relevant laws and other standard of care factors.
- Evaluate your ability to comply with all legal requirements – check with all applicable licensure boards to ensure the appropriateness of what you want to do and how you want to do it, including licensure requirements, in-person examination requirements, prescribing requirements, etc.
- Understand the importance of the patient's location – that is where services are rendered, so you may need to be licensed there, you need to follow that state's laws, and you must know the patient's location in case of a clinical emergency.
- Determine your ability to meet the standard of care, which is the same for telepsychiatry as it is for in-person. Consider which tasks would be expected if

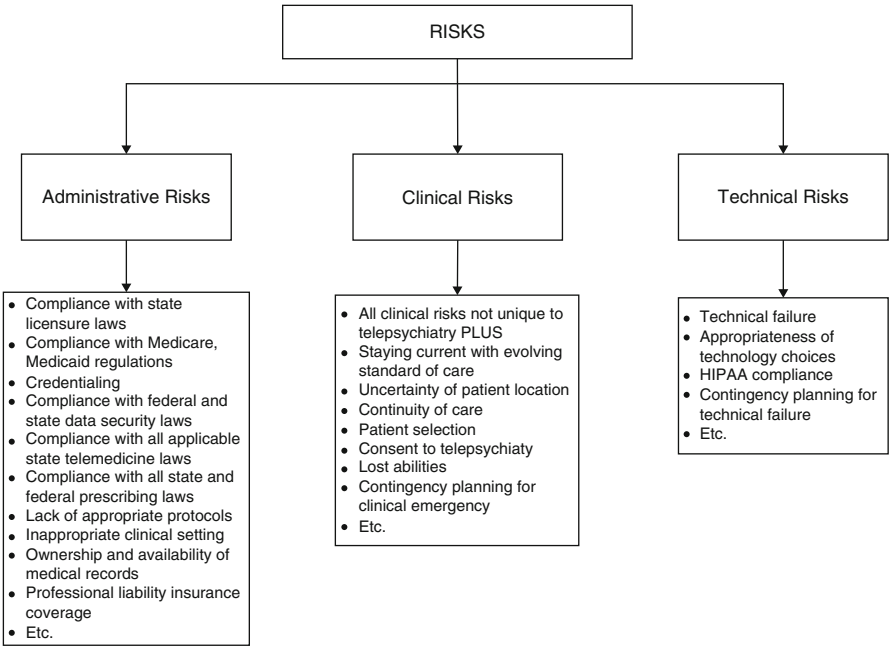

Fig. 8.4 Telepsychiatry risks [10]

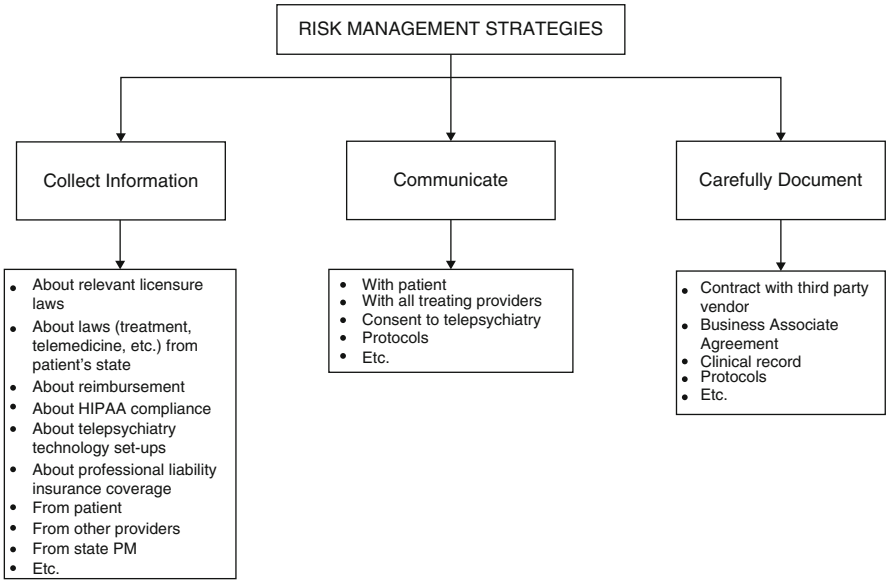

Fig. 8.5 Telepsychiatry risk management strategies [10]

the encounter was taking place with you and the patient in the same room. Then examine the ways in which the circumstances surrounding the arrangement – including the particular technology to be used – are likely to impact your ability to perform those tasks.
- Confirm coverage for telepsychiatry services, including to patients located out of state (or out of the country, if applicable) with your professional liability insurance company prior to providing telepsychiatry services.

Once you are providing services via telepsychiatry:

- Consider what abilities are lost when treating remotely.
- Carefully evaluate whether a particular form of telepsychiatry is appropriate for a given patient, both at the beginning of the treatment relationship and periodically as treatment progresses.
- Ensure the patient has a basic understanding of the technology used.
- Be sure to have an appropriate contingency plan for emergencies, including local emergency services telephone numbers.
- Obtain appropriate consent from the patient after discussion, including risk of confidentiality breach, and the chance that telepsychiatry may not be appropriate for future treatment.
- Document adequately and ensure the confidentiality, security, integrity and availability of the clinical record.
- Continually re-evaluate your satisfaction, as well as the patient's satisfaction with the remote treatment.

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Chapter 9
Social Media

John S. Luo and Brian N. Smith

Abstract Social media use on the Internet has become the predominate activity online. It incorporates elements of Web 2.0, a construct where an architecture of participation, collective intelligence, and collaboration define how the website is to be used. While Facebook, LinkedIn, and Twitter dominate the social media landscape, healthcare and health information are now using these social media tools. The boundary between personal versus professional social media has blurred, where patients, providers, and healthcare organizations navigate and utilize all of these tools for both personal and professional reasons. Privacy online is slowly becoming extinct. In mental health, ethics still rule what type of searching behavior is appropriate. Patients now have access to a plethora of health tools, ranging from provider and hospital ratings, to peer support and even open access to health information posted by patients about their condition. Use of these social media tools and health information is no longer a domain of the tech savvy young as now seniors go online with increasing frequency and utilizing broadband Internet access.

Keywords Anxiety • Bipolar disorder • Blogging • Cellular phone • Cognitive therapy • Cooperative behavior • Dancing • Depression • Drug interactions • Electrocardiography • Electronic mail • Exploratory behavior • Friends • Information dissemination • Leadership • Malpractice • Mental health • Neuroleptic malignant syndrome • Paranoid disorders • Paroxetine • Patient care • Patient-centered care • Physicians • primary care • Psychiatry • Public health • Self-help groups • Social media • Social networking • Social support

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9.1 Introduction

Nowadays, use of the Internet has become practically synonymous with use of social media online. According to the Pew Internet and American Life project survey in 2013, 73 % of online adults use a social networking of some kind [1]. This survey noted that while new services such as Pinterest [2] and Instagram [3] have become popular, Facebook remains the dominant social networking platform with over one billion active users since 2012 [4]. Social media is inclusive of various web-based tools such as blogs, wikis, video sharing sites, people search engines, and social bookmark services, all of which help people to engage with each other and share information in so many different ways. While Facebook, LinkedIn [5], and Twitter [6] may still dominate, more websites are always on the horizon and they will capture users to interface in new ways. The term "Web 2.0" is commonly associated with such web-based applications that facilitate community and interactive information sharing. These tools are making it easier than ever before to find information, resources, and contacts, and to interact with others around these sources in meaningful ways. In the context of health and health care, the term "Health 2.0" is used to describe the application of these participation-enhancing tools – such as health care blogs, patient support sites, patient friendly drug interaction tools, and social networking services – by all actors in health care. From the scientists seeking innovative therapies, to physicians and nurses providing treatment, to the patients receiving care, we are all participants in health care. In this chapter we aim to not only review these participation-enabling technologies and discuss their implications for behavioral health providers, but to also provide useful guidelines for when, why, and how to get the most out of these innovative tools. We will also provide cautionary warning for situations in which use of some technologies may be ill advised. Upon reading this chapter we hope you will agree that while there are certainly some risks and temptations with respect to these technologies that are best avoided, the benefits of these innovative tools – to the extent that they empower patients and health professionals, foster information sharing and community, and facilitate engagement across the spectrum of health care – can be quite powerful.

9.2 Background

9.2.1 Web 2.0: Fostering Interactivity, Engagement, and Community

The concept of Web 2.0 has morphed into what we do online as our use of the Internet has become practically synonymous with social media use. Nonetheless, a review of the concept of Web 2.0, and the significant frame shift on how users interact on the Internet has evolved over the last 5 years is important to understand in

order to put the new cultural norms of the Internet into context. It is fitting then, that the most illustrative example of Web 2.0 provides us with its definition. Wikipedia indicates that Web 2.0 is a term that describes web sites that use technology 'beyond the static pages of earlier web sites', and refers to 'changes in the way Web Pages are made and used' [7]. The platforms that were and are still often associated with Web 2.0 are those that are built upon an architecture of participation, where tools make it easy for end users to provide value and connect to their peers as well as the overall community. Perhaps the most central byproduct of this underlying structure is the ability to harness the power of collective intelligence. Web 2.0 refers to the shared approach and attitude of facilitating collaboration, harnessing network effects, and providing the resulting collective intelligence back to the end user and community as a whole.

Web 2.0 is essentially the difference between using the Encyclopedia Britannica Online [8] and Wikipedia. The former, while it can provide a great deal of information on a given topic, does not harness and allow users to benefit from the collective intelligence and insights of the "community," a quality that is at the core of Wikipedia. One can readily anticipate the flipside of the argument as well, as willingness to contribute to Wikipedia's ever-growing encyclopedia does necessarily imply "expert" status – anyone with access to a computer and the desire to submit entries or edits to Wikipedia can have their information posted. This collaborative participation is how the trust in the collective process has developed into mainstream Internet use. Millions of people have made contributions to Wikipedia's ever-expanding project, and not only does the community work to continuously build upon the database, they also efficiently update incomplete, incorrect, or biased information. As a result, Wikipedia, as a resource, becomes more robust over time, a process that will continue as long as people are motivated to contribute their expertise via the platform. It is this engagement with the collaborative process and information exchange which has contributed to a fundamental shift in how the public has begun to trust the collective process online as much as the expert opinion if not more.

Among the Web 2.0 social technologies that have seen the most attention, the most powerful and ubiquitous are those that offer some form of social networking. It is difficult to argue against the popularity of social networking sites, which, at their core, provide tools for connecting people to other people. Only the search engine site Google [9] ranks above social media sites such as Facebook [10] and Twitter [11] as seen on Quantcast's monthly top sites accessed by people in the United States [12].

As is often the case with technology, social applications are often first adopted by younger audiences, and for predominately casual uses. The first social networking site to attract a significant following was Friendster [13], which was conceptualized and launched in the spring of 2002 by computer programmers as a tool to help people find friends through their friends. Fast-forward 12 years later, and we see that hundreds of millions of people are using social networking platforms to connect as seen by the traffic monitored by Quantcast. Not only is the number of users staggering, the amount of time people use social media sites such as Facebook is astounding. Statistics to validate that statement are not needed here because we all have seen for ourselves how people have become consumed with adding posts and

reading them. That Facebook is able to command such loyal attention on a scale that is in the hundreds of millions is a testament to the power and potential inherent in many social technologies.

9.2.2 Health Care-Based Internet Tools Go Health 2.0

It probably does not come as a surprise that these Web 2.0 technologies (i.e., wikis, social networks, blogs, and social site sharing networks) have found their way into the world of healthcare. Over the last few years as we have seen these new web-based technologies enable information search, collaboration, and community, the Web 2.0 revolution is being applied to empower patients and facilitate information sharing. Patients who used to use the Internet to connect primarily through email discussion lists have transitioned to using these robust tools to build communities around their health interests. This phenomenon is not only limited to patients as health professionals are also harnessing these technologies to connect and collaborate as well. Wikis, which are websites that are designed to allow users to collaborate on content, have been built for a multitude of health and health care domains (e.g., helping communities prepare for public health emergencies).

WikiHow, for example, has a mental health section that provides tips for promoting good mental health [14] and the Psychology Wiki [15] is a resource for psychologists, covering many different psychological topics organized in a textbook-like structure.

In addition to enhancing search and building community, these technologies and the companies behind them are promoting engagement, information sharing, and patient empowerment. It is no wonder then, that use of social media related websites has become the predominate activity on the Internet.

9.3 Social Networking

Social networking sites are based on a very simple concept – they are designed to allow users to connect and communicate with those friends and peers that they already have, and to also find new contacts, peers, romantic relationships, collaborators and so on through those they already know. As explored previously, this concept is now a ubiquitous phenomenon on the Internet. Facebook started out as a social networking site based primarily on university campuses to network students and eventually faculty; however, it reached its fame by opening up its system to anyone, and to allow people to connect around personal, professional, and commercial interests. With easy to navigate applications for sharing pictures, videos, comments, and blog entries, Facebook's popularity took off when the platform's programming interface (API) was opened up to third party developers in 2007. These programmers have created games and other socially based applications

such as quizzes to develop an online sense of connection to one's friends and family. In addition, numerous groups have been created to also foster a sense of belonging. One can connect, for example, with others who appreciate news outlets like National Public Radio, television shows such as Dr. Who, or thousands upon thousands of other entities – movies, sports teams, restaurants, vacation destinations, artists, political affiliations, support groups, the list goes on and on. If you can think of it, there may already be a Facebook group or page dedicated to it. The site also allows users to sift through existing connections to find new ones based on profile characteristics, common connections (i.e., friends), and similar interests, thereby facilitating new contacts.

Other current popular social networking sites include Pinterest [16], Instagram [17], and Twitter [18]. Pinterest helps its members share photos and infographics from different websites by saving them on 'boards', which function as digital version of a corkboard. Instagram, which was purchased by Facebook in 2012, facilitates sharing photos created on their smartphones and stylized with filters [19]. While these two sites are extremely popular, their use remains primarily personal and not professional in nature. On Pinterest, a search using the tags 'md' and 'psychiatry' has many interesting boards, including a board from Sharon Packer, MD, which then links back to her practice website [20]. Instagram tends to be used primarily by hospitals, such as NewYork-Presbyterian Hospital, which are linked to their Facebook accounts and provide a more personal and intimate connection to the facility [21]. Twitter is a very simple but effective micro-blogging platform that allows users to send and receive 'tweets', which are text-based messages of no more than 140 characters that can be sent via twitter.com, a cell phone, or any number of other Twitter applications. Each user decides which other users they wish to follow, which enables the user to control the information that they see in their twitter stream, which is the continuous feed of all of the tweets from those that one has elected to follow. Twitter is a popular forum for many medical professionals, who send tweets regarding topics of interest. For example, Psychiatry Rounds is a Twitter account that serves as a professional social network for psychiatrists to discuss and share ideas as well as network [22]. Dr. Gabriela Cora's Twitter account has almost 2,000 followers, a diverse group including professionals, organizations, groups, and individuals [23]. These social media sites demonstrate how mental health professionals are using these new mediums for outreach, education, and engagement in discussions that promote mental health.

Although Facebook, Twitter, Pinterest, and Instagram are social networking sites primarily for personal use, there are a number of social networking sites dedicated to professional use as well. The most well-established professional networking site is LinkedIn, with over 300 million members worldwide [24]. This site was initially adopted by the technology-based working sector, but has now grown to encompass practically all professional industries such as healthcare, architecture, search firms, etc. The primary use of this site has been to connect to colleagues but to then leverage the degrees of separation to establish new connections in the context of finding jobs, collaborators, and references. There used to be all too many professional social network sites, but over the last 5 years, many of them

have folded as LinkedIn has dominated the professional networking sector, much as how Facebook dominates personal social networking. It is a highly recommended strategy to create a profile on LinkedIn, and perhaps one to two other specific social network sites such as MedicalMingle [25] or Therapy Networking [26].

In the past, the dichotomy of having separation between personal and professional social networking site use was recommended in order to maintain a boundary for personal versus professional use. Now, it has become widely accepted that there is an advantage in having a professional focused social network account on Facebook as well as on LinkedIn. The key aspect has been to have these various professional focused social networking accounts link back to a professional website, either for a private practice or to one's university or hospital based profile page. It is recommended that in order to maintain privacy and to keep the personal and professional channels from getting mixed up, create two accounts on Facebook, one for personal use and the other for professional use. The primary advantage of having a professional social network profile on both Facebook and LinkedIn is that these pages are often indexed and searched by the various Internet search engines. By having a link on your social networking account to your professional website, you will have more traffic without much marketing effort. These professional connections are ideal for referrals and new business ventures. Many recruiters often search through these sites to find candidates for their job openings. Therefore, it helps mental health professionals to provide a complete profile with details on leadership, administration, and experience that will enable the recruiter to contact you with a more likely job of interest.

Just as Facebook's popularity has grown, so has the comfort that both patients and physicians have developed using social networking-based websites. Indeed, the social networking phenomenon is enabling patients, health providers, and other stakeholders to efficiently share information and experiences in every health context imaginable – from health and disease to treatment and recovery, patients, scientists, and health providers are utilizing these tools to connect, mobilize communities, and filter information. There are now even a few reports of healthcare providers in other fields who have chosen to "friend" or connect to their patients [27, 28]. In those instances, the providers were not in the field of mental health, and the reasons why patients wanted to connect with their doctors seem innocuous enough. One patient was thinking about going to medical school, and had contacted her former medical student, now a resident, on that simple issue. Patients also found that being connected to their doctor on Facebook was convenient in asking for medication refills or scheduling an appointment, which bypasses the hit or miss of whether the doctor was available since on Facebook your friends currently online are made known to you. Patients even commented that seeing personal matters such as the doctor's videos of his children dancing made them feel more connected to their provider. However, in the field of psychiatry and psychology, such personal information and privacy are much different matters.

In mental health, privacy is a critical parameter, as many patients would not enter into treatment or disclose the very issues that torment them without that sense of privacy. Scott G. McNealy, chief executive officer of Sun Microsystems,

Inc. has been quoted in1999, stating that on the Internet "You already have zero privacy. Get over it" [29]. Indeed, the plethora of search engines and specific individual information mining sites such as PeekYou [30], Zabasearch.com [31], and Pipl.com [32] search for information on numerous sites including public records, Amazon.com, Facebook.com, and many others. It is rather illuminating and perhaps even frightening to see what private information is available on the Internet such as birthdays, wish lists, pictures, and comments posted on a web site many years ago. However, just because absolute privacy is perhaps a lingering memory it does not imply that the principles of privacy no longer apply to mental health care on the Internet.

Privacy of personal information is critical to the therapeutic relationship in behavioral healthcare. Patients in psychotherapy who know all too much about their therapist may have difficulty with transference, and discover that they struggle more with their issues. Providers who search for more information about their patients may uncover lies or other unrelated matter that will change the perspective and focus of the therapy goals. As therapists begin and continue to explore the connectivity inherent with Health 2.0 applications, they are advised to remain cognizant of just how public the Internet is, and to strive to maintain clear distinctions between their professional and personal lives online. While it can be advantageous to provide professional information to current and prospective patients online (e.g., your medical specialties, hospital affiliations, whether or not you are taking new patients, as well as highlight online resources that you believe to be useful), it would not be advisable to share content that is of a personal nature. This includes, for example, photos of yourself or family, lists of "friends," and specific updates as to where you might be spending your weekend. This is not to say that behavioral therapists are forbidden to join sites like Facebook or Twitter, but rather that those in mental health professions should consider the importance of boundaries. You could, for example, limit Facebook connections to just family and close friends, and set up the privacy controls on the platform to ensure that your information is only accessible by those to whom you are directly connected. When patients make a "friend request" to a therapist on any social networking site, privacy and boundaries are the primary reasons to consider declining the request. It is far too difficult on these social networking sites to create settings that prevent patients, for example, from accessing specific pictures or reading certain comments made with regards to blog postings, and many users have no idea that these adjustments were possible, and allowed default settings of general access to remain. Facebook has a tendency to readjust its privacy controls, and even with simplified options, these are difficult to use and often underutilized. In general, it is recommended that when a patient makes a 'friend request', discussing the privacy matters in person with the patient while politely declining the request is important to avoid the perception of abandoning or ignoring the patient.

Similarly, if a therapist is comfortable – perhaps even excited – about the utility of micro- blogging tools like Twitter for information sharing, he or she could choose to limit posts to those that are professional in nature. Many health professionals have adopted this strategy, choosing not to share personal information via Twitter

(e.g., such as where they might be having dinner that night) and instead using it to share and receive professional content, such as news of exciting research findings, or tips for managing stress. In fact, a number of therapists have incorporated their Twitter posts directly into their professional websites, which is a clever and relatively simple way to keep the content on a website dynamic and fresh.

Just as mental health professionals are advised to maintain boundaries when it comes to their own personal information and accessibility, it is similarly important to respect the privacy of patients. Consider the following question: do you think that "Googling" a patient would be a positive or a negative strategy vis-à-vis the therapeutic process? One possibility is that the therapist could glean some information that might help the treatment, such as evidence of specific rumination or paranoia, or the discovery of improved functioning (i.e., behaviors) in some domain following a set of targeted therapy sessions. On the other hand, looking for information not explicitly disclosed by the patient can also be seen as a violation of trust. As such, it has been suggested that, before searching for information online regarding a patient, therapists first consider the reason for doing so. That is, is information being sought in an effort to help the patient in some way, or is the therapist merely "researching" to satisfy his or her own curiosity? If the answer is the former, the therapist could address the boundary issue by being upfront with the individual prior to searching for information online, and ask how they would feel about online information being sought in an effort to inform the therapeutic process. If the patient agrees, the therapist could consider reviewing any pertinent findings obtained with the patient. The American Psychiatric Association Ethics Committee considers providers who have searched for information on their patient to satisfy their curiosity to have committed an ethical violation [33]. The key element that makes searching for information an ethical violation is that finding such information does not contribute to patient care and serves another purpose. In some instances, searching for information about a patient does make clinical sense. For example, when the patient makes a grandiose statement and there are no other sources of collateral information, it may be necessary to determine if that information is true by checking information on the Internet.

9.4 Provider Ratings

Nowadays, the wealth of health information on the Internet now includes opinions by patients and others regarding their professionals. In the past, word of mouth or lists of providers from the insurance panel were the traditional method for finding behavioral healthcare providers. For many patients, the starting point may be their primary care physician, who will then refer the patient on to someone they know. One of the challenges is that for many primary care physicians, their network primarily consists of specialty colleagues to whom they frequently refer patients such as cardiology, rheumatology, and gastroenterology. Oftentimes, this network was established via contacts made through graduate school, postgraduate

training, local healthcare provider society, or just because they are in the same health professional building. In these circumstances, it is often the case where a primary care provider would ask colleagues for recommendations regarding mental health providers. To remedy this situation, a virtual network via social networking sites such as LinkedIn or Doximity [34] as well as continued efforts to expand a referral network in person make sense for the mental health practitioner.

Today, patients can search physician and therapist rating sites to see what others had to say about their experience. These sites include RateMDs [35], DrScore [36], Vitals [37], HealthGrades [38], UCompareHealthCare [39], and LifeScript [40], where patients post comments both in free form as well as give ratings on scales regarding aspects such as professionalism, punctuality, helpfulness, knowledge, and quality. None of these ratings have been studied to produce validity, although HealthGrades does search through malpractice databases, public state medical board disciplinary action records, and board certification agencies to create an award called 'Healthgrades Honor Roll" for those providers with valid board certification and no record of disciplinary action or malpractice lawsuits.

One of the problems for providers is that there is little recourse for negative reviews. This stance is typical of most ratings sites, which state that they serve as a forum not an arbiter of opinions. Some sites will remove comments or ratings determined to be unconstructive or merely lambasting the provider. Yelp has developed notoriety in offering to 'downgrade' and displace negative reviews in return for purchasing ads for better placement of the business on their site [41]. A significant fact to consider by both behavioral health providers as well as potential patients is that many of these reviews are done anonymously. Few patients actually give their real name or other identifying information in order to maintain privacy. The adage "caveat emptor" comes to mind in determining whether anonymously provided information has much merit. In addition, the majority of patients who do rate their healthcare providers are typically extremely dissatisfied or hopefully quite happy with their provider.

Another downside to provider ratings sites is that there are too many of these sites out there, and patients often do not know where to turn to find accurate or helpful information. Even the most 'liked' physician or provider has about 30 ratings on a particular review site, with many sites averaging only two or three per provider. Although an online reputation is important to maintain, a broader perspective, such as the attitude that one negative review out of many positive ones is likely to not drive future patients away, may preserve sanity and decrease anxiety and paranoia. Furthermore, the reality is that the majority of referrals still come in traditional ways, from providers or other satisfied patients, as well as from search engine hits on the practice website. In addition, another strategy is to decrease the search ranking of the provider rating site as many patients today just enter the provider's name into the search engine versus checking a specific provider rating site. This downgrade of the search ranking can be accomplished by having many other sites linked to your primary professional site as well as creating additional content for the Internet, such as postings on other health related sites. It also may be helpful to know what sites containing information about you are being viewed. As such, we suggest that

health professionals periodically check the online landscape to see what kinds of information on them might be out in the public domain, and hence easily accessible by others. One way to accomplish this task is to set up a search alert in popular search engines such as Google [42] and Yahoo [43], which will then notify you via e-mail on what terms and what pages were viewed.

9.4.1 Health Tools

Searching for health and medical information online has been commonplace for a number of years, as more and more people turn to online resources for insight. Recent research indicates that the use of the Internet for access to health information in this country reached 59 % in 2013, up from 25 % in 2000 [44]. One of the problems facing patients today is that there is too much information, both good and erroneous, contradictory and confusing, as well as misleading available on the Internet. To address this issue, specific health search engines, such as Medstory, Healia, and Healthline were developed to search specific medical databases, healthcare websites, and use a specialized health-related taxonomy to improve the relevancy of the search findings. While the efforts of these sites were helpful in finding health information, traffic through them were limited due to the popularity of the search engine portals Google and Microsoft's Bing. Medstory's technology was incorporated into Bing Health, which then became integrated into the search results, thereby making the technology invisible to the user [45]. Many patients are reading about other patients' accounts with medications and types of therapies, which inform their decision making about compliance or follow-through on recommendations by behavioral health providers. Although traditional sources of health information on the Internet such as the National Institutes of Health [46], Medscape [47], PsychCentral [48], and now Wikipedia are still utilized, it behooves the behavioral healthcare practitioner to check out what patients are viewing that may potentially shape their actions.

In addition to general information, specific tools are now available on the Internet to help and perhaps stimulate the consumer to consider behavioral health services. The Depression and Bipolar Support Alliance offers confidential screening tools for mania, depression, and anxiety [49]. MoodGym is an online-based cognitive therapy program to help prevent and cope with depression [50]. Patients are using the web site DoubleCheckMD [51] as well as the popular medication program ePocrates [52] to determine if there are drug interactions among their medications to be concerned about. One source of confusing information is the result of various drug interaction programs available online. For example, in checking the interaction between paroxetine and risperidone, DoublecheckMD will highlight the need to monitor blood sugar, platelet counts, and white blood cell counts, as well as checking EKG for abnormal heartbeats, but it does not comment on how paroxetine with its 2D6 cytochrome P450 enzyme inhibition may slow down the metabolism of risperidone. The drug interaction program of Epocrates has identified this potential

increase in risperidone levels, and Epocrates then reminds providers about the increased risk of the adverse effects as well as neuroleptic malignant syndrome. Although it is nearly impossible for patients and providers to check all of the various mental health tools available on the Internet, it makes sense to ask patients what health information and health tools on various web sites they have been visiting in order to determine the relevancy of the information they are considering. By engaging the patient in a discussion of the information they have found online in a confident, non-accusatory, and open manner, behavioral healthcare providers are providing patient centered care and establishing that they are open to learning about the concerns of their patients. This process helps engender trust that the provider has the expertise to help patients determine whether the information they have discovered in the Health 2.0 era is relevant to their health needs.

9.4.2 Peer Support

Of all of the Health 2.0 applications that we have seen to date, among the most powerful have been those that bring support to those who need it most. When faced with uncertainty, we turn to peers for support. In the context of health, where the stakes can be quite high, people are particularly motivated to seek out others like them – people that have faced or are facing the same types of illnesses and health situations that they are themselves facing. Fortunately, thanks to the Web 2.0 movement, patients have at their disposal an ever growing arsenal of online tools and networks to provide what can be otherwise elusive insight and support. Sites like MedHelp [53], PatientsLikeMe [54], and DailyStrength [55] are providing powerful tools and dynamic communities to empower patients and foster a sense of belonging and community among those facing illness. Armed with a basic understanding of the sites and tools that are available, mental health providers will be better able to understand the experience of their patients who turn to these communities for help, as well as be able to facilitate patients reaching those resources that may offer the most benefits. Mental health professionals, as well as any health care provider, understand and appreciate the value of social support, and the importance of not feeling isolated or alone. Given that patients (and we are all patients at some point) are turning to these platforms, it is suggested that those providing therapy at least have a basic understanding of the online communities that are available to patients seeking further support and insight. While this section will certainly not cover all or even most of the online peer communities available for patients, several dynamic communities will be highlighted.

PatientsLikeMe, founded in 2004 by three MIT engineers, is considered by many to be one of the most creative and high impact companies in the patient support domain. Their tools are designed to help those diagnosed with "life-changing diseases" by allowing patients to share and discover the outcome based on a number of disease categories. As an example, patients who have been diagnosed with major depression may be interested in going to their Mood Conditions community to see

data on the kinds of treatments being used by thousands of other patients who have been fighting depression. Here they would be able to see information regarding efficacy and side effects for a multitude of treatments, as well as learn about how behavioral changes like quitting smoking and getting physical exercise may impact their symptoms. Not only is this information readily available for patients, the anonymized data that is generated via the PatientsLikeMe community helps researchers learn how these diseases act in the real world, thereby facilitating the potential discovery of novel treatments.

Of the many entities that are offering health-related peer support, among those with the longest staying power to date has been MedHelp, which has been a reliable destination for medical information and support for patients since 1994 – well before there was talk of "Web 2.0" technologies. One of the significant advantages of MedHelp is the active presence of medical experts who moderate many of the forums and wikis on the site. As such, their dynamic community consists of patients and physicians working together. MedHelp has taken this collaborative approach even further by establishing partnerships with some of the most reputable health care institutions in the world, such as the Cleveland Clinic, Johns Hopkins, and The Mount Sinai Medical Center, among others. As a result of these partnerships, not only can patients post questions to the community of members, they can also utilize any number of "Ask a Doctor" forums, where they are able to ask questions of medical specialists from MedHelp's partnering institutions.

Another Health 2.0 site that allows patients to get information from experts is DailyStrength. DailyStrength has created hundreds of support groups for people facing a number different disease conditions. Like MedHelp, DailyStrength has combined efforts with other reputable healthcare institutions, such as the Centers for Disease Control. Not only can patients find support from peers within the DailyStrength community facing the same illnesses that they have faced, medical professionals are also available for advice and consultation. WebMD [56] a pioneer in the world of online health and medical information also provides tools that allow patients to interact around medical content and interests, along with their expert-vetted medical information.

In addition to these and many other Health 2.0 sites that offer peer support for patients, Ning [57] is one network service provider that has taken a different approach. Through the Ning platform, anyone can essentially create their own social networking site, and establish a community for whatever interest they may wish to connect around. Literally millions of networks have been created on Ning, many of which are privately branded. While Ning is not a Health 2.0 company per se, countless communities have been created around medical conditions, diseases, and other health-related interests. Private and public groups have been formed around topics such as addictions, anxiety disorders, Asperger syndrome, cancer support, autism, obsessive compulsive disorder and on it goes.

Patients are not the only players in the healthcare industry benefiting from Web 2.0 tools and technologies. Just as PatientsLikeMe and many other community-based platforms offer resources and communities to patients, companies like Sermo [58], Medscape Connect [59], and Doximity provide technologies to help facilitate

networking and information sharing among medical professionals. Sermo, which is often cited as the largest physician-only network in the United States, provides an online environment where licensed physicians can exchange ideas and clinical observations in real time. Medscape Connect enables physicians to utilize a large community of peers to discuss clinical and nonclinical topics, as well as search through thousands of archived discussion posts. Doximity provides networking with colleagues and employees at hospitals as well as free CME credits with its partnership with the Cleveland Clinic. In addition to these social network-based communities, there are a number of others focused on specific specialties, geographies, and other professional interests. While there are certainly more sites specifically geared toward patients, it is clear there are also a number of platforms designed to foster connectivity within and beyond professional networks within healthcare. Given the multitude of connections that exist between colleagues within health systems, alumni groups, academic centers, and medical societies, it is not surprising that more and more tools are being developed to allow medical professionals to more efficiently utilize these valuable networks.

In sum, it is clear that there are a multitude of web-based resources available to provide peer support for both patient and provider. The tools for connecting to others with common interests are continuously becoming more robust, and they seem to be on a ubiquity-approaching trend. Of course, the value and potential positive impact of support from others cannot be understated; a point that may not be understood by all medical providers, but is not likely lost on most behavioral health professionals. Knowing what we know about social support, we can help others navigate toward networks and communities that are likely to provide social resources for those who could most benefit from.

9.5 Conclusion

Social media technologies are facilitating interactivity and community development among all actors in the healthcare system. These trends of connecting, sharing information, and participating are only going to become more common and robust as additional innovations are developed. It is clear that the innovative technologies that we are seeing now are not just for the young crowds. According to a recent survey conducted by the Pew Research Center in April 2014, over 60 % of America's seniors now go online, and 50 % of them are broadband Internet users [60].

Another signal of the staying power of some of the most heavily used social media platforms can be seen with the abundance of businesses, government offices, professional societies, nonprofits, and academic centers that are using them to facilitate their mission. It has become common for professional organizations to establish a presence on Facebook or Twitter, and to use these technologies to disseminate information and engage audiences. Health professionals are encouraged to at least become familiar with these participation-enhancing tools as well, and we hope that this chapter will serve that purpose for many. If you are an expert in some

area, why not find out what is being said on the topic on some of the widely used wikis, social networks, and interactive forums, and perhaps even contribute to the collective discussion? While there are certainly risks that should be avoided and protective strategies that should be taken – particularly with respect to privacy – psychiatrists and other behavioral health professionals can do themselves a great service by becoming aware of these powerful tools, and, when applicable, helping to make patients and colleagues aware of them.

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Chapter 10
Technology Tools Supportive of DSM-5: An Overview

Nathaniel Clark, Theresa Herman, Jerry Halverson, and Harsh K. Trivedi

Abstract In order to have tools supportive of DSM 5, we first need to start with an understanding of the validity and reliability of psychiatric diagnoses. Inherent to the success of what can be built is the ability to maintain both the face validity and test validity of the diagnostic schema. The authors begin this chapter with a discussion regarding the development of DSM 5. They consider how technology can support accurate diagnosis and treatment planning. In the planning of the DSM-5 revision, attention was given to address concerns regarding previous editions. Research into the validity and reliability of the DSM-IV diagnostic constructs revealed problems regarding test-retest reliability. There was also the logistical challenge of accurate data collection across thousands of patients and multiple centers, compilation and analysis of that data in an expedient fashion, and the application of the most current advances in statistical measures of reliability and validity. In summary, the logistical challenges around creating and coordinating a multi-site system for surveying and collecting data across thousands of patients and hundreds of providers, research coordinators, and analysts was solved with the involvement of REDCap. The technological tool to assist with data collection and a central data management function elevated psychiatry beyond the ancient system of one provider to one patient, and created a wealth of possibilities for how to use this data beyond the research for DSM 5.

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At Vanderbilt University Medical Center, an important refrain from our information technology (IT) colleagues is that IT solutions cannot fix underlying flaws in process or function. For IT to be innovative, useful, and easily adopted—the key is to have a well-functioning and reliable process. To that end, in order to have tools supportive of DSM 5, we first need to start with an understanding of the validity and reliability of psychiatric diagnoses. Inherent to the success of what can be built is the ability to maintain both the face validity and test validity of the diagnostic schema. We begin this chapter with a discussion regarding the development of DSM 5. We then consider how technology can support accurate diagnosis and treatment planning.

10.1 Background/History

Throughout the history of psychiatry, the foundation of diagnosis has remained consistent: observation, clinical interview, and judgment [1]. The earliest tools available to begin the categorization and classification for psychiatric illness consisted of the observation of a disturbance in behavior [2]. The identified psychiatric patient was then interviewed, focusing on the nature and etiology of the apparent behavior. Finally, it was incumbent upon the expert diagnostician to utilize knowledge of existing psychiatric diagnostic systems to apply them in a common sense fashion to the patient whom had been observed and interviewed. The obvious limitations of this approach consisted of how to demonstrate the reliability and validity of a psychiatric diagnosis as a construct. More specifically, how would we know that the constellation of symptoms that this expert called bipolar disorder, for example, would indeed be diagnosed as bipolar disorder by the next astute clinician? In addition, how would we know that what they are describing really was bipolar disorder, and not simply two experts concurrently misdiagnosing borderline personality disorder?

Psychiatric classification, or the creation of diagnostic systems, arose from this problem. Emil Kraeplin developed the earliest major diagnostic system, Compendium der Psychiatrie, in 1883 [3]. His diagnostic nosology pioneered several concepts fundamental to future psychiatric diagnostic systems. First was that psychiatric illness was to be held as a disease of the brain and nervous system. In addition to its pathology beginning in the brain and nervous system, he posited that psychiatric illness was naturally occurring and degenerative. In regards to specific disease conditions and differential diagnosis, he defined manic-depression and dementia praecox as distinct illnesses. Kraeplin developed successive versions of his textbook and was working on the ninth edition when he died in 1926 [3].

10.2 Development of the Diagnostic and Statistical Manual (DSM)

In the United States, the major diagnostic classification system emerging in the twentieth century was the Diagnostic and Statistical Manual (DSM) [4]. The DSM represented an effort to form consensus in the US around diagnostic validity and reliability. It developed out of an 80-year history in the US focused on the gathering of statistics on mental health diagnosis, stemming from a recording in the 1840 census of the frequency of "idiocy" and "insanity" and also establishing how many were "at public or private charge" [5]. By 1952, the American Psychiatric Association published the first edition of the Diagnostic and Statistical Manual as an offshoot of the International Classification of Diseases sixth edition (ICD-6) [4]. In 1994, the DSM-IV was published, with a major revision in 2000—the DSM-IV TR. As a result of the concerns about a new edition of the DSM in the wake of the publication of the DSM-III in 1980, the DSM-IV was designed with a number of "procedural safeguards ... instituted to minimize arbitrary and idiosyncratic revisions" [6].

These safeguards consisted of process oriented changes: (1) expert advisers were appointed to each of the DSM diagnostic workgroups on illness categories, (2) methods conferences were utilized to review methodological issues facing the development of the DSM, (3) specific change criteria were developed for the diagnoses under review, and (4) a balanced review of literature with inclusion of the body of evidence both supporting and opposing the diagnostic constructs that had been developed in the DSM III [6]. These reviews were intended to be "descriptive, comprehensive, explicit, and systematic. The goal [was] not to generate the data to argue for a certain position, but rather to provide a fair, balanced, and descriptive summary of the literature" [6]. This review then forms the foundation of the three-step process of the empirical review that leads directly to the development of diagnostic criteria, as well as the inclusion or exclusion of diagnostic constructs from the manual.

To complete the process, the work groups developed a standard that reanalysis of existing but unanalyzed data sets and ultimately field trials are required [7]. The DSM-IV field trials were conducted for 12 diagnostic constructs: Antisocial Personality Disorder, Autism and Pervasive Developmental Disorders, Disruptive Behavior Disorders (including Conduct Disorder, Attention Deficit Hyperactivity Disorder [8], and Oppositional Defiant Disorder), Insomnia, Major Depression and Dysthymia, Mixed Anxiety-Depression, Panic Disorder, Obsessive-Compulsive Disorder, Posttraumatic Stress Disorder, Schizophrenia, Somatization Disorder, and Substance Use Disorders [9]. Practically speaking, the field trials represented an effort to capture how psychopathology appeared to the clinician. An effort was made to ensure a variety of clinical sites, generally between 5 and 10 in number, as well as a mix of new and follow-up patients. Definitions also included the use of standardized assessment tools such as the Yale-Brown Obsessive Compulsive Scale,

the Fixity of Beliefs Scale and the Structured Clinical Interview for DSM Disorders (SCID) for patients being assessed for obsessive compulsive disorder [10].

Despite these advances in the development of DSM-IV, concerns regarding the validity and reliability of the diagnostic system arose. Specific concerns were raised regarding the validity of the distinction between mania and schizoaffective disorder [11] and between depression and anxiety [12]. The validity of the construct of specific diagnoses were also questioned, such as for bipolar disorder [13] and seasonal affective disorder [14]. The news was not all bad, as evidence and research emerged supporting diagnostic constructs from the DSM-IV, such as for Psychotic Depression [15]. More fundamental research was also conducted which investigated the diagnostic structure and hierarchy of the DSM-IV as well as the diagnostic reliability and validity of Axis V [16].

10.2.1 Development of the DSM-5

In the planning of the DSM-5 revision, specific attention was given to address concerns regarding previous editions. Research into the validity and reliability of the DSM-IV diagnostic constructs revealed problems regarding test-retest reliability [17]. There was also the logistical challenge of accurate data collection across thousand of patients and multiple centers, compilation and analysis of that data in an expedient fashion, and the application of the most current advances in statistical measures of reliability and validity. The process leading up to the field trials of the DSM 5 was similar to that of the DSM-IV.

In 1999, an initial planning conference involving thought leaders and experts in research was convened to determine the research direction heading into DSM 5 development [18]. Interestingly, leaders of the DSM-IV process typically were excluded so as to foster creativity and an objective look at the challenges which had arisen in the previous edition. Work groups were convened, research agendas were developed and set, and white papers were ultimately published in "A Research Agenda for DSM 5" [19] and "Age and Gender Considerations in Psychiatric Diagnosis" [20]. Thirteen conferences were subsequently held in which specific research questions were addressed and presented by content experts; these findings were also subsequently published [21].

A task force was convened to review the DSM-IV, compare the findings with the research generated by the research conferences, and this group developed the drafts of the DSM 5 [18]. Concurrently, from 2010 through 2012, field trials were undertaken [22]. There were two phases of field trials; the first consisted of Field Trial Testing in Large, Academic Medical Centers in which 11 Academic Centers participated. Data collection took approximately 10 months to complete. The second phase consisted of Field Trial Testing in Routine Clinical Practices, which were composed of solo and small group practices, randomly selected from an AMA Database of physicians. Data collection for this group took approximately 8 months.

The challenges for this version of the DSM included the greater number of patients, large academic medical centers participating, and the exponentially greater number of routine clinical practices taking part in the field trials. The design group also planned to take advantage of improved statistical technology developed subsequent to the publication of the DSM-IV. The complexity of this project greatly eclipsed that of the previous edition. The technology tools supportive of this updated process (data collection, sampling strategy, and data analysis) are described in several publications by the implementation workgroup [23–25].

There were 11 identified sites, 7 adult and 4 pediatric [23]. There were 2,246 patients enrolled in the field trials throughout the study. In contrast with the typical prospective double blind randomized studies characteristic of pharmaceutical trials, the field trials were designed to test the reliability of diagnosis in the "real world"—the degree to which two examiners could agree on a diagnosis across a variety of settings ranging from the solo practitioner to the large academic medical center, and in a patient population in which comorbidity was common.

The methodology used to simulate the use of the manual by the clinician included: clinical interview approaches versus structured research interviews; separate interviewers interviewing the same patients at short intervals of separation; inclusion and stratification of patients into multiple diagnostic groups for study to account for comorbidity; assessment of "cross-cutting symptoms" which could indicate another diagnosis, or dimension to the present diagnosis [24], and assess if diagnoses held up under these conditions. 86 % of all enrolled patients were interviewed twice, and a total of 279 clinicians of varied disciplines were involved in the total study. 33 total diagnoses were tested, on average about two trials per diagnosis, and each site studied approximately 5 diagnoses [23].

Furthermore, the DSM 5 Field Trial utilized centrally designed protocols that required uniformity of data collection and data analysis. The project's main challenge in terms of data collection placed a significant strain on available technology. The main areas of tension included central protocol development and implementation, data collection, and ongoing monitoring of the field trials, with the potential for rapid assimilation and interpretation of the data. These project needs required the use of an adaptable, widely distributable data capture system, ideally using internet protocols for availability and ease [23].

The study designers elected to use The National Institutes of Health-funded Research Electronic Data Capture system (REDCap) developed through Vanderbilt University [23]. The REDCap system, described by the designers in a seminal article [26], is an open source program developed to solve problems around sharing research data with multiple collaborators at multiple sites via high-speed network sharing, while maintaining a high degree of security. The conceptualization of research while incorporating the REDCap tool involves the Informatics team at the outset of the project design. They would demonstrate how REDCap works, including use of the web interface, security, validation, statistical export, and a data collection strategy for the project. Case report forms are created in a format familiar to the researcher, typically an excel spreadsheet, which are populated by the research

team around the specific goals, data, and other project requirements. This then forms the foundation of a web-based electronic data collection application [26].

The next step in project design involves the user interface. Data on study variables can be entered into the web-based application by text field, drop down menu, or other .html object design, and then exported either in part or by whole for analysis. According to the designers:

"[The project] uses PHP + JavaScript programming languages, and a MySQL database engine for data storage and manipulation. Hardware and software requirements are modest, and the system runs on Windows/IIS and Linux/Apache web server environments" [26].

Each project also contains significant and flexible data useful to the project as a whole outside of the data collection and analysis. This includes a log of all data transfers, researcher rights, and any ancillary forms required such as consents. REDCap was developed and released within the Vanderbilt University research environment in 2004, and at the time of the paper [26] included 204 active projects, and the total number of subjects in all databases exceeded 17,000. In 2006, the REDCap project was released in a pilot program to partner institutions, which had grown to 27 total partners in 2009. According to the REDCap website [27], as of 2014, the total number of projects was 72,643, and the REDCap Consortium was composed of 1,108 institutional partners from 83 countries. The group had also developed an Online Designer via a web interface for easier access for remote partners, and they note that both surveys and databases can be created.

The designer group emphasizes the flexibility and portability of REDCap in terms of requirements. The hardware requirements are listed as a Web Server with PHP, MySQL Database Server, and SMTP email server (installed if emails need to be sent directly out of REDCap), and an optional file server [26]. These can be running on the same or separate computer[s]. There are no hard requirements for processing speed, memory, clock speed, or hard drive space, as the total program space is approximately 10 MB. 20 GB total are recommended to be dedicated to the web server and MySQL, which should suffice for approximately a year of use. Being open source, there is no cost for the program [26].

Prior to the implementation of the REDCap system for the entire DSM 5 field trials, two pilot studies were done at Johns Hopkins in the Community Psychiatry Outpatient Program, and in the Child and Adolescent Outpatient Program at the Johns Hopkins Bayview Medical Center [28]. These pilot studies took place over an 8 week period with between 10 and 20 patients per stratum, and, identical to the eventual field trials, included two study visits for test and retest validity separated by between 4 h and 2 weeks. On the adult side, the pilot included Major Depressive Disorder, Bipolar Disorder, Schizophrenia, Schizoaffective Disorder. On the Child and Adolescent side, the pilot included Major Depressive Disorder, Disruptive Mood Dis-regulation Disorder, Oppositional Defiant Disorder, Generalized Anxiety Disorder. The total number of adult patients was 100, and the total pediatric patients was 50.

The REDCap system could flexibly be developed to suit the needs of the study or survey. In pilot field trials, the main modifications were around permitting the embedded research coordinator to oversee the study progress and contained a program that facilitated communication of the data entered in real time, as well as, in communicating the data with a central management system. The types of data that the patients (or parents) could enter were composed of self-administered and clinician scored metrics. These included proposed DSM 5 cross cutting symptom measures, the World Health Organization Disability Assessment Schedule II, and the Personality Inventory for DSM-5. Similarly, clinician driven data consisted of the proposed DSM 5 metrics for Suicide Risk in Teens, Suicide Concerns in Adults, Psychosis, Early Development and Home Background, Clinical Utility and a 6 item World Health Organization Disability Assessment Schedule [28].

Anonymous subject tracking was managed by assigning Patient Identification Numbers (PID) and Clinician Identification Numbers (CID). The CID data was used as a login for the system, and permitted data entry, access to reports and blindness to the ratings of other clinicians. The Research Coordinator was permitted access to a Patient Research Screening Form and to patient tracking forms, and the component on REDCap was designed to allow the Coordinator to identify additional fields to make the recruitment process more efficient. The Research Coordinator assisted patients and parents in the self-administered section of the assessment, and then in real time was able to download the results and make them available for study clinicians to review prior to the diagnostic assessment of the patient.

The pilot study results regarding the inclusion of REDCap was felt to be successful, with findings that most clinicians responding that a single 2–3 h training session combined with sufficient practice would result in feeling comfortable managing the data entry system. The REDCap system by necessity compelled clinicians to enter data via a checklist to qualify or disqualify for diagnoses and most study participants felt that greater automation in the entry of data would be helpful. Finally, at the time of the pilot study, a feature of REDCap which makes it attractive for study design—the coordination and communication of workflow between patients, clinicians, and research coordinator—was not available, and a second calendar system was implemented to help with the logistics of scheduling to enhance recruitment [28].

In summary, the logistical challenges around creating and coordinating a multi-site system for surveying and collecting data across thousands of patients and hundreds of providers, research coordinators, and analysts was solved with the involvement of REDCap. The technological tool to assist with data collection and a central data management function elevated psychiatry beyond the ancient system of one provider to one patient, and created a wealth of possibilities for how to use this data beyond the research for DSM 5. It remains to be seen if the flexibility of this instrument could be further utilized across providers and entities to assist with diagnosis, treatment, and research.

10.3 Using Technology Tools in Support of DSM-5 in Clinical Practice

The introduction of DSM-5 has provided an excellent opportunity for better integration of technology into clinical practice to enhance patient care. Although there is much promise to improving clinical flow and the quality of patient care in psychiatric setting by integrating technology, there are aspects of psychiatric practice that have made such integration inherently difficult. The relatively personal, private and subjective nature of psychiatric care have made such integration a challenge. The increasing complexity of systems of psychiatric care combined with improvements in the technology used in psychiatric diagnosis and the proliferation of more objective measures in clinical practice have lead to an increased desire to integrate technology into clinical practice.

The introduction of DSM-5 and the included assortment of measures to help quantify psychiatric illness and qualify improvement provide several opportunities to use technology to help the DSM-5 be more clinically relevant than any of the previous versions. The implementation of the data collection and coordination part of the DSM 5 field trials suggest ways in which the current tools available for clinicians could be made available to enhance accuracy and reliability of diagnosis, as well as communication of diagnosis among treatment entities.

Several areas could be of interest to developers and clinicians. The first could be developing tools to assist clinicians with diagnosis. This would be an opportunity to increase specificity and reliability of psychiatric diagnoses given in clinical setting and provide "decision-support" at the point of care for clinicians to lead to a more accurate diagnosis. This diagnosis could then be bridged to a menu of evidence based options based on accepted guidelines. Furthermore, these clinically validated diagnoses could be used for registries or for the basis of performance based measures.

These diagnoses could also be collected and used in psychiatric epidemiologic databases and possibly treatment outcomes databases. The data could be used to track and improve psychiatric care at the population level. Further, the specific diagnosis information could then coordinate with a computerized medical record and be used in communication with treatment entities outside of the home institution or potentially outside of psychiatry (such as primary care or other subspecialties).

Second, the digital tools could be useful for assisting the clinician to make co-morbid diagnoses as well as track response to treatment and evolution of the psychiatric illness. DSM-5 rating scales for diagnostic assessment of other conditions, such as functioning, degree of impairment, and suicide risk among others could prove invaluable. If available at the point of care or if previously completed by the patient, these rating scales could provide a valuable enhancement to the clinical encounter. There would be many ways that the cross-cutting assessments and rating scales that are provided in DSM-5 could be integrated in the clinical encounter with technology including applications on mobile devices or integration within the medical record. Having the results of these assessments and scales at the

point of care would tremendously benefit patient care by helping to make diagnoses that may not be manifestly clear by the presentation as well as by helping to track treatment progress. Data that can provide the clinician an objective signal regarding symptom clusters that require more attention could help prevent adverse outcomes.

Practical Scenario
Mrs. X is a 45 y/o female that has been seeing her psychiatrist Dr. H for several years. She has a history of Major Depressive Disorder which has proven to be recurrent. She has been well maintained on medication and psychotherapy for several years. Her current episode began shortly after she lost her job. Dr. H has used symptoms scales filled out by Mrs. X on a tablet computer while she was in the waiting room. This tablet had a program that integrated with Dr. H's electronic medical record so that was able to see her depression scores at this visit as compared to the last visit. He was able to see that the depression scores were worse and was able to identify that the current treatment plan may not be sufficient. He was also able to evaluate depression symptom cluster scores and he noted that she has been sleeping particularly poorly and had elevated scores in suicidal ideation. Dr. H was able to tailor his interview to be sure to address both of those issues. Further he was able to evaluate the insomnia scale that had also completed and was able to use that information for purposes of the differential diagnosis of the trouble sleeping.

Technology could also lead to enhancements of clinical care with the use of DSM-5 for interview support. The Cultural Formulation Interview (CFI) included in DSM-5 could be integrated with an electronic medical record to not only enhance the sensitivity and the accuracy of the interview but also with its documentation. Thus the CFI may be used as an interview aid as well as a documentation template. This may lead to enhanced effectiveness of care provided.

Housing rating scales and fields with inputtable results from diagnostic interviews within REDCap also suggests that greater diagnostic accuracy is possible. The transition from the DSM-IV to the DSM 5 is potentially fraught with confusion regarding the nuances of diagnosis from one edition to another, but with the safety net of the diagnostic criteria embedded in the REDCap interface, omitting elements of diagnosis is less likely. This would be a helpful IT solution to ensure that practices do not incur such coding risk to avoid penalties if billing and documentation are audited.

It is also clear that REDCap is capable of managing the comorbidity implicit in real world medical and psychiatric diagnosis from its handling of the comorbidity data from the DSM 5 field trials. REDCap and other diagnostic tools could be a valuable assistant in considering what diagnoses should be considered concurrently given the potential overlap in diagnosis. The DSM 5 has also explicitly stated that the text will be available as a subscription, and that this will make the book "readily adaptable to future scientific discoveries and refinements in its clinical utility" [29]. While the DSM-IV underwent only one major revision (the DSM-IV TR in 2000), the presence of a web-based subscription creates the possibility that changes may occur more rapidly in the future, reinforcing the need to keep up to date with

potential changes, and therefore making integration with a readily updateable survey and database for diagnostic interview assists valuable to the busy clinician.

The converse to this scenario is also possible. If a centrally managed database of information from clinical interviews is created across institutions, the amount of data and ability for the tool to manage and analyze creates opportunities for vast trials powered to examine progressively smaller variations and subtypes of diagnosis in real world circumstances. In this way, the collection of interview data could influence the development of an expert consensus text (the DSM), and a discussion based format in which dynamic results could be assessed and viewed by users throughout the world. For example, the development of a new designer drug in a small region has been known to become disseminated widely throughout the country causing public health problems. Some recent examples include synthetic cannabis and bath salts [30].

Various studies have attempted to capture the public health impact, notably a report from SAMHSA (Substance Abuse and Mental Health Services Administration) that abuse of synthetic cannabis accounted for 11,406 Emergency Room visits in 2012 [31]. Could a nationally shared database of information regarding clinical interviews and experiences have enabled physicians and policy makers to act more rapidly to prevent the enormous impact of designer drugs in the US?

At the same time, substantial obstacles exist to the creation of a broadly available data sharing technology tool. In the arena of medicine, privacy concerns regarding the electronic mode of communication abound [32]. These concerns center around the nature of privacy regulations, the feasibility of secure data exchange, the security of personal devices and cloud computing, and social media. For example, the ability to store large amounts of data in compact devices, or in data accessible via internet connection such as a patient-provider connection website raises the possibility of data loss or theft, which in the case of medicine would constitute a large breach in confidentiality and privacy.

Given the role that technology has played in the development of the DSM 5, and the potential for the effect on the field of psychiatry, tools currently available to the psychiatric health care consumer and provider are affecting the current environment of diagnosis and practice. In an article in Clinical Psychiatry News, [33] the board of directors of the Anxiety and Depression Association of America (ADAA) is developing a rating system for mental health apps available for smartphone, and will be available on the associations website. For example, the National Center for PTSD is distributing an app created by the National Center for Telehealth and Technology, the Center for Deployment Psychology, and the National Center for PTSD, entitled “Mobile App: Prolonged Exposure Coach” [34]. The app is intended to be a companion tool for mobile devices that is intended to facilitate the evidence based treatment for PTSD, Prolonged Exposure, and serve as an extender for the therapist when not in session. The app features PTSD symptom tracking, psychoeducation videos including common reactions to trauma, recording and playback of prolonged exposure treatment sessions, availability of homework forms and a record of completed tasks, and an “interactive breathing retraining coach”. The app is free, and privacy concerns are handled via a disclaimer with instructions on the

app's webpage. Notably, the user is instructed that the data are only "as safe as the phone/device itself", and that storing or sharing data do not fall under HIPAA laws until the data are transmitted or shared with a mental health provider.

Another area of interest is in substance abuse treatment, where several companies have developed devices that either connect to smartphones/devices via the audio jack or usb connection, or bluetooth, that will approximate a breathalyzer reading [35]. These devices synchronize with an available app to track Blood Alcohol Levels over time, include blood alcohol levels in texts, and gain a real-time approximation of a blood alcohol level while drinking. Despite the comparative inaccuracy of these devices compared to a roadside breathalyzer available to a police officer, their relatively inexpensive cost may help them be more widely available. In addition, the idea is less to gain a blood alcohol concentration of high accuracy, and more to give the consumer objective information regarding blood alcohol rises and falls that may help provide them with better decision-making ability. If such data were available to a clinician, it may also aid in detection of substance related diagnoses apt for treatment.

Electronic Health Records available from vendors also tout the benefits of improved ability to enter rating scale data directly into patient records, asserting that the benefits of rating scale presence in the medical record results in improved quality outcomes and enhanced compensation from insurance, and attributing the lack of common practice in community settings is around access [http://www.patienttracemr.com/psychiatric-rating-scales/ for an example]. Vendors that tie electronic records to a billing and coding system offer the additional advantage of communicating rating scale results directly to an insurance company. Rating scales are widely seen as helpful adjuncts in psychiatric diagnosis [36–38].

Overall, the sheer technology utilized in developing DSM-5 has greatly advanced our field and the validity of our diagnoses. There are many additional benefits to be derived from the greater adoption of technology to improve clinical care. While we must balance the importance of confidentiality and avoid the creation of a cookbook mentality to diagnosis and treatment, the potential for dramatically improving care is difficult to argue.

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Chapter 11
Summary and Look Forward

Nancy M. Lorenzi and Naakesh A. Dewan

Abstract The goal of this book is to provide an overview of the important components that touch the technological expansion. The use of computer technology is more prevalent and the future will bring different changes. Technology innovations supportive of mental health care will be pervasive, continuous, and disruptive. Clinicians will become "IT implementers" whether they practice in solo offices, group practices, or large systems of care. There are a number of trends emerging that will have a direct impact on the mental health professions. One trend is that the scientific foundation for mental health is shifting and another is that technology is becoming smaller and some technology is wearable. The role of blogs, wikis, websites, podcasts, on-demand information, etc. will become more important in educating and helping people. The digital age is well ensconced in our day-to-day lives and our goal is that this book will help the reader understand the impact of information on their mental health practices.

Keywords Cognitive therapy • Mental health • Mental health services • Psychopathology • Psychotic disorders • Public health

The use of computer technology is more prevalent in our emerging digital world. As you look at your practice world your use of information technology systems has probably dramatically increased in the last few years. If the use of technology has not increased, "fasten your seatbelts" as it will in the near future! Each chapter in this book presents the multiple components that are key to being successful with the more extensive use of the programs for information technology systems. Incorporating what is needed into one book will be a major source of information about the current issues and needs.

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The purpose for this book is to prepare clinicians to understand, to critically evaluate, and to embrace well-designed and validated technologies that have the potential of transforming the access, affordability, and accountability of mental healthcare. To reach that purpose we invited the most knowledgeable people to share their knowledge so that the reader would become aware of the practical applications of technology in mental health as well as research supporting information technology tools, policy debates, and so forth. Each chapter contains either examples or scenarios that are relevant to the current practice of mental health care.

The goal of this book is to provide you an overview of all the important components that touch the technological expansion. The book begins with an abbreviated overview of the past, present and future of policy issues in mental health. It provides an excellent foundation for your current practice. Chapter 2 focuses on electronic health records outlining the issues within your practice and also the interconnections beyond your practice. The leading change chapter will take you through the various phases of implementing technology in your practice. It includes the people and process components as well as the technology component of the implementation.

Today we hear what is called Informatics, information-technology or software or programs quite frequently. The next section of this book focuses on the digital tools that are informatics-based used to aid in psychotherapy, cognitive training, substance abuse and the treatment of adolescents. Chapters also outline coding disease diagnoses, virtual reality, avatars in Second Life for innovative treatment and computer programs to aid adolescents.

Currently technology is used for tele-psychiatry. Tele-psychiatry is the delivery of psychiatric services via telemedicine. As Chap. 8 outlines that telemedicine is the use of technology to enable the medical practitioner delivered medical services remotely, with the physician and the patient in different locations, or the physician consulting remotely with another provider.

11.1 The Future

The future will bring different changes. Technology innovations supportive of mental health care will be pervasive, continuous, and disruptive in the first half of the twenty-first century. Clinicians will need to become “IT implementers” whether they practice in solo offices, group practices, or large systems of care.

Yearly goals and a plan for action will be essential requirements for success. Hardware, software applications, or process engineers and market “makers” will not have the same regulatory, liability, or economic constraints that traditional clinical developers such as pharmaceutical or device makers have in healthcare. In fact, purchasers of healthcare like consumers, and insurance companies or accountable care organizations will have greater freedom to innovate than clinicians who are held to a more conservative standard of patient safety and risk avoidance by society and the institutions that monitor quality and standards of care.

Consumers will have access to "self-therapy" and virtual coaches, and automated computerized eeg- guided magnetic stimulation devices to change cognitions, behavior, emotional states, and neural functioning and circuitry. The clinician must become an expert advisor of technology for the consumer and must strive to increase "computer-assisted" or technology-assisted treatment. The regulatory bodies such as accreditation organizations, licensing boards, and payers need to innovate their processes to permit clinicians to innovate at a similar pace with developers of technology. Vendors of technology will increase their "efficacy" research automatically due to the speed and efficiency of data capture and analytics. Clinicians will have outcome and predictive dashboards for each consumer and can benchmark their clinical practices with an international risk adjusted norms. There may come a time when clinicians spend half of their professional learning time dedicated to technology use and implementation.[1]

The mass accumulation of neuroscience knowledge and applications, engineering advances, and technology innovations is coming at an ideal time in healthcare.

Technology is still too naïve and primitive to solve the issues that have plagued modern healthcare for the past 50 years. Access, affordability, and accountability are still utopian demands by society, and it may well take a half of a century to respond to these demands. Clinicians must partner with their patients to accomplish this utopian dream.

11.2 Trends

Fun futuristic vision from The Atlantic, titled The Extremely Personal Computer: The Digital Future of Mental Health: "It's 2018, and you're not feeling your best. Yesterday, on the phone with Comcast, you forgot your social security number, and had to call your mom to get it . . . You fire up your PC and dig out your biomonitor wrist strap. "Welcome back kiddo," Regina, your therapist avatar, greets you. Regina has shiny red hair and glasses, and the Australian accent of a Bond girl. "Let's catch up." "I'm so sorry to hear what you've been through," Regina says, eyes wide. "I am here for you, ready to help you improve your mood and your mind." Thomas Insel, head of the National Institute of Mental Health, supported these efforts from the start, as an example of what he described to the Royal Society of London in 2011 as psychiatry as "clinical neuroscience." . . . We're at an extraordinary moment where the entire scientific foundation for mental health is shifting, with the 20th century discipline of psychiatry becoming the 21st century discipline of clinical neuroscience."[2]

[1] http://sharpbrains.com/blog/2012/10/04/the-digital-future-of-mental-health/ Oct 4, 2012 The Digital Future of Mental Health By: SharpBrains.

[2] The Extremely Personal Computer: The Digital Future of Mental Health. The Atlantic, October 3, 2012. http://www.theatlantic.com/health/archive/2012/10/the-extremely-personal-computer-the-digital-future-of-mental-health/263183/

11.3 Clinical Neuroscience

There are a number of trends emerging that will have a direct impact on the mental health professions. One trend is that the scientific foundation for mental health is shifting. For example, mental health is moving to more to clinical neuroscience based. A question for the future is, how will the therapy-practices change?

Clinical neuroscience is a branch of neuroscience that focuses on the fundamental mechanisms that underlie diseases and disorders of the brain and central nervous system. It seeks to develop new ways of diagnosing such disorders and ultimately on developing novel treatments. Clinical neuroscientists – including psychiatrists, neurologists and other medical specialists – use basic research findings to develop diagnostic methods and ways to prevent and treat neurological disorders that affect millions of people. Such disorders include addiction, Alzheimer's disease, amyotrophic lateral sclerosis, anxiety disorders, attention deficit hyperactivity disorder, autism, bipolar disorder, brain tumors, depression, Down Syndrome, dyslexia, epilepsy, Huntington's Disease, multiple sclerosis, neurological AIDS, neurological trauma, pain, obsessive-compulsive disorder, Parkinson's disease, schizophrenia, sleep disorders, stroke, Tourette Syndrome, among many others.

11.4 There Is a Dynamic Technology Shift

Technology is becoming smaller and some technology is wearable. There will be more technology to support the mental health professionals. For example, using a neuro-cap for neuro-feedback or biomonitor/biometrics to help monitor the patient could be readily available. In 2014 Myndbot technology was approved by the FDA for anxiety treatment. Insurance companies have begun to pay for partial coverage. In 2012 the National Institute of Health offered its first grants in the field of video games as psychiatric intervention.

Virtual reality is one technology that has and can be used in therapy. Researchers at the University of Southern California have used virtual reality to address war wounds and combat related post-traumatic stress disorder. Mental health researchers immerse patient "in simulations of trauma-relevant environments in which the emotions intensity of the scenes can be precisely controlled by the clinicians, in collaboration with the patient wishes."[3]

Another form of virtual reality is Second Life, which is a 3D virtual world where each person has an avatar and is able to socialize. The School of Medicine at Vanderbilt University tested the possibility of nurse practitioners and physicians from the Diabetes Center interacting with some of their patients by using Second Life for counseling. In the virtual reality pilot Second Life was more successful for

[3]Rizzo, A, Buckwalter, G, Forbell, E, et al. Virtual reality applications to address the wounds of war. Psychiatric Annuals. 43(3):123–133. March 2013.

the people who were more familiar with technology. However, as people become more familiar with technology this appears to be another way to work with patients.

11.5 Digital Technology for Prevention and Treatment

People are living longer and with the longer life there might be more geriatric mental health issues that need to be addressed. Is it possible that technology will have a role with the older population? How can technology help the mental health professional help his/her patients gain a more holistic wellness program? What about prevention?

As computer programs become more sophisticated there will be a time when people could get the needed answers through a computer. For example, what if a computer could verbally help a person figure out how to put a product together or what if the computer would ask the user enough questions to allow them to make a better decision. A further "what if" is the possibility of a computer "talking" through a problem with the user? [For those of you who have an iPhone, think about Seri and how Seri can respond to such a wide range of questions today.] People need help with decision making. Some of the issues that people go through today is that they have made poor choices or poor decisions. Could this help mental health?

11.6 Education/Training

With all of the issues that need to be addresses we need a continuous supply of well-trained mental health professionals. Can the use of information technology accelerate training, especially for the patient therapy processes?

11.7 Public Health and Social Change Through Social Media

With all the school shootings and other acts of violence is there a role for technology and the mental health professions in the future?[4] Biofeedback, computer based software programs can be now used to help children reduce test anxiety. Will this spread to other places? Neuro-feedback for children with attention-deficit /hyperactivity disorder. Will there be technology to actually change brain function? Can any of this help the path of the "school shooters"? Wearable computers that can help with depression or post-traumatic stress disorder will be more routine in the future.

[4]Randy Borum: Improving the clinical practice of violence risk assessment: technology guidelines and training. American Psychologist September 1966 pages 945–956.

Can technology help to better connect the mental health professional to other healthcare professionals? Will there be more Facebook type programs for the world to use? Our phones keep us connected today and in the future the phones will offer more and more connections. The number of apps are amazing. M-health is a word used for the mobile health apps that are available for the "smart phones" today.

As a support network, e.g. Patients like me. http://www.patientslikeme.com/ On June 18, 2014 there were about 2,000 results in 0.29 s! The following are the first six listings.

Mental Health Counseling (Individual Therapy) Report for Patients . . .
Mental Health Counseling (individual therapy): Find the most comprehensive real-world treatment information on **Mental Health** Counseling (individual therapy) . . .
www.patientslikeme.com/.../11845-mental-health-counseling-side-effects-and-efficacy? . . . clipped from Google – 6/2014

Mental Health Nurse Practitioner Report for Patients Like You
Mental Health Nurse Practitioner: Find the most comprehensive real-world treatment information on **Mental Health** Nurse Practitioner at PatientsLikeMe.
www.patientslikeme.com/...;/25400-mental-health-nurse-practitioner-side-effects-and-efficacy clipped from Google – 6/2014

Art and Mental Health Charity (Volunteering) Report for Patients Like . . .
Art and **Mental Health** Charity (volunteering): Find the most comprehensive real-world treatment information on Art and **Mental Health** Charity (volunteering) at . . .
www.patientslikeme.com/...;/16355-art-and-mental-health-charity-side-effects-and-efficacy-and-efficacy clipped from Google – 6/2014

Mental Retardation Symptoms and Experiences Straight from . . .
Mental Retardation: Find the most comprehensive real-world symptom and . . . help each other live better and uncover the best ways to manage your **health** today . . . www.patientslikeme.com/conditions/1182-mental-retardation

Life Chart Method (Individual Therapy) Report for Patients Like You
Life Chart Method (National Institute of **Mental Health** prospective Life Chart Methodology) allows for the daily assessment of mood and episode severity based . . .
www.patientslikeme.com/...;/10822-life-chart-method-side-effects-and-efficacy?

Post-traumatic Stress Disorder Symptoms and Experiences Straight . . .
Post-Traumatic Stress Disorder (PTSD), a **mental health** condition triggered by a traumatic event, is characterized by many symptoms including flashbacks, . . .
www.patientslikeme.com/conditions/24-post-traumatic-stress-disorder

11.8 Future Challenge

With all of the increased use of technology will you face more patients who are addicted to technology? Will there be an over reliance on technology instead of face-to-face or verbal conversations? The role of blogs, wikis, websites, podcasts, on-demand information, etc. will become more important in educating and helping people.

11.9 Summary

The digital age is well ensconced in our day-to-day lives. It is our hope that the chapters in this book and our predictions about the future will help the reader understand the impact of information on their mental health practices.

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