

## DIGITAL HEALTHCARE: DIGITAL MENTAL HEALTHCARE AND NURSING SERVICES REVOLUTION IN INDIA

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### Abstract

The World Health Organization data shows India as one of the most depressed nations of the world. What's worse, the number of mentally disordered people is projected to multiply in the coming decades. When the World Happiness Report 2022 reveals that mental illness is not only eating into the vitals of India in terms of happiness, quality of life, and productivity of its workforce, the World Economic Forum projection 2030 shows how mental illness is costing the national economy trillions of dollars. While several socio-cultural, political, economic, and environmental factors, besides the decline in the function of religion as a balancing force, are responsible for poor mental health in India, as elsewhere, poor mental healthcare infrastructure and the dearth of trained professionals are quite appalling. Not only there is an acute shortage of mental health professional (e.g., psychologists, psychiatrists, and medicine doctors who can treat mental health disorders) but also most of the people suffering mental health disorders do not seek, let alone receive, institutional therapy available in hospitals and clinics. Factors such as social stigma attached to mental illness, lack of access to professional help and/or affordability have put India in a state of mental health crisis even after the implementation of the Mental Health Care Act 2017 since 2018. However, e-health services and mental health apps (MHApps) using artificial intelligence (AI) technologies have come forward to provide alternative mental healthcare in India. This study concludes that the AI-enabled mental healthcare services and tools that are endowed with features like anonymity, no-space barrier, ease of use, flexible-timing, and affordability have emerged to be more reliable in India than the face-to-face traditional therapy. Case studies of several online services platforms and apps have been presented in this work to demonstrate how AI-powered evidence-based psychotherapies including CBTs, chatbots, virtual reality (VR) apps, and stress-busting computer/mobile games are increasingly becoming popular in India. It is found that customers of mental healthcare consider computerized self-help intervention as the best option. This paper concludes that the AI-enabled health services and applications, blessed with their scalability, will bridge the infrastructural and services gap both quantitatively and qualitatively and ensure universal mental healthcare in India by 2030.

**Keywords:** Digital health, Digital mental health, Digital mental healthcare, Mental healthcare in India, MHApps

### I. INTRODUCTION

In the 21st century, every country on the globe, especially India, has got to classify its citizens into ‘haves’ and ‘have-nots’ — in terms of mental health. Mental health, which is defined by the World Health Organization (WHO) as “a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community” [1], is the key to “self-actualization of one's intellectual and emotional potential, among others” [2,3]. As the foundation for an individual's affective, cognitive, and behavioral well-being, mental health is crucial for the overall wellbeing of individuals, families, societies, nations, and the world. Mental illness, on the other hand, is “a condition that affects a person's thinking, feeling or mood” [4] and is responsible for personality and behavior disorder. It happens to be one of the major causes of ill-health and disability worldwide. When there are more than hundred kinds of mental disorders [5], the most common forms of mental illness constitute anxiety disorders (e.g., Obsessive- Compulsive Disorder or OCD; Post-traumatic stress disorder or PTSD), mood disorders (e.g., depression, bipolar disorder), dementia, and schizophrenia. Even as mental illness transcends age, gender, nationality and ethnic boundaries across the world, more than 450 million people are already suffering from mental illness or mental health disorders globally. One person in some part of the planet dies every 40 seconds because of one or other form of mental illness [5]. However, the buck does not stop here. Nearly 50 million people around the globe are afflicted with dementia, a form of mental disorder, and the number is projected to be around 150 million by 2050 [5] and by 2030 mental health burden will have cost the global economy something around \$6 trillion to \$16 trillion [6,3].

In 2020, India topped the list of the depressed nations in the world, with little rural-urban differences, followed by the USA and China [7] although global position has changed due to COVID-19 but India carries 15% of global health burden whereas % of its workforce suffers mental health as of 2022 [8].

Although India's engagement with mental illness in between its first legislation on mental health (the Lunacy Act 1858) and the latest one (the National Mental Health Act 2017) can be tagged “progressive”, the country's mental health disease burden remains enormous and ever-increasing. India's official goal to achieve universal mental healthcare—mental healthcare to all its citizens—might appear overambitious, but the Government of India's commitment to achieving mental healthcare for all Indians is manifest in all its national policies and programs since independence — the National Mental Health Programme (NMHP) of 1982, National Mental Health Policy, 2014 (New Pathways, New Hope, 2014) and the National Mental Health Act 2017 (compatible with WHO's Comprehensive Mental Health Action Plan 2013-2020 and WHO's Mental Health Gap Action Programme 2018). However, factors like lack of awareness about mental health, social stigma [9, 10], colossal gap between demand for and supply of mental health professionals [11, 12] and lack of affordability are some issues that have failed India to achieve exemplary success. To use a metaphor, the crisis of mental illness in India is tickling like a time bomb that can burst anytime, unless defused strategically in time.

To put it in proper perspective, mental health disorder is a global crisis afflicting not only numerous low and middle-income countries including India and China but also developed nations including the USA—cutting across gender, age, and ethnicity. [13] studied mental disorder in India from 1990 to 2017 has found that 197.3 million Indians suffered from mental disorders (45.7 million from depressive disorders and 44.9 million from anxiety disorders) in 2017. Besides, one in every seven Indians were afflicted from mild to severe mental disorders in 2017 and the number of the mentally ill has nearly doubled since 1990. While the Deloitte September 2022 study shows that 80% of employees in India suffer from some symptom of mental illness or the other [8], the Associated Chambers of Commerce of India (ASSOCHAM) 2018 survey revealed that sleep deprivation, resulting from high stress, anxiety disorder, and reduced workplace productivity, affects India Inc. around USD 150 billion a year.

As the number of mentally ill people is projected to multiply in the coming years, India must provide proper mental healthcare for its most vulnerable section of the society—the mentally ill. Proper mental healthcare is basically grounded on five basic principles: (1) universal, free and fair access; (2) rational distribution of burden of healthcare in terms of access to quality professionals and services, latest innovations and optimization of resources; (3) guarantee of empathy, trust and critical care; (4) special attention to patients deemed to be vulnerable as defined by law or so recognized by society (e.g. PVTGs), and (5) inclusion of recovered persons as volunteers of community health developers. India's track record in affording quality mental healthcare—diagnosis, intervention, monitoring, treatment, and post-treatment care—has been lamentable but nonetheless quite promising.

Mental illnesses constitute one-sixth of all health-related disorders and India has accounted for nearly 15% of the global mental, neurological and substance abuse disorder burden. The treatment gap, which is defined as the prevalence of mental illnesses and the proportion of patients that get treatment, is over 70 percent. Mental illness is not only eating into the vitals of India in terms of happiness and productivity of its workforce [14] but also costing Indian firms \$ 14 billion every year [7]. And to make matters worse, the acute shortage of psychologists, psychiatrists, and doctors who can treat mental health disorders is abysmally low — there are 0.3 psychiatrists, 0.07 psychologists, 0.12 nurses, and 0.07 social workers per 1 million population in India [3]. Inadequate number of mental health hospitals and trained professionals on one hand and stigma, lack of access and affordability of treatment on the other call for better interventions and more pragmatic solutions. Ironically enough, India has been one of the first nations under the “developing” tag to have a mental health programme (MHP) in place in 1982 [15]. India's first National Mental Health Policy 2014—New Pathways, New Hope, 2014—and its National Mental Health Act 2017 (superseding the Mental Health Act, 1987) have nurtured the vision of providing universal psychiatric healthcare. However, the current picture of mental health care in India is at best ‘promising’ and at worst ‘dismal’. Thus, it is worth studying how India is going to deal with its current national crisis that is projected

to grow with time.

What the WHO found in its World Health Report in 2000 about handling mental health issues has remained valid till date. For example, its assertion that “treatments are available, but nearly two-thirds of people with a known mental disorder never seek help from a health professional. Stigma [even the word ‘mental’ in India is considered offensive], discrimination and neglect prevent care and treatment from reaching people with mental disorders.” It further observed that “some mental disorders can be prevented; most mental and behavioral disorders can be successfully treated; and that much of this prevention, cure, and treatment is affordable. Despite the chronic and long-term nature of some mental disorders, with the proper treatment, people suffering from mental disorders can live productive lives and be a vital part of their communities” [16]. Even as providing, promoting, and sponsoring mental healthcare remains the primary responsibility of the governments, the burden is always with the individual undergoing mental illness and their family or caregivers. The report found that “large mental institutions no longer represent the best option for patients and families. Such institutions lead to a loss of social skills, excessive restriction, human rights violations, dependency, and reduced opportunities for rehabilitation. Countries should move towards setting up community care alternatives in a planned manner, ensuring that such alternatives are in place even as institutions are being phased out.” Clearly enough, a globally relevant mental health plan to contain the menace is an imperative.

The WHO’s Mental Health Action Plan 2013-2020 calls for innovative techniques, increased social interventions, and disruptive technologies to address global mental disorders. This is undoubtedly the guideline for India, which houses millions of depressed people. Further, the Lancet Commission’s policy (2018) on global mental health, such as to ensure inclusion of mental health affected people, address across SDGs, exploit innovation and research, increase investment in mental health, apply to India as well. Against this background, this paper intends to discuss the futuristic role of digital mental health platforms, technologies and start-ups in providing alternative mental healthcare services.

Most of the mental disorders are curable and people diagnosed with mental health problem can recover through effective individualized treatment plan. There are evidences that prove that common mental disorders like anxiety and depression can be diagnosed, treated and cured even in primary care settings using medications as well as psychotherapies [17]. It is the a priori that appropriate therapeutic communication as well as proper medication holds the key to solving mental health disorders. However, there have been many a slip between the cup and the lip in India. Thus, a radical change in the way mental healthcare is administered in India has become inevitable. We shall examine how and why digital interventions are going to be the main stay of such change.

Surveys and studies like the National Mental Health Survey of India (2015-16), the World

Health Organization report (2018), Mental Health Action Plan 2013-2020, and the World Happiness Report 2022 have rightly emphasized that mental health rights are universal human rights and there is urgent need to destigmatize mental health disorders and promote mental health by expanding mental healthcare services. With the vision of ‘health and wellbeing for all at all ages’, the National Health Policy, 2017 articulated the Government of India’s commitment to (i) “Increase creation of specialists through public financing and develop special rules to give preference to those willing to work in public systems”, (ii) “Create network of community members to provide psycho-social support to strengthen mental health services at primary level facilities”, and (iii) “Leverage digital technology in a context where access to qualified psychiatrists is difficult.” With the Mental Health Care Act 2017 (implemented since 2018), however, the government of India came forward with clearly defined goals, roadmaps, and actionable plans and programs to combat the national crisis of mental illness.

## **II. India’s Mental Health Care Act 2017 and Universal Mental Healthcare**

The Mental Health Care Act 2017 is based on India’s commitment to the SDG (3.4 and 3.5) of UN Agenda for Sustainability 2030 and UN Convention on Rights of Persons with Disabilities-2006 that came into force in 2008. According to this Act, “Mental healthcare” includes analysis and diagnosis of a person’s mental condition and treatment as well as care and rehabilitation of such person for his mental illness or suspected mental illness. This comprehensive Act intends to address the shocking revelation of the National Mental Health Survey of India 2015-16 that 10.7% of adults (150 million) suffers from one or the other form of mental health problem, that 70-92% of these people (108 to 138 million) have little access to any form of mental healthcare from the existing public mental health system. The Act has tried to address the issue of mental health in India squarely.

With its two primary objectives (i) “To ensure access and availability of mental healthcare and treatment to all persons;” (ii) “To ensure that the rights of persons with mental illness are respected, protected, promoted and fulfilled when they exercise their right to access mental healthcare and treatment”, the Act highlighted its object—to ensure the right of all persons to mental healthcare, i.e., universal mental healthcare.

The Mental Health Care Act 2017 of India mandates the government(s) to:

- (a) “integrate mental health services at all levels of healthcare including primary, secondary and tertiary healthcare and in all health programs run by the appropriate Government;”
- (b) “provide treatment in a manner, which supports persons with mental illness to live in the community and with their families;”
- (c) “ensure that the long-term care in a mental health establishment for treatment of mental illness shall be used only in exceptional circumstances, for as short a duration as possible, and only as a last resort when appropriate community-based treatment has been tried and shown to have failed;”

- (d) “ensure that no person with mental illness (including children and older persons) shall be required to travel long distances to access mental health services and such services shall be available close to a place where a person with mental illness resides;”
- (e) “ensure that as a minimum, mental health services run or funded by Government shall be available in each district;”
- (f) “ensure, if minimum mental health services specified under sub-clause (e) of subsection (4) are not available in the district where a person with mental illness resides, that the person with mental illness is entitled to access any other mental health service in the district and the costs of treatment at such establishments in that district will be borne by the appropriate Government.” Further, the MHCA 2017 mandates the government to meet internationally accepted guidelines for maintaining the number of mental health professionals, based on the total population of India, by the year 2028. It goes without saying that the Act envisions universal mental healthcare by 2030.

Notwithstanding the clear provisions laid in the Mental Health Care Act 2017, several constraints have surfaced as deterrents in achieving the goals of universal mental healthcare. The problems that affect mental health care in India are basically five: (1) Social stigma attached with mental illness that prevents most of the mentally ill to access and undergo mental treatment; (2) Enormous demand-supply gap of patients and health professionals; (3) Lack of mass awareness and affordability of psychotherapy; (4) Financial constraints of the government(s) to provide adequate infrastructure and trained health personnel; and (5) lack of adequate community health care network or community psychiatry services for the mentally ill. Thus, alternative mental healthcare is deemed essential to address the inadequacy of mental health institutions; deficit of counsellors, psychiatrists and psychologists to treat large number of mentally ill; non-availability of non-judgmental psychotherapy; and lack of access to convenient, low-cost or freely available preventive, diagnostic, regulatory, and self-monitoring therapeutic treatment. In other words, an alternative or adjunct mental healthcare system is essential to address the population left by traditional healthcare. Studies claim that genuine digital mental health intervention technologies can augment traditional mental healthcare and can be useful in real-time assessment, prediction, detection, symptom tracking, diagnosis, intervention, monitoring, and therapeutic treatment of mental illness [18, 19].

While availability of large mental health institutions providing therapy to mentally ill people are inadequate in both quantity and quality, digital mental healthcare treatment services and systems that are adjunct and/or alternatives to mainstream services offer hope of solving India’s national crisis. Against this backdrop, this paper aims to prove that integrated mental healthcare—face-to-face psychotherapy and e-services and applications—is going to be the future of mental healthcare in India.

### **III. Why India Needs Digital Mental Health System**

When every year around 800000 suicides happen globally and as much as 16000000 suicide attempts have been recorded [20], India records 16.5 suicides per 100,000 people, the highest number in South-East Asia (WHO, 2019 Suicide report). The fact remains that suicidal ideation is a symptom of mental illness and the leading cause of it is depression. Around 200 million Indians are suffering from depression [21]. Approximately 10 million Indians are supposed to suffer from dementia [22] and the rate is going to double by 2030 and treble by 2050 [23]. According to a recent study published in December 2019 in the Lancet Psychiatry, 45 million Indians suffered from anxiety disorders [13]. This study reveals that the contribution of mental disorders to the total disease burden has doubled in India from 1990 to 2017. On the contrary, the treatment gap through traditional mental health care ranges from 70% to 90%. While several socio-cultural, political, economic, and environmental factors, as well as individual living standard and life style, determine the current state of mental health in India as elsewhere, poor mental health and poorer mental healthcare infrastructure and services are quite appalling in India [23], not to mention poor investment. India pines its hopes on digital healthcare (National Health Policy, 2017; National Digital Health Blueprint, 2019) including mental healthcare, where technology delivers therapy, to ensure universal mental healthcare. Launched on 15 August 2019, the National Digital Health Mission, which is committed to “making India a digital health nation enabling digital healthcare for all” leverages the increased internet access in India. The launch of 5G or 5th generation mobile network in 2022 has expanded the possibility hundred times.

Aligned to the Vision of NHP 2017 for “extensive deployment of Digital Tools/Technology to enhance health system performance”, comes the National Digital Health Blueprint (NDHB), 2019 with the vision “To create a National Digital Health Eco-system that supports Universal Health Coverage in an efficient, accessible, inclusive, affordable, timely and safe manner, through provision of a wide-range of data, information and infrastructure services, duly leveraging open, interoperable, standards-based digital systems, and ensuring the security, confidentiality and privacy of health-related personal information.” While directing the governments to adopt “federal cooperative” system for universal healthcare, the NDBH has mandated the following digital architecture and action plan: (1) Design and establish Personal Health Identifier (PHI); (2) Design and establish Electronic Health Record (EHR) system; (3) Design and Develop Core APIs; (4) Design, develop and establish Consent Manager; (5) Establish MyHealth App; (6) Design, develop and populate Health Directories (Master data of professionals, institutions); (7) Establish National Health Portal; (8) Design and establish Health Locker; (9) Design and Develop Health Analytics system; (10) Design and Develop Anonymizer; (10) Integrate PMJAY with NDHM; (12) Establish NCD Registries; (13) Design, develop and launch Common Applications including Hospital Information System, Emergency Management System, E-Pharma, Wellness Centres Management, Ayush, Screening, MEDucation, CDS (Clinical Decision Support System); (14) Localization Tools; and (15) Design and Develop Health Schemes Management System(s).

The NDHB proposes the constitution of National Digital Health Mission (NDHM), “a purely government organization with complete functional autonomy”, to implement the NDBH. It pitches for the evolution of a digital eco-system. The NDBH has identified 23 building blocks, “the core of NDBH” to facilitate the evolution of the digital eco-system. While calling for “Unique identification of Persons, Facilities, Diseases and Devices”, NDBH asks for Personal Health Identifier (PHI) through Personal Health Record (PHR) along the line of UID Aadhar and maintenance of Health Master Directories & Registries. The Blueprint highlights the need for “maintaining the confidentiality, security and privacy of the health records”. It mandates the patient’s authority for “consent for data capture and consent for data use”, data privacy, anonymity, etc. It is hoped that NDHB will pave the way for the evolution of a national digital ecosystem and facilitate universal healthcare, including mental healthcare, for all Indians. It can be said here that India’s National Digital Health Blueprint (2019) and the WHO guideline: recommendations on digital interventions (2019) share much common grounds on the utility of digital technologies in healthcare which also apply to digital mental healthcare.

India’s growing mental health challenges in the face of resource crunch—human resources (e.g. psychologists and psychotherapists) as well as financial resources—leaves policymakers, health analysts, and health professionals fret about securing mental healthcare to all its citizens. However, alternatives to face-to-face treatment for mental disorder has been mooted— e-mental health services and digital technology-empowered therapy and medication. Studies reveal that e-health services and digital technologies can greatly help the people suffering from mental illness but shy of receiving medical aid in the face-to-face mode, i.e., face-to-face therapy). E-mental health services use the internet and related technologies to deliver mental health information, services and care. It is found that the emergence of e-mental health services has been a boon to mental healthcare in the world and India, as we shall see, has a competitive advantage due to its mobile and internet network. Large number of mentally ill patients are unable to avail face-to-face therapy, not to mention the huge gap between the number of patients and mental health doctors and counsellors. E-mental health services can to a great extent solve the problems arising out of social stigma, lack of access and/or lack of affordability for regular mental health services.

#### **IV. Psychotherapy and Medication Can Cure Mental Illness**

Psychotherapy and medication or a combination of these two can help prevent, treat, and cure mental disorders. “Psychotherapy, or talk therapy,” according to the American Psychological Association “is a way to help people with a broad variety of mental illnesses and emotional difficulties... Psychotherapy may be used in combination with medication or other therapies” [24]. By eliminating or controlling troubling symptoms, psychotherapy can cure mental disorders, such as depression, anxiety, trauma, schizophrenia, dementia.

There are so many therapies that psychotherapists, psychiatrists and psychologists use with their patients. As different individuals respond differently to therapies and medication, even when they have common symptoms, it cannot be said which therapy is the best. However,



the most common therapies used in mental health care are (1) Cognitive Behavioural Therapy (CBT) and (2) Exposure therapy (ET). When CBT is a therapy employed to unseat fossilized thoughts, strong beliefs, and fixedly negative attitudes that affect one's behavior and thought process adversely and resulting in mental disorder [25], Exposure therapy (ET) is a psychotherapy in which the patient is "exposed" to the "the feared objects, activities or situations" created by the psychiatrist/therapist and the patient overcomes the phobias while being in a safe zone. According to the American Psychological Association, "Cognitive behavioral therapy [CBT] focuses on the relationship among thoughts, feelings, and behaviors; targets current problems and symptoms; and focuses on changing patterns of behaviors, thoughts and feelings that lead to difficulties in functioning" [26]. CBT helps the individual move from unhealthy emotions and behaviors to emotional intelligence and healthier behavior. On the other hand, mental disorders like phobias, social anxiety disorder, panic disorder, posttraumatic stress disorder (PTSD), Generalized Anxiety Disorder, Obsessive-Compulsive Disorder, etc. can be effectively treated and cured using exposure therapy, which was "developed to help people confront their fears." In its PTSD clinical practice guideline (<https://www.apa.org/ptsd-guideline/>), several strategies and classifications of exposure therapy, used to help patients overcome their morbid fears, have been given in detail. CBT as well as ET focus on boosting the coping skills of an individual undergoing treatment and converting their pessimistic thoughts into optimistic thoughts. Thus, if timely and proper mental healthcare services are availed or provided, normalcy and happiness can be restored to many a person suffering from mental disorders such as depression, trauma, anxiety, schizophrenia, and bipolar disorder. If mental illness is ubiquitous, mental healthcare must be readily availed.

Digital mental health care services or e-mental health care (eMH) services are "mental health services provided through the internet and related technology (including apps for smartphones)" as well as telemedicine—the practice of medicine using electronic communications, information technology, etc. between the doctor(s)/medico and the patient located in different places with or without intermediary. According to [27], eMH services can be categorized into four main areas: providing information; screening, assessing, and monitoring; intervention; and providing social support. Telemedicine tools now include video, e-mail, text messaging, apps, and other mobile health modalities, deployed synchronously, asynchronously and in hybrid combinations to offer assessment, consultation, direct treatment, and integrated care. Telepsychiatry, a subset of telemedicine, can involve providing a range of services including psychiatric evaluations, therapy (individual therapy, group therapy, family therapy), patient education and medication management.

We agree with the American Psychiatric Association's study [24] that "video-based telepsychiatry helps meet patients' needs for convenient, affordable and readily-accessible mental health services". Through internet and mobile health apps, people in rural areas can access mental health care. A patient can get consultation and psychotherapy at his or her

location. Digital technology can integrate primary health care and psychological health care. While digital online services and apps can help reduce significantly delay in care, monitoring and follow-up will be quite easy. Mental health services can be accessed online without the fear of stigma or ostracization.

Cognitive computing, CBT-based apps, AI-enabled mobile and web-based apps, and technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR) for therapy are evolving and tested considerable success in India either as alternatives or adjuncts to psychotherapeutic services. Although studies show that despite the effectiveness of e-mental health services, consumers prefer face-to-face services [28, 29], this paper asserts that in India e-mental health services and mental health apps are not only growing in number day by day but are also evolving as alternative mental health crisis managers by augmenting the scarce pool of trained personnel, aiding in early detection, diagnosis, continuous monitoring, prevention, decision making, problem-solving, treatment, and post-treatment care. We foresee that the 5-G mobile and internet services are poised to make e-mental health services more preferable to f2f services.

This paper discusses the emerging trends in e-health services and applications (apps) catering to mental healthcare in India and the issues and prospects thereof. It can be argued that the failure of community mental healthcare in India [30, 31] has led to individualistic choices and reliance on online services. This study analyses dozens of e-health services, service providers (including start-ups) and mobile healthcare apps --- digital facilities that have emerged to be more reliable than the inadequate and inhospitable hospitals in India. It is concluded that digital mental healthcare services and apps cannot only supplement and complement traditional mental healthcare therapies like yoga, but they can also provide better substitutes per se as per individual (read customized) needs. In the next sections, we will discuss the digital mental healthcare services and apps and the technologies that enable these platforms and apparatus, their enabling functions and the benefits that mental health patients are relying on. A discussion of the salient features of e-healthcare services and behavioral/mental healthcare apps will be useful in ensuring a zero-stigma society and universal mental healthcare.

## V. Salient Features of E-Mental Health Services and Mental Healthcare Apps

Mental healthcare involves prediction, detection, prevention, diagnosis, treatment, post-treatment care of mental disorders. As stated earlier, all sorts of mental disorders can be prevented, treated, and cured by psychotherapy or medication or a combination of both. Digital therapeutic solutions, especially CBT and exposure therapy, can be provided by IT-enabled e-healthcare services and mental healthcare apps.

Information technology enabled e-healthcare services and mental healthcare apps are endowed with the characteristics as follows:

**Self-management:** E-health services and mental healthcare apps can be used by a person suspecting he or she needs to understand his or her mental problems. The CBT-based apps are

easy to use. Thus, apps are useful in preventing one's mental disorder from getting worse. Online mental healthcare empowers one to overcome stigmatization and discrimination. In the initial stage of mental illness, self-supporting online services and apps can be relaxing to caregivers of the mentally ill. E-health services and mental healthcare apps can provide individualized/customized/tailor-made services. An AI- or IoT-enabled device, such as a mobile app, can help one be self-aware, self-monitor, predict and control emotion, mood, and behavior.

**Convenience:** The patient or the caregiver can decide the time and place of treatment. He or she can, for example, decide to receive the treatment in day time or at night, with people or in private. It is an ideal choice for the patients who tend to avoid or loathe face-to-face treatment. Besides being reliable, e-healthcare services and mental healthcare apps could be entertaining enough to attract and engage the mentally ill patients.

**Real-time Service:** Digital technology can enable service providers to cater to large number of people transcending space and time barriers. It can provide 24x7x365 monitoring and intervention support. For the patient, an IoT-enabled (wearable) device can send need-based message to alert a relative, caregiver or crisis center for help in emergency.

**Confidentiality:** Another convenience with online services and apps is that the patient has the liberty of not revealing his or her name and can still receive treatment. Due to the social stigma and low self-esteem the patient might be undergoing, the patient may choose to go anonymous and utilize the treatment. The neutral manner in collecting personal data is appreciable. E-healthcare services and mental healthcare apps maintain privacy of the end-users.

**Affordability:** Most of the e-healthcare services and apps either cost very low or they are entirely free of cost. Therefore, they are better options than traditional care.

**Error-free service:** Consistency of treatment is a feature of technology and therefore e-healthcare services and mental healthcare apps can cull real-time data and hence they are reliable and trustworthy for end-users. Assisted by AI, IoT, and cutting-edge technologies, digital mental health services and apps can significantly reduce instrument error, process error and technician errors and provide fool-proof services.

**Scalability:** Scalability or scaleability refers to the ability of a product, process, software or an organization to cater to the growth in demand and productivity as per changing needs or demands of its users or clients with growing time. Digital mental health services, apps, and platforms are scalable and can cope with growing demand and use unlike human health professionals.

## **VI. Business with a Cause: Popular Mental Health Apps (MHApps) for Mental Health Victims**

An app is a software that enables a user to perform certain tasks online, on a desktop/laptop or on a mobile phone/smartphone. There are thousands of mental health apps (MHApps) based on CBT and other therapies and techniques addressing mental disorders of different degrees of mildness to severity. Different types of MHApps are available to address different mental health concerns.

Here is a list of mental disorders and the MHApps addressing the concerns:

### **A. Addiction Apps**

Addiction can be defined as “a compulsive, chronic, physiological or psychological need for a habit-forming substance, behavior, or activity having harmful physical, psychological, or social effects and typically causing well-defined symptoms (such as anxiety, irritability, tremors, or nausea) upon withdrawal or abstinence” (Merriam-Webster Dictionary). Addictions to substance include alcohol, tobacco smoking, drugs and opioids (e.g. heroin, sedatives, hypnotics, sleeping pills, tranquilizers, hallucinogens, inhalants, LSDs), cocaine, cannabis (marijuana). Behavioral addictions include food, sex, pornography, playing computer/internet/video game, obsessive shopping, kleptomania, eating obsession.

#### ***Most popular Addiction apps include:***

HabitBull (Free/Paid Premium Membership Android App to de-addict you); iQuit (Free iPhone app designed to help chain smokers quit/reduce smoking); Pear reSET (Free mobile app to address substance disorder); Quit Drinking (Free Android app designed to help people cope with the emotional and physical cravings for alcohol); Quit That! (Free mobile app that helps to stop drinking alcohol, quit smoking/ drugs rTribe (Free mobile app that helps Quit Porn/Drug/Food Addiction); Sober Grid (Free mobile app available on Google Play and Apple store; helps to connect to sober people); WEconnect (Free mobile app that can send SOS message).

### **B. Anxiety Apps**

*According to the American Psychological Association, “Anxiety is an emotion characterized by feelings of tension, worried thoughts and physical changes like increased blood pressure. People with anxiety disorders usually have recurring intrusive thoughts or concerns. They may avoid certain situations out of worry. They may also have physical symptoms such as sweating, trembling, dizziness or a rapid heartbeat” [32]*

#### **Most popular Anxiety apps include:**

AnxietyCoach (Self-help app that addresses fears and worries, using CBT strategies); Aura (Free/Paid Premium Membership Android App); Brain.fm (Paid App that uses AI-generated tunes and music to improve focus, meditation and sleep); Mind Shift (Android and iOS App that helps teens and young adults with anxiety); Panic Relief (Free mobile app to address anxiety and panic across ages); Positive Body Image for Women: A Hypnosis Guide (Free iOS App that provides hypnosis audio album for women in need of positive body image and self-esteem); SAM: Self-Help for Anxiety Management (Free iPhone and Android app that offers options for tracking anxiety, identifying anxiety triggers, breathing and relaxation strategies, and anxiety management toolkit); Sleep Cycle (Free/Paid Premium Membership Android App that tracks sleep and snoring; helps in gently and timely awakening); Stop, Breathe, Think (Paid iOS and Android App that checks in various emotions); Woebot (Google Play Award Winner 2019 AI chatbot that uses CBT and can hold tiny conversations with users; App designed by former employees of Stanford University); Youper (Free/Paid Premium

Membership Apple and Android App that uses AI chatbot to track moods and overcome stress, anxiety, and depression; iPhone: 5 stars and Android: 4.9 stars)

### **C. *Bipolar Disorder Apps***

According to the WHO mhGAP Intervention Guide, bipolar disorder is “characterized by episodes in which the person's mood and activity levels are significantly disturbed. This disturbance consists on some occasions of an elevation of mood and increased energy and activity (mania), and on others of a lowering of mood and decreased energy and activity (depression). Characteristically, recovery is complete between episodes. People who experience only manic episodes are also classified as having bipolar disorder” [33].

#### ***Most popular Bipolar-disorder apps include:***

eMoods (Free; iOS and Android App that tracks bi-polar disorder); IMoodJournal (Paid iOS and Android App that provides a mood journal, personal diary, and charting tool); Medisafe (Free iOS and Android app used for pill reminder and medication tracker); Mood Log (Free Android App that helps track mood changes); MoodKit (iOS-supported CBT-based App that provides 200 different mood improvement activities); Sanvello (Stress reliever App that provides videos and audio exercises, interactive activities, mood and health habit tracking; it has more than 3 million registered individuals); T2 Mood Tracker (Free Android and iOS App for mood tracking); What's My M3 (Validated iPhone/Android app that provides a three-minute tool to assess symptoms of anxiety, bipolar disorder, depression and other mood disorders).

### **D. Depression Apps**

“Depression is a common mental disorder, characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness and poor concentration. It can be long lasting or recurrent, substantially impairing a person's ability to function at work or school, or cope with daily life. At its most severe, depression can lead to suicide. When mild, depression can be treated without medicines but, when moderate or severe, people may need medication and professional talking treatments... Alzheimer's disease is the most common form of dementia.” [34].

Most popular Depression apps include:

Depression CBT (Free Android mobile App based on CBT principles and used to change negative thoughts); Happify (Free; iOS and Android Mood training App that comes with evidence-based games and activities using positive psychology and CBT); MoodGYM (Internet based app that helps you treat depression using Cognitive Behavioral treatment; tool is more effective with in person therapy); Moodnotes (Free; iOS and Android app based on CBT that offers a thought journal and mood diary and its toolkit helps you fight depression); Moodpath (Free; iPhone and Android app that provides 150 exercises and helps you with in-moment questions over two weeks and overcome symptoms of depression; facilitates conversation with a psychiatrist); MoodTools (Free; iOS and Android CBT-based App provides 6 evidence-based tools that help you fight clinical depression and other negative moods); Positive Activity Jackpot (Free Android app using Augmented Reality tool with a

professional behavioural health therapy for depression, namely, pleasant event scheduling (PES) with anti-depressant activities); TalkLife (Free “peer-to-peer” app that uses CBT and talk therapy; connects a depressed person with empathetic and supportive listeners across the world; iPhone: 4.5 stars, Android: 4.5 stars).What’s Up (Free smartphone app that using CBT helps you overcome depression by educating about positive thoughts, breathing techniques useful for relaxation; habit tracker, and motivational advice).

#### **E. Eating Disorder Apps**

Eating disorders are serious health conditions related to persistent eating behaviors that negatively impact a person’s health and his/her ability to function in important areas of life. Obsessions with food, body weight, and shape may also signal an eating disorder. The most common eating disorders include Anorexia nervosa, Bulimia nervosa, Avoidant Restrictive Food Intake Disorder (ARFID) and Binge-Eating disorders (BED), which can affect both men and women. Although these illnesses can develop at any age, they are more prevalent during the teen and young adult years. With appropriate and timely treatment, people can return to healthier eating habits and sometimes reverse serious complications caused by their eating disorder.

#### ***Most popular Eating-disorder apps include:***

Eating D (Free Android App that uses CBT and helps you overcome eating disorders, food worries, and how to manage anxiety and stress concerning your diet); Jourvie (Free Android App that provides a food diary for managing meals); Lifesum (Free; iOS and Android); Nourishly (Free; iOS and Android app that helps you to track your hunger, fullness, digestion, meals, sleep and stress; it reminds to take medicines in time); Recovery Record (Free; iOS and Android app that helps you to recover from eating disorders that include anorexia nervosa, binge eating disorder, bulimia nervosa, compulsive eating disorder, and obsessive eating disorder); Rise Up + Recover (Free iPhone and Android App that helps recovery from a variety of eating disorders).

#### **F. Mindfulness and Meditation Apps**

Mindfulness meditation, as taught in mindfulness-based stress reduction (MBSR), involves the cultivation of present moment focus without distorted evaluation (Kabat-Zinn, 1990). Mindfulness practice is conceptualized as directly reducing the habitual tendency to automatically engage in and react to evaluative mental states [35]

#### ***Most popular Mindfulness and Meditation Apps include:***

Buddhify (A paid Android App meant to easy to guide meditation to busy people by its 11 hours of meditation);  
Calm (Apple’s “App of the Year” in 2017, this paid iOS and Android App is designed to reduce anxiety, improve sleep, and helps to lift your mood; it has 700,000 5-star reviews);  
Happier (Free Apple-supported App that helps you practice mindfulness and gratitude);  
Headspace (iOS and Android App; \$12.99/Month or \$9.99/Year for students; it has been downloaded more than 11 million times); INSCAPE (Paid Android App that offers

professional quality vector graphics software with guided meditation and relaxation techniques); Insight Timer (A free meditation smartphone app that comes with 6,000 plus meditations and the app has been used by more than six million people till now); Smiling Mind (Free Android App for mindfulness training; well suited for beginners); Whil (The website [www.whil.com](http://www.whil.com) is relied by companies as it focuses on employee happiness by providing personalized well-being training, leadership and emotional sessions, and how to develop resilience).

### **G. *Obsessive-Compulsive Disorder (OCD) Apps***

According to the National Institute of Mental Health (NIMH), a constituent of the U.S. Department of Health and Human Services (HHS), “Obsessive-Compulsive Disorder (OCD) is a common, chronic, and long-lasting disorder in which a person has uncontrollable, reoccurring thoughts (obsessions) and/or behaviors (compulsions) that he or she feels the urge to repeat over and over” [36].

#### ***Most of the OCD Apps include:***

iCounselor: OCD (This application, developed by OCD specialists, helps the patients not only to rate but also to resist and change their obsessive and compulsive thoughts through the help of tools that provide calming and thought-changing activities); nOCD (Free; iOS app that helps patients with OCD immediately during OCD episode by giving them mindfulness and Exposure Response Prevention Treatment); Obsessive Compulsive OCD Test App (Designed to help adolescents and adults test and understand frequent intrusive and obsessive thoughts as well as repetitive compulsions by providing psychoeducation and screening); OCD Anxiety Graph App (This app helps track and rate severity of obsessions/ compulsions; OCD users can track their own symptoms over time on a graph); Worry Watch (Paid iOS App that tracks anxiety level and worries, and helps user overcome obsessive/compulsive thoughts).

### **H. *Posttraumatic Stress Disorder (PTSD) Apps***

Post-traumatic stress disorder (PTSD) is a mental health condition that's triggered by a terrifying event — either experiencing it or witnessing it. Symptoms may include nightmares or flashbacks, avoidance of situations that bring back the trauma, heightened reactivity to stimuli, anxiety or depressed mood. People may experience: Behavioral: agitation, irritability, hostility, hypervigilance, self-destructive behavior, or social isolation; Psychological: flashback, fear, severe anxiety, or mistrust; Mood: loss of interest or pleasure in activities, guilt, or loneliness; Sleep: insomnia or nightmares; Also common: emotional detachment or unwanted thoughts.

#### ***Most of the PTSD Apps include:***

Breathe2Relax (Developed by the National Center for Telehealth & Technology (T2), a principal coordinating agency of the US Department of Defense (DoD), this free app for all mobile devices teaches “diaphragmatic breathing” to overcome PTSD symptoms); CPT Coach

(App is useful for a patient undergoing Cognitive Processing Therapy (CPT), a CBT treatment, and educates user about their PTSD symptoms and how to overcome them); PE Coach (Free smartphone App designed by for use during PTSD therapy and should be used when prescribed by a trained therapist in prolonged exposure or PE treatment); PTSD Coach (Free; iOS and Android app created by collaboration of the U.S. Department of Veterans Affairs and the Department of Defense for serving/retired employees who have or think they have PTSD; it teaches how to respond to traumatic symptoms positively); SuperBetter (Free; iOS and Android app. Created by the award-winning game designer Jane McGonigal, this smartphone app is powered by “the Live Gamefully® method—a framework that activates the psychological strengths of game play to build resilience and be stronger for life).

### **I. *Schizophrenia Apps***

Schizophrenia patients usually suffer from extreme disordered thinking, hallucinations and delusions that not only impairs their daily activities but also may disable them. Such people are afflicted with and experience behavioral problems like social isolation, aggression, compulsive behavior, hostility, repetitive movements, etc. On the cognitive side, the schizophrenic patients suffer from amnesia, delusion, mental confusion etc. These people also suffer from anxiety, apathy, paranoia, depression, mood swings, and may even imagine hearing voices. Speech disorders like incoherent and frenzied speech are associated with the victims of schizophrenia.

#### ***Most of the Schizophrenia Apps include:***

7 Cups (160,000 trained listeners and licensed therapists who are available to anonymously speak with 24/7); UCSF PRIME (personalized real-time intervention for motivational enhancement; Free iOS and Android App)

### **J. *Suicide Prevention Apps***

When suicide is intentional killing of self, suicidal behavior includes a range of behaviors that include thinking about suicide (or ideation), planning for suicide, attempting suicide and suicide itself.

#### ***Most of the Suicidal Prevention Apps include:***

A Friend Asks (This iPhone and Android app offers tips for getting help for a friend or yourself. Helpful information includes what to do RIGHT NOW as well as what NOT to do.); LifeBuoy (This iPhone app is designed specifically to assist suicide survivors after a recent attempt. It offers a daily mood diary, suggestions for decreasing social isolation, and other ways to monitor increased warning signs of suicidality.); notOK (is a free app developed by a struggling teenager (and her teen brother) for teenagers. The app features a large, red button that can be activated to let close friends, family and their support network know help is needed. Users can add up to five trusted contacts as part of their support group so when they hit the digital panic button, a message along with their current GPS location is sent to their contacts. The message reads: “Hey, I’m not OK! Please call, text, or come find me.”); Operation Reach Out (This lifesaving app for iPhone and Android was developed by the military to prevent suicide.



Recorded videos and menu options help users assess their thinking and reach out for help in crisis.); ReliefLink (This award-winning suicide prevention iPhone app assists users with tracking daily mood/thoughts, creating a safety plan, locating the nearest hospitals, and obtaining quick-access to coping methods).

#### **K. Virtual Reality (VR) Apps**

VR Apps are immersive in nature and slightly expensive but their popularity is on rise.

##### ***Some VR Apps include:***

AppliedVR (VR App that helps in hospital settings); Cognitive Leap Solutions (VR App that deals with attention disorders of children); Openmind 360 (VR App that deals with teenage problems); Oxford VR (VR App that helps fight anxiety and psychosis); Psious (VR App that arranges in-person therapy and biofeedback); Rendever (VR App that helps you fight depression and isolation of elderly)

As the above features reveal, digital technologies have a critical role to play in turning the dream of universal mental health care into reality. However, the apps should be evidence based, peer-reviewed, longitudinally observed, consumer-reviewed and clinical research supported.

### **VII. Select Cases of Mental E-Healthcare Services and Start-ups in India**

In this section, we present certain cases of 10 Indian e-mental healthcare services and start-ups providing mental healthcare through digital platforms.

#### **A. Push-D (Practice and Use Self Help for Depression), developed by the National Institute of Mental Health and Neurosciences (NIMHANS), Bengaluru, India**

Developed by the National Institute of Mental Health and Neurosciences (NIMHANS), Bengaluru, India, PUSH-D, i.e., Practice and Use Self-Help for Depression (<https://echarge.mentalhealth.nimhans.ac.in/pushd/>) is a pilot-tested, computer-based/ mobile-based programme that offers individuals suffering mild depression the “space to learn, strengthen and practice psychological skills” and overcome depression. This self-care platform is intended for individuals facing mild depression and need self-induced intervention. Based on psychotherapeutic approaches that have the history of successful application in managing depression in the face-to-face consultations mode, the PUSH-D e-service uses AI-compatible techniques such as Cognitive Behavior Therapy (CBT), Supportive Therapy, and Interpersonal Therapy (IPT). Positive psychology informs all the features of PUSH-D, which is meant for individuals suffering from mild levels or low severity depressing symptoms. During the registration, the consumer must fill in a self-evaluation sheet and undergo initial screening test, to get informed about his/her stress, depression and anxiety levels. PUSH-D is useful for the ones suffering from mild depression but if the consumer is suffering from severe depression or from multiple mental disorders, the PUSH-D team advises him/her to consult or get treatment directly from some mental health professional.

The PUSH-D program can be accessed by a customer via his or her desktop/laptop/smartphone. While the PUSH-D mobile app can be downloaded free from the Google Play Store, its web-based version can be accessed via desktop/laptop. One can easily and freely switch from app to browser version at any point during the program. As it is an interactive self-help course, the web version of PUSH-D attracts consumers more. Of course, the entire e-learning program is self-driven and requires internet access. A consumer can schedule his or her own timing to access the content. It is convenient to use at home or any internet accessible place and one does not need to go to any hospital or clinic to log on to the program. Privacy and confidentiality regarding consumer data are ensured, and the end-user is entitled to create a user id and password to log on to the program. The user can set targets in the workbook (only accessible via the web version <https://echargementalhealth.nimhans.ac.in/pushd/>) and proceeds to interactive, therapeutic contents for self-help. PUSH-D being a self-help tool has its limitations like a first-aid and must not be regarded or used as a substitute for professional diagnosis and treatment.

### **B. 1to1help**

Co-founded by IIT Roorkee alumnus Anil Bisht and wife Archana, the 1to1 (<https://1to1help.net>) is a Bengaluru-based, perhaps India's no. one, Employee Assistance Program (EAP) online mental health services provider to working individuals. According to Business World, it has "prevented over 4000 suicides, completed 500,000 counselling sessions and provides services to 1.7 million lives" (20 Feb. 2019). This employee wellness platform extends professional help to working individuals to manage stress at work and work-related stress at home. Established in 2001, with the vision to 'Enable Individuals Make +ve Changes in their Life', 1to1 happens to be first to start online counselling in India. The 1to1 EAP free mobile app can be downloaded from Google Play for use. Of course, you must be an employee and your organization must be a client of 1to1.

Reportedly, 1to1help.net has completed 600,000 counselling sessions and serviced over 1.8 million employees at 400 Indian and multinational enterprises (The Economic Times, September 10, 2019) and overall 1 million during the COVID-19 pandemic. 1to1 EAP provides self-help library consisting of "practical, reliable information on relationships, self-development, marriage, parenting, and work". It offers interactive assessment tools in form of quick tests, self-understanding questions and quizzes that help you to know yourself better. Its wellness resources include articles, mood calculators, and materials that can help you understand the web of relationships at work. More importantly, 1to1 EAP provides confidential help by ensuring private, confidential, and online interaction at your convenience with a professional counsellor. An employee is free to schedule his or her telephonic/ face-to-face counselling appointments as per requirement.

The mood meter of 1to1 EAP helps an employee to track his/her moods, use assessment tools and learning materials. In this way, an employee can deal with various work-life challenges

involving emotional balance (e.g. stress, anxiety, low self-esteem), handling difficult people and complex relationships, pre- and post-marital issues, decision taking challenges, and sexual harassment issues. With a team of more than 250 counsellors in 55 plus locations in India, 1to1 e-health service claims to have covered 1.7 million lives. 1to1 has tried to live up to its name by catering to a client's individual needs and by offering customized support.

### **C. YourDost: Online Counselling & Emotional Wellness Coach (Bengaluru, Karnataka, India)**

Saddened by the suicide of a close friend who succumbed to depression during her student days at IIT Guwahati in 2008, IIT Guwahati alumnus Richa Singh felt that her friend's life could be spared if she had talked to someone about her depression. The girl suffered from depression anticipating bad placement and finally committed suicide. She also learned that even the availability of counsellor at the institute could not help as her friend was reluctant to visit the counsellor fearing she will be looked down upon. Richa researched extensively on emotional health issues and concluded that rising aspirations, fear of failure, and lack of support system drive people to mental distress. She states, "I found there is a lot of stigma about psychological illness and that one out of four Indians is going through mental illness" [37]. Empathetic, anonymous, technology-enabled, need-based psychological and psychiatric counselling services from experts could help the depressed, Richa was convinced. With this conviction, along with IIM Bangalore alumnus Puneeta Singh, in December 2014 Richa founded YourDost (<https://yourdost.com>), the e-services mental wellness platform, to help people tackle emotional and mental challenges for improving self-image and quality of life. YourDost uses email, telephoning, real-time chat, mobile app, and video conferencing for cognitive behaviour therapy.

YourDost ("Your Friend" in Hindi) is an online platform for counselling and emotional support and is designed to foster mental wellness. It is an e-health platform where psychologists, life coaches, psychotherapists, career guides and people with rich experience and proven track record in counselling and guidance help customers to boost confidence, overcome pre-wedding jitters, strengthen marital relationship, prevent depression from taking control of you, beat loneliness, quit smoking, de-stress life, improve love life, and manage employee stress from laid off to fired up situations. Among other e- counselling services, YourDost uses chatbot. The YourDost chatbot (<https://hellotars.com/chatbot-templates/miscellaneous/SyqzIs/yourdost-bot>) helps the consumer interact and fix appointment with mental health professionals if needed.

YourDost connects individuals with mental health experts and life coaches from over 15 cities in India. Its users can engage in anonymous online chat sessions with experts of their choice or opt for voice/video calls with psychiatrists/psychologists. As of today, 800,000 people have sought the help of YourDost, the website claims. This digital mental healthcare platform runs as many as 2000 counselling sessions a day with the help of thousand plus mental health experts. The market has recognized the high potentiality and success of YourDost (YourDOST

Health Solutions Private Limited) as much as the news media and social media (Facebook, LinkedIn, Twitter). As a result, this start-up, which began with a small self-funding, has now been able to raise millions of rupees through angel investment. And the future looks brighter.

#### **D. Moodcafe (Ahmedabad, Gujarat)**

Moodcafe (<https://www.moodcafe.in>) mental healthcare start-up was founded in October 2018 by Mikul Patel, an electronics and communication engineering alumnus of IIT Roorkee and IIM Ahmedabad and Rahul Ratan Mirdha, alumnus of IIT Roorkee and former secretary of Artificial Intelligence section at IIT Roorkee. The Moodcafe digital mental healthcare platform offers free, anonymous chat (<https://www.moodcafe.in/terms>) and counselling to a person requiring counselling and guidance to convert their negative mood into positive mood. It caters to anyone who needs emotional wellbeing and does not know who to talk with. The Moodcafe mobile App (is free and can be downloaded from Google Play Store ([https://play.google.com/store/apps/details?id=com.anonchatapp&hl=en\\_US](https://play.google.com/store/apps/details?id=com.anonchatapp&hl=en_US)) and offers assistance to overcome anxiety, depression, stress – to You can tell your story of trouble---your thoughts, problems, and situations-- to a fellow person and can listen to theirs. Besides listening to stories of trouble, Moodcafe chatbot, based on CBT, helps its consumers fight anxiety, depression, loneliness, and suicidal ideation by helping them reach out to a network of trained mental health professionals. A user undergoes screening test and gives inputs about his or her moods, difficulties, and unfavorable circumstances causing mental stress. As a psychologist with Moodcafe stated, “A chat may last just for a few minutes or extend even to a few days. It is the user’s call to end it” [38]. Moodcafe, incorporated as Moodcafe Wellness Solutions Private Limited, has 200 plus volunteers as listeners and its App has been used by around 30,000 users.

#### **VI. InnerHour (Mumbai)**

Dr. Amit Malik, an Indian psychiatrist who practised for years in the UK, had already treated hundreds of mentally ill patients before he realized that his patients could have avoided their present plight had they had got psychological counselling early during their illness. His experience as a commercial director of a healthcare firm had further convinced him that in mental healthcare technology-driven treatment holds the solution to disrupt mental disruptions. In 2016, Dr Malik launched the InnerHour (<https://www.theinnerhour.com/>) with co-founder Dr. Shefali Batra in Mumbai, the financial capital of India. The InnerHour describes itself as an organization that “delivers mental healthcare through technology” (<https://www.theinnerhour.com/about-us>). However, InnerHour is no substitute for face-to-face counselling and therapy.

InnerHour focuses on reducing anger, anxiety, depression, unhappiness, sleep disorder, and stress. The platform uses AI. Its chatbot Allie, a relief bot, is an empathetic listener and well-informed preliminary-level counsellor. The InnerHour app can be downloaded either from Google Play or Apple App Store. Digital therapeutic experience, based on CBT, to beat anxiety, depression, and stress is the technological approach of InnerHour app.

A consumer of InnerHour can do several activities via its app. For example, its PMR (Progressive Muscle Relaxation) exercise (<https://www.theinnerhour.com/activity/pmr>) is a “guided relaxation technique” following which you can reduce muscle tension and fatigue, thus helping you to recharge you with calmness and happy feeling. InnerHour relies on deep breathing to help the user to feel emotionally better and relaxed. It takes the consumer through guided deep breathing exercise (<https://www.theinnerhour.com/activity/deep-breathing>) by voice-based instructions. If you want to get rid of your negative thoughts and thereby reduce your stress, InnerHour’s guided imagery relaxation technique can help you to reduce mental pain by positive imagining. If you intend to virtually visit a serene and beautiful beach, InnerHour’s Beach Visualisation exercise (<https://www.theinnerhour.com/activity/beach-visualisation>) will help you to have your mental vacation online at a calm and cool beach. The Self-compassion exercise (<https://www.theinnerhour.com/activity/self-compassion>) aims at rediscovering yourself and helps to love and understand yourself better. These online activities have been designed as immediate stress relievers. In addition, based on the consumer’s screening through inputs provided by him or her about self, the InnerHour app schedules a 28-day course and helps the end-user develop a strong positive mindset, venting and coping skills, emotion-resilience, mindfulness and positive self-image. The InnerHour app is all set to provide the consumer with a digital, i.e. through technology, experience of therapy.

The InnerHour app uses CBT and mindfulness techniques and provides immediate relief from overwhelming negative emotions like anger, phobia and stress. Its chatbot Allie is intelligent enough to destress the vexed and perturbed and, if needed, will connect you with a therapist. A user can book a therapist through the app. No wonder that over 1.5 lakh consumers have benefitted from InnerHour app. It has one thousand plus paying clients. Buoyed by the story of its success and growing popularity, several investors have reposed faith in InnerHour, and the organization had raised more than \$450,000 venture capital by 2017. Thanks to the COVID-19, its revenue has multiplied by hundred times by March 31, 2022.

## **VII. Wysa (The Bengaluru-based mental health start-up)**

Wysa (<https://www.wysa.io/>) is an emotionally-intelligent, mental-health boosting, AI chatbot owned and operated by the Bengaluru-based start-up Touchkin eServices Pvt. Ltd. (Inc. 2015). This conversational bot works as a life coach and helps in improving its user’s mental fitness while ensuring empathy, anonymity, and privacy. Founded by Jo Aggarwal and Ramakant Vempati, Wysa stress, sleep and mindfulness therapy chatbot app that can be accessed via Wysa website and via Facebook, LinkedIn, and Twitter can be downloaded from Google Play ([https://play.google.com/store/apps/details?id=bot.touchkin&hl=en\\_IN](https://play.google.com/store/apps/details?id=bot.touchkin&hl=en_IN)). The Wysa app uses evidence-based therapeutic techniques like CBT, mindfulness, yoga, and DBT. Co-designed by psychotherapists and AI experts, Wysa is “a mood tracker, mindfulness coach, anxiety helper and a mood boosting buddy all rolled into one” and “someone who works odd hours, sometimes needing support at a time when friends are sleeping or chat lines are disabled ...” (Google Play review, April 11, 2018).

Working as a virtual, therapy-based mental fitness guide or coach, Wysa employs CBT and behaves as an empathetic conversationalist. The app raises a set of daily questions that help track a person's daily mood, sleep activity via wearable integration, and also provides expert answers from psychologists directly. The startup also works closely with clinical psychologists and therapists to constantly train the AI engine, which was originally written with help from certified therapists. Till date, Wysa has helped over 1.2 million people from 30 countries.

Wysa's consumer base has exponentially increased. Jo Aggarwal explains the phenomenal success of the conversational artificial intelligence bot: "Wysa has been co-designed by therapists, users, and designers over hundreds of iterations and 80 million conversations. What people want most is to feel heard, without judgement. Anonymity is key – people are scared to be seen or judged for what they are going through. We combine the free AI with unlimited support from a qualified therapist, still anonymously, over chat to make it easy to get help." Wysa has proved that AI can help destigmatise mental health. Wysa has also proved that mind care can provide good business. Its founders have been able to raise up to \$3 million in seed funding from Kae Capital and other angel investors to strengthen its technology and outreach to patients globally.

#### **VIII. I Will App & EpsyClinic HealthCare Private Limited, Gurgaon, Haryana, India**

Shipra Dawar, "the woman who founded India's first online mental health portal" ePsyClinic (Purtrevu, 2018), learnt in a hard way the value of therapy to combat depression. She became a victim of mood disorders and depression during her student days at Australian National University (ANU), Australia, but got better of it through counselling and talk therapy. Shipra understood the value and need of therapeutic counselling to people suffering from mental illness. After MBA in Leadership and International Strategy from ANU, Australia, Shipra returned to India to find shockingly that stigma surrounded mental issues and even those who suffered from some sort of mental problems and willing to avail professional help did not find access to psychiatrists and psychologists. To turn the table, Shipra founded her digital platform ePsyClinic (<http://epsyclinic.com/>) in 2015, based at Gurgaon, to provide online counselling, psychotherapy (talking therapy), and emotional wellness counselling and services through in-built internet-based technologies Video, Audio, Email, Chat, Voice memo and Messages. In its initial days, this e-mental health start-up faced challenges as her company had to build up the market for the services from ground zero. The stigma attached with mental health, reluctance of people to discuss their mental problems, and doubt regarding the efficacy of online therapy were the hiccups. However, Shipra was determined to overcome the hassles. Her strategic planning and immaculate execution aided by online marketing and social media advertising, helped Shipra to overcome the teething problems. Shipra admits, "The biggest challenge was to build an online therapy science from ground up because there were no white papers. The company developed copyrighted and proprietary training and therapy programmes to ensure recovery in online modes as well as chat therapy and phone therapy protocols." For patients, ePsyClinic's professional therapists, counsellors, and professionals provide therapy sessions

with a charge. Use of modern health technologies, such as neuro-linguistic programming (NLP), real-time Thought-Monitoring Records (TMRs) and Daily-Task Planners (DTPs) and therapeutic techniques like CBT, renders its services more dependable. Especially with the launch of its I Will App ([www.iwillapp.com](http://www.iwillapp.com)), which is smartphone and laptop/desktop compatible and available for download on GooglePlay(<https://play.google.com/store/apps/details?id=com.epsyclinic.iwill>), the reliability and efficacy of ePsyClinic (<https://iwill.epsyclinic.com>) for its emotional and mental well-being counselling services has gone up. Besides, the ePsyClinic team runs awareness programs at schools, corporations, shopping malls, complexes, village blocks, government organizations to generate “actionable awareness” about mental health. Thus, ePsyClinic provides both online as well as face-to-face counselling services. Further, providing consultations online has made it possible for ePsyClinic to rope in psychiatrists and psychologists from different parts of the world, to make up shortage of counsellors in India” (Ghosh, 2015). Each session lasts 20-60 minutes. Whereas the company offers first counselling session free of charge, subsequent sessions are charged ranging from rupees 600 to 1500. With huge consumer base, commercial success, and growing business, ePsyClinic is today a name in the mental healthcare system to reckon with.

#### **IX. The Juno Clinic, Mumbai, India**

The Juno Clinic (<https://www.juno.clinic/>) is an online mental health start-up that provides online counselling and treatment for all kinds of psychological as well as psychiatric problems through video, audio, and chat sessions. A comprehensive wellness clinic, Juno handles metal disorders like anxiety disorder, bipolar disorder, depression, OCD, Attention Deficit Hyperactivity Disorder (ADHD), addiction, relationship issues, and sexual dysfunctions. Juno’s well-qualified and experienced psychiatrists and psychologists are regular and well-versed in psychotherapy. The Juno web portal offers free assessment tests on depression (including Goldberg’s depression test), screening test for bipolar disorder, anxiety disorder test (including Zung Self-Rating Anxiety Scale or SAS), addiction test (including Pornography Addiction Screening Test or PAST). However, it is acute distress counselling or emergency services. Juno Clinic aims to make counseling more accessible through online therapy. Our therapists are available both at our clinics as well as online for video, audio or chat sessions. You need a computer equipped with a webcam and microphone or you need a smartphone. Aside from these things, all you need is a good internet connection to meet our therapists using video conferencing. You don’t need to install software; the video conferencing will open in your browser itself.

#### **X. GrowthEX, Gurgaon, Haryana, India**

An online personal counselling, e-learning and mental healthcare platform, the Gurgaon, Haryana-based GrowthEx (<https://www.growthexp.com/>) that was founded in 2014 has grown to become a global organization providing its users with personal and professional growth support through online counselling, programmes, and technology (artificial intelligence).

Founded by Engineer Varun Saxena, who is also the CEO of GrowthEx, this personal wellness company leverages its founder's working experience with American and European clients/consumers. As of 1st January 2020, GrowthEx boasts of 1 lakh users, 5,000 counsellors, and 1000 programmes. It has regular, paying individuals using their counselling services across India, Qatar, Brazil, and Nigeria. Earlier this year, the company announced that it had received an undisclosed amount in funding from a group of angel investors in Chandigarh. In 2017, Varun, an MBA from NITIE Mumbai, acquired the edtech start-up LeapWired, an "online counselling platform that connects engineering aspirants all across India with students from the colleges they wish to attend." GrowthEx provides counselling on learning and career choices, pre- and post-marital relationship difficulties, sexual wellness, and depression. Reportedly, its 80% plus content is distributed as videos, and 58% content usage is through mobile phones. As of now, users have availed 400,000 plus hours of counselling. GrowthEx has raised a handsome amount through angel funding (the amount is not disclosed by the company, though). Besides, the platform plans to employ predictive analytics and artificial intelligence to ensure proactive solutions for its consumers. Varun is optimistic about the future of GrowthEx company: "In the next year, we are looking to touch the lives of a million users by enabling them to grow in their lives. We also aim to extend the share of customers from outside India to 15 percent." The wellness company depends on counselling and guidance experts, who follow their passions. They come from as diverse grounds as industry, psychologists, psychiatrists, bankers, relationship counsellors, IIT graduates, IIM graduates, retired defence personnel. According to Varun, they prefer GrowthEx "to host their programmes or to join as counsellors". The COVID-19 pandemic helped Varun realize his plans to scale up his team of experts so that GrowthEx can touch one million individuals and increase its consumer base outside India.

#### **XI. VerapAI Mental Healthcare Start-up, India**

With "a mission to deliver intelligent, affordable, and effective AI-driven virtual reality therapy in a manner that reflects both the personalized and intimate nature of mental health therapy today to the doorsteps of every single person worldwide", two Standard 12 Indian boys, namely, Aditya Uchil (The International School Bangalore) and Ankur Samanta (Irvington High School in California, USA) have developed the mental healthcare start-up VerapAI (<https://www.verapai.com/>). VerapAI describes itself as "fully automated, intelligent, virtual reality therapy". VerapAI plans to use IBM Watson technology to develop its AI therapist, to carry out conversation with the patients, guide them through talk-based CBT program and exposure-based therapy program.

VeraMeet is basically a virtual reality social engagement platform that plans to pull in together psychologists and therapists and mental health patients onto its safe platform server. From the comforts of their home or chosen place anywhere in the world, patients can log on to the VeraMeet therapy-oriented server and chat with therapists, fellow patients, and counsellors. Clients can log on at any time and participate in various social activities on the server with fellow patients, all while helped along by the therapists themselves. The VR platform offers



several social environments that provide simulated real-life social situations that can be helpful. Virtual reality can help the patients to overcome depression and trauma by developing their coping skills and adaptation abilities. Besides, the VeraMeet platform also offers the services of MARY, the AI-driven therapeutic assistant, who would be able to engage patients in abstract conversation and/or run specific programs as requested by the patient or as directed by the patient's real therapist. MARY is modelled to act like a Rogerian Psychotherapist capable of interacting with its patient in a personal and confidential manner. It can also act like a stand-alone device for the ones who lack access to real therapists. MARY is designed to be accessed through a phone app and a Google Cardboard VR-headset for therapeutic counselling. As such, a person can access and use MARY from any part of the globe. As an autonomous and intelligent robot, MARY the chatbot therapist can constantly learn from its interactions with patients and upgrades itself autonomously for effective personal sessions of therapeutic counselling. In the simulated therapy session, the patient can get much relief. If he or she needs a human therapist, the chatbot can connect him or her to one such. Its beta test in Bengaluru, Karnataka has shown the evidence that children suffering from autism have improved after sessions with MARY. The VeraMeet app, which is going to be available free of cost on both Android and iOS, integrates virtual therapist with live ones. When MARY provides personalized and immersive solutions to mental disorders through VR and AI technologies, care is taken to keep the identity of patients as well as therapists undisclosed.

### **VIII. Can India achieve Universal Mental Healthcare by 2030?**

Cases of AI-enabled and VR-empowered apps and start-ups analyzed so far point towards the future of mental healthcare in India — the advent of the digital care. In addition to the physical institutions of healthcare and face-to-face counsellors and therapists, digital technologies—AI- and VR-empowered platforms and applications—have augmented the exiting mental healthcare system in India. In the face of exponential growth of mentally ill patients in India and high demand-supply gap of mental healthcare professionals, and when there is need for alternative system to address the population left by traditional healthcare, the emergence of e-mental healthcare enterprises and digital technology-integrated positive psychology and therapy techniques in the forms of AI, VR, AR and MR has bolstered the traditional mental healthcare system in India. Digital mental healthcare reduces the demand-supply gap being scalable. The exponential growth of the business of mental healthcare and start-ups addressing the issues thereof point towards a bright future of mental healthcare in India. However, the million-dollar question that pops up its head is whether the co-existence and integration of traditional mental healthcare system and digital mental healthcare system can help India achieve universal mental healthcare.

The Govt. of India's attempt to provide universal healthcare to its citizens through various national health schemes such as Ayushman Bharat, a scalable National Health Protection Mission that covers 50 crore beneficiaries, with Rs 5 lakh per family per year for secondary and tertiary care hospitalization, Rashtriya Swasthya Bima Yojana (RSBY) and the Senior Citizen Health Insurance Scheme (SCHIS). The central government's attempt to

integrate general healthcare and mental healthcare is a right step in the right direction. Universal mental healthcare must begin with minimum mental healthcare to the citizens of India--- access to all, easily affordable or free access, and stigma-free treatment and post-treatment care. Compared to traditional face-to-face mental healthcare system, digital mental healthcare system is more effective in the direction of universal mental healthcare because digital mental healthcare can not only complement and supplement the traditional system but can also augment it. With online health services, mobile health apps, and AI-VRAR-MR counselling platforms, traditional mental healthcare system has become more pervasive and more scalable. Through India's Digital India, the nation's flagship scheme, 250,000 grampanchayats have been connected with a network of 3.40 lakh km of optical fibre, and 1.29 lakh gram panchayats have been connected digitally via Bharat net and Govt. of India's intent to empower all the villages of India through digital system by providing access to education, health or financial services through the digital medium. In a decade, India will have become a Digital India.

By 2030, India will have a splendid digital landscape with 1 billion Indians having access to the Internet and by then 1.2 billion will have a smartphone. Further, a whopping 500 million Indians are projected to access Internet in their respective regional languages (Forbes, August 28, 2019; KMPG, India's Digital Future report, 2019; World Economic Forum, 2019). In addition, the internet users will be enjoying far greater speed of internet through next-gen (i.e., 5G/6G/7G) broadband/Wi-Fi services at no cost or at an easily affordable cost over time. Using Information and Communication Technologies (ICTs) via websites, smartphones and mobile apps, online mental healthcare will be an easy option for availing mental healthcare. Further, India's pie in the global behavioural/mental health care software and services market size (USD 1.9 billion plus) is increasing at a fast speed. The burgeoning number of digital mental healthcare platforms and apps is a positive indication toward the future of attaining universal mental healthcare and reducing the burden of disease. According to McKinsey report (Digital India: Technology to transform a connected nation, 2019), India could save up to \$10 bn in 2025, by using telemedicine instead of face-to-face doctor consultations. Going further, India's goal of universal healthcare, including mental healthcare, seems feasible.

One of the largest and fastest-growing markets for digital consumers, India is Industry 4.0-ready. Technology, especially AI, VR, and Internet of Things (IoT) inform the healthcare industry in India. The McKinsey report (2019) reveals that Indians downloaded as many as 12.3 billion apps in 2018, next to China, and more time on social media, more than USA and China. With more digital financial inclusion, more internet access and smartphone use, India is poised to be a digitally connected country by 2030. Recorded to be one of the topmost scorers on Country Digital Adoption Index (McKinsey Report, 2019), India's digital growth trajectory is upward trending. Country Digital Adoption Index includes digital foundation (speed, cost, and reliability of Internet service), digital reach (number of mobile devices, app downloads, and data consumption), and digital value (how much consumers engage online by chatting,

tweeting, shopping, or streaming). India's score has risen by 90 percent since 2014. And the trend is skewed in favor of country adoption index.

With 500 million plus internet connections, India has become a world leader in mobile adoption and in the process of becoming a mobile-first country with the meteoric rise of mobile media, social media platforms, and messaging applications on which Indians rely for consumption and sharing of news and information. India has certainly become a mobile-first country and people prefer to use Internet through mobile [39]. Given that data and internet connectivity are affordable and cheaper than most countries, including USA and China, 5-G already rolled out, trends show these will be further cheaper, India is going to be a mobile-first country. With 1 billion Indians having access to the Internet and 1.2 billion with smartphones by 2030 (Forbes, August 28, 2019; KMPG, India's Digital Future report, 2019), India is likely to be a Digital India. The speed at which AI, IoT, and virtual clinics are positively changing the mental healthcare scenario in India, digital mental healthcare has become a reality than a future possibility. As the Nielson data and the Internet and Mobile Association of India report (Nielson's India Internet 2019 Report) reveals, the active internet users' age ranges from 5 years and above and the most popular format of accessing the internet is through smartphones. Studies show that mobile apps for mental health have also earned the trust of caregivers in addition to the patients. As such, smartphone-based mental health apps are growing in geometric speed. It is projected that by 2030 India will have moved from mobile-first country into mobile only country, as India is a country that loves to access the internet through smartphones.

## **IX. Results and Discussion**

Digital health in India is increasingly becoming a reality. Websites, videos, mobile based mental health applications, and e-resources offering self-guided and self-help tools to people suffering from mild stress to severe mental illness. The future of mental healthcare is bright as Indians can access e-mental healthcare services and apps seamlessly from any part of the world through the Internet. Due to the scalability of digital services and apps, the demand-supply gap in mental healthcare will be less impactful. Further, the individuals suffering from mental illness can better understand themselves, get self-checking for mood disorders, regulate their emotional disturbances, and control their own behaviors significantly through mobile apps. Governments, NGOs, and business organizations are spreading awareness to dispel the stigma surrounding mental healthcare. Slowly though, mental healthcare is being integrated into general healthcare in India. The future has partly unfolded itself with the constant spurt in the number of Indian online mental healthcare start-ups tapping into the potential of AI and VR technologies in providing de-stigmatized (i.e. non-judgmental), free or affordable services. Mental health institutions (e.g. hospital and clinics) have started using digital technologies to augment face-to-face therapy or as an adjunct. Digital self-help interventions have become a reality in India, if not the order of the day. However, it can be safely concluded that we have only seen the trailer and the complete picture is yet to be seen.

In order to integrate primary healthcare and mental healthcare through the world's largest government scheme Ayushman Bharat, the government must increase budgetary allocations for this purpose from mere 0.06%. Insurance of mental illness, by both government and private parties, must be put in place like general health insurance. If needed, the Govt. of India and state governments should attract Foreign Direct Investment (FDI) to provide quality mental healthcare. When the hospital sector has already attracted US\$ 13.09 billion FDI between April 2000 and March 2022, roping in FDI to realize the dream of universal mental healthcare is tenable. At a time when the Government of India is planning to increase public health spending and India's healthcare industry has become the fastest growing sector (IBEF, Healthcare Industry in India), FDI in India to integrate primary healthcare and mental healthcare as well as personal mental healthcare and digital mental healthcare holds great promise for universal mental healthcare. In this way the burden of mental illness will be eased.

With the integration of traditional and digital mental healthcare systems, the delivery, availability and affordability of mental health services to all will be a reality. Universal internet access, with every family owning a smartphone, and rapid increase in adoption of technology in mental health business, industry and services, the goal of providing universal access to mental healthcare will not be a far cry. The Govt. of India must integrate mental health with primary health care, as envisaged in the National Mental Health Care Act, 2017. To democratize mental health care, that is to ensure the availability and accessibility of minimum mental healthcare for all, we strongly recommend that the central government and the provincial government must fully integrate digital mental healthcare and traditional institutional healthcare. The governments must open digital mental care units in all government and recognized private hospitals across the country. We conclude that computational psychiatry (involving AI, VR, AR, MR, machine learning, data analytics) dispensation through chatbots, autonomous robots such as socially assistive robots (SARs) and other technology-assisted clinical interventions in the field of mental healthcare will revolutionize the way mental healthcare is accessed, dispensed, and availed; the process has already started, hence our title 'the past of the future'. We believe that Nicole Shanahan's famous prediction, albeit in another context, that it will "be slow at first—and then will happen suddenly". There can be no health sans mental health.

## **X. CONCLUSION**

More is expected from the central government of India, provincial governments, and local self-governments in governing, promoting, and upgrading mental health care and in preventing mental illness. For example, it is essential to revitalize the District Mental Health Program (in effect since 1996 and re-strategized in 2003 with schemes such as Modernization of State Mental Hospitals and Up-gradation of Psychiatric Wings of Medical Colleges/General Hospitals) and Manpower development scheme (in effect since 2009). Further, the central and state governments and UTs must implement the National Mental Health Care Act, 2017 and other central schemes jointly as health is a concurrent affair under the Indian constitution. All

the local-self-governments must be empowered to enhance community development and mental health awareness. The civic society, media, and public figures must come forward to be mental health ambassadors. It will serve the need if positive psychology and stress management techniques are taught in schools as a deterrent to stress. Community mental health through primary care and community participation must be a major responsibility of the governments. As the current trends show, by integrating traditional personal healthcare and digital healthcare, stigma reduction will be a reality and help India achieve its national dream of universal mental healthcare by 2030.

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