Deficits in Healthcare: Shortcomings in Psychiatric Theory, Research, Treatment, and Employment

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Abstract

Throughout the history of psychiatric interventions, there have been deficits in treatment, as well as subsequent innovation in response to these deficits. It is important to examine the historical aspects of psychiatric interventions, along with how they came to be today and the problems within the healthcare system. Chapter one focuses on the evolution of psychosurgery and how techniques evolved as the understanding of behavior changed. Understanding the former psychosurgical interventions such as trepanation and phrenology allowed for the framework of surgical techniques to be introduced. Chapter two focuses on contemporary treatments for major depressive disorder (MDD). There are multiple contemporary treatments that can be used which provides a starting approach to creating and applying effective treatments to help MDD. Chapter three provides potential solutions to a major problem with the healthcare system, the nursing shortage. It is important for solutions to this problem to be created to allow for better patient care within the healthcare system. Within chapter four, there is evidence of real application of psychosurgery with contemporary medicine such as within a neurosurgery office and a hospital. It was helpful to be able to connect many different themes seen throughout history to contemporary problems still existing today within the field. Overall, the purpose of this paper is to examine the importance of more effective plans for psychosurgical interventions, plans of treatment for disorders such as MDD and providing the healthcare system with solutions to improve the effectiveness of patient care.

Keywords: psychosurgery, major depressive disorder (MDD), nursing shortage

Chapter 1: The History and Evolution of Neurosurgical Interventions for Psychiatric Disorders

Neurosurgery for psychiatric disorders, also called psychosurgery, is a term used to describe attempts to physically alter behavior and consciousness in an effort to treat behavioral pathologies and mental illness using surgical techniques (Bauerle et al., 2023). While psychosurgical interventions are thought to have origins before the Common Era, psychosurgery has changed greatly since its inception, especially in the mid-twentieth century, as a culmination of the burden of psychiatric illness and novel understandings of how the brain may function and its relationship to behavior (Robinson et al., 2012). The aim of this paper is to examine how the modification of psychosurgical techniques occurred throughout history, starting from the inception of psychosurgery and ending in the late twentieth century. Upon analysis, it is evident that the evolution of psychosurgical techniques can primarily be attributed to outside forces, specifically to what is now recognized as incomplete understandings of neuroanatomy and neurophysiology, as well as experimental trial and error, which may provide an explanation for modern ethical objections.

Trepanation

The first recorded human psychosurgery, with origins dating back to as early as the Neolithic period of the Stone Age, is trepanation, known today as burr holing (Robinson et al., 2012). The trepanning procedure begins with lacerating the scalp to reveal the skull, and is then followed by drilling or cutting into the skull to form a hole. While trepanation is believed to have been used traditionally as a method to alleviate symptoms of head trauma following injury, it is

also hypothesized to have been used to excise evil spirits and demons, thought to be the cause of mental and/or behavioral disorders, in the prehistoric era, although this likely was not the purpose for performing the procedure most of the time (Bauerle et al., 2023). The practice of trepanning continued well into the establishment of Greek and Roman civilizations, evidence of which can be found in classical writings of Hippocrates, Galen, and Celsus (Bauerle et al., 2023; Robinson et al., 2012). Trepanation as a psychosurgical intervention gained prevalence during the Renaissance, as highlighted by Hieronymus Bosch's painting *The Extraction of the Stone of Madness*, likely painted around 1501. In this image, Bosch depicts a man undergoing a procedure on his skull with the inscription describing the patient's desire to remove "stones of folly" from his head (Gross, 1999). Per Robinson et al. (2012), the idea of "brain stones" were a commonly held superstition throughout this period, with the popular belief being these stones were responsible for madness or epilepsy.

The prevalence of trepanation began to decrease as understandings of behavior changed. René Descartes first proposed a formal link between the brain and behavior through his theory of dualism (Descartes, 1641/1931). In his *Meditations* (1641/1931), Descartes describes the idea of dualism, in which the mind and body are separate entities, yet the mind seems to control the body, in a manner such as a ghost in a machine. According to Lokhorst and Kaitaro (2001), Descartes believed the pineal gland in the brain served as a relay between mind and body, indicating one of the first links between the brain and behavior, which would be expanded upon in future research.

Localization of Function

Into the eighteenth and nineteenth centuries, trepanation became less prevalent as focus shifted towards identifying connections between brain and behavior, specifically as it pertained to localization of function. Localization of function, as described by Bauerle et al. (2023), is the idea that specific areas of the brain serve distinct functions. Research in this time period originated with Franz Gall, a German physiologist, and his theory of phrenology. According to Gall, functions of the brain were localized to individual organs within the brain, which worked in tandem to create an individual's personality. Gall thought ridges and grooves on the skull reflected larger or smaller organs, respectively, and believed that larger organs indicated greater ability. From these theories, Gall developed phrenology, which was described as the analysis of the shape and size of the skull to predict personality (Jones et al., 2018).

Although Gall's work was influential in changing the scope of neurological research, it was proven to be pseudoscientific, though it did contribute to other localization of function discoveries. In 1824, Pierre Flourens developed a method to test Gall's assertions through selectively ablating different regions of the brain. Flourens' work disproved Gall's theory of phrenology in favor of what he called cerebral equipotentiality, which suggested the brain functioned as a whole, though he did note that the cerebrum, cerebellum, and brainstem had distinct differences in their individual functions and how they contributed to cerebral equipotentiality (Bauerle et al., 2023; Pearce, 2009).

Further research in the nineteenth century supported localization of function to the limited extent proposed by Flourens. In 1861, Pierre Broca discovered a localized area for speech production. According to Bauerle et al. (2023), Broca's discovery came following the observation of a patient with widespread cerebral damage experiencing aphasia as an inability to express speech. Through his observations, Broca attributed the motor component of speech to a

single area on the frontal lobe, giving it the name Broca's area. In a similar manner, Carl Wernicke discovered a region separate from Broca's area on the lateral sulcus on the temporal lobe. From his studies, Wernicke found individuals with lesions to this area exhibited aphasia as an inability to understand language, thus he deemed this region, named Wernicke's area, responsible for written and spoken language comprehension (Wernicke, 1970). The studies of Gustav Frisch and Eduard Hitzig further emphasized some localization of function as it pertains to motor function. In their research from 1870, Fritsch and Hitzig stimulated the cerebral cortex of dogs in an effort to elicit a motor response, resulting in the identification of the motor cortex (Fritsch & Hitzig, 2009).

Perhaps the most significant of localization of function findings for applications in psychosurgical advancement was the case of Phineas Gage in 1868. Gage, a railway foreman, experienced profound damage to his frontal lobe after an accident in which a tamping iron penetrated his skull following an explosion (Bauerle et al., 2023). According to Gage's physician, John Harlow (1888), Gage experienced significant changes in his personality, with Harlow noting he became impatient and easily irritated, with other accounts noting he became belligerent and disinhibited (Bauerle et al., 2023). Gage's accident, combined with aforementioned localization of function research, provided foundations for modern psychosurgical intervention by locating areas specific to personality and confirming the possibility of the existence of these regions.

Burckhardt and the First Psychosurgery

Influenced by localization of function discoveries, Gottleib Burckhardt, a Swiss psychiatrist, performed the first modern psychosurgery in 1888. Burckhardt operated under

several assumptions based upon prior research. Firstly, he subscribed to the idea of biological psychiatry, meaning he believed mental illness was a projection of a disordered brain and thus, mental illness could be cured through fixing the brain (Kotowicz, 2005). Secondly, he believed that the nervous system operated in a three-step system with an afferent sensory system, an efferent motor system, and a connecting system to bridge the two (Stone, 2001). Lastly, believed in a modular brain, consistent with localization of function, meaning symptoms could be traced to a specific location of the brain. Therefore, Burckhardt hypothesized that the excision of a specific cortical area could eliminate symptoms of mental illness (Kotowicz, 2005). In 1888, Burckhardt performed a "topectomy" in the frontal, parietal, and temporal lobes, where pieces of the cerebral cortex were surgically removed (Mashour et al., 2005). Burckhardt performed this surgery on six patients, aiming to make the patients less violent and more easily managed. Of the six patients he operated on, Burckhardt reported improvement in four patients, a death during the procedure in one patient, and one death due to a postoperative complication (Kotowicz, 2005). Although Burckhardt may have mostly met his described purpose of improving patients' disposition, he was met with heavy criticism by the psychiatric community. Burckhardt's work was seen as immoral, reckless, and reprehensible, effectively prohibiting further psychosurgical intervention at the time (Kotowicz, 2005; Stone, 2001).

Moniz and the Leucotomy

Psychosurgical research remained suspended until the months following the 1935 Second International Neurologic Congress in London. At the conference, physiologist John Fulton presented his research about the effects of frontal lobe dissection in primates. Fulton's results showed that, following partial frontal lobotomy, the primates exhibited more blunted affect while still retaining cognitive abilities (Bauerle et al., 2023). These results inspired Egas Moniz to

adapt the procedure for use in humans. Moniz hypothesized that mental illness was caused by excessive synaptic connections, based on the neuron theory of Ramón y Cajal, which states that neurons are discrete cells responsible for communication within the nervous system (Kotowicz, 2005). Therefore, Moniz believed that, by eliminating some synaptic connections within the brain in subcortical white matter, the brain would begin to function normally, as mental illness was merely a symptom of neuronal disarray (Moniz, 1937).

Moniz and his collaborator, Almeida Lima, began the process of destructing subcortical white matter, known as a leucotomy, upon Moniz's return to Portugal following the Neurologic Congress. Together, the pair performed procedures on twenty patients (Kotowicz, 2005). The first ten procedures utilized absolute alcohol ablation, in which a high concentration of alcohol was injected directly into the white matter structures, however, due to the unpredictability of the dispersion of alcohol, the procedure was modified for the second half of patients (Bauerle et al., 2023). For the second set of patients, a tool now known as a leucotome was developed to surgically sever subcortical white matter tracts (Mashour et al., 2005). According to Bauerle et al. (2023), burr holes were drilled into the skull and the leucotome, a long device with a wire loop on the end, was inserted into the brain and rotated to lesion the white matter in affected patients.

Of his twenty patient trials, Moniz reported zero fatalities, and his reported side effects were less severe than those reported by Burckhardt (Kotowicz, 2005). At the end of his study, Moniz and Lima reported that seven patients were cured of mental illness, seven patients' symptoms were improved, and six patients did not improve, though their symptoms also did not worsen (Bauerle et al., 2023). Compared to Burckhardt, Moniz was met with welcoming

reactions to his research, with the leucotomy gaining international favor due to promising results of safety and efficacy (Moniz, 1937).

Freeman and the Lobotomy

Following the success of the leucotomy in Europe, Walter Freeman, an American neurologist, introduced the procedure to the United States in 1936. Following his first leucotomy with collaborator James Watts, Freeman observed a flaw in the original technique published by Moniz, that is, the leucotomy intervention does not provide permanent relief of symptoms in all patients, thus leaving patients susceptible to the return of their symptoms (Robinson et al., 2012). According to Robinson (2012), Freeman performed post-mortem examinations of the brains of individuals with mental illness in order to locate an area implicated in the production of symptoms. Through these examinations, he observed degeneration of tissue in the thalamus, which he believed was implicated in symptom production (Freeman, 1942). Therefore, using a modified version of Moniz's leucotome, Freeman and Watts lesioned the white matter tracts between the prefrontal cortex and the thalamus in a procedure now known as the frontal lobotomy (Bauerle et al., 2023).

Freeman and Watts performed over two hundred frontal lobotomies before 1942, of which the majority were considered successful. According to Robinson et al. (2012), only 14% of the outcomes of the surgery were negative, including both fatalities and negative postoperative effects, while 63% of surgeries yielded improvement and 23% yielded no change. Encouraged by this success, Freeman again modified the lobotomy procedure to eliminate the necessity of a neurosurgeon. In this novel procedure, called the transorbital lobotomy, the patient was anesthetized and a pick-like instrument was inserted through the orbital roof into the prefrontal

cortex. Once in the brain, the instrument was swept across the prefrontal cortex in order to sever white matter tracts in the frontal lobe (Mashour et al., 2005). This procedure was quickly popularized in the United States due to its accessibility, as, unlike the leucotomy and frontal lobotomy, the transorbital lobotomy did not require surgical training and it could be completed as an outpatient visit (Bauerle et al., 2023).

The transorbital lobotomy procedure was performed in over 60,000 American patients between 1936 and 1956, though its prevalence may not be due to its efficacy. According to Mashour et al. (2005), psychiatric illness was extremely costly to the United States, with over 400,000 individuals being patients in psychiatric institutions costing over 1.5 billion dollars by the 1940s. The accessibility of the transorbital lobotomy provided a method to quickly alleviate some of the burden of mental illness, hence its rapid dissemination (Wang et al., 2022). While transorbital lobotomies may have satiated an economic need, they were not without consequence. By 1949, there was heavy skepticism pertaining to the safety and efficacy of the transorbital lobotomy. While the procedure was criticized for "frontal lobe syndrome," which encompasses impulsivity and lack of emotionality, it was also criticized for its side effects, such as seizure disorder, excessive cerebral bleeding, and death (Bauerle et al., 2023). Therefore, in combination with the advent of antipsychotic drugs, skepticism pertaining to transorbital lobotomies ultimately led to a sharp decline in the prevalence of the procedure.

Minimally Invasive Procedures

Although the transorbital lobotomy was the predominant psychosurgery in the United States until the 1950s, less invasive procedures were beginning to emerge. William Scoville, an American physician, is credited with the advent of a more precise version of the prefrontal

lobotomy, known as selective orbital undercutting (Wang et al., 2022). Scoville claimed this procedure was much more precise than the lobotomy, as only two specific areas of the prefrontal cortex, the orbital, and the cingulate gyrus were targeted instead of the entirety of the frontal lobe (Wang, 2022). Scoville is mostly known for his role in the case of H.M., where he performed a bilateral medial temporal lobectomy in an effort to eliminate seizure activity (Squire, 2009). Through this procedure, Scoville discovered implications of memory storage, such as the role of the hippocampus in memory, and contributed to novel understandings of memory through the Atkinson and Shiffrin model of memory (Wang et al., 2022)

Stereotactic procedures were also invented for use in psychosurgery following the introduction and dissemination of the lobotomy in the United States. While stereotaxic procedures were similar to other psychosurgical interventions in the sense that they lesioned the brain, these procedures were different from others as they used alternative methods to create the lesions. E. Spiegel was an influential proponent of these procedures, credited with the development of the stereoenphalotome, which is the apparatus used in stereotaxic psychosurgeries (Spiegel et al.1948). According to Spiegel (1947), the procedure starts with securing the head in the stereotaxic apparatus, then performing an x-ray with the fixated apparatus to determine a location to drill a burr hole. After finding a location and completing the trepanation process, a wire or cannula is threaded into subcortical areas of the brain. From here, Spiegel (1947) lesions the targeted area through radiation, thermocoagulation, fluid injection, and/or fluid aspiration. While Spiegel focused primarily on lesioning the medial nucleus of the thalamus, other procedures were focused on the subcaudate nucleus, the hippocampal commissure, and other thalamic nuclei (Spiegel, 1948; Knight, 1973).

Scoville also experimented with electronarcosis, also known as electrical anesthesia. Electronarcosis, as described by Alan van Poznak (1963), is the process of delivering electricity to the brain in order to induce sleep, reduce pain, and produce stupor. In his research, Scoville observed minimal improvement in patients that received electrical anesthesia treatment, though he was inspired to expand upon this research, which led to the aforementioned case of H.M. Other electronarcosis research yielded similar results. In a study of individuals with schizophrenia, electronarcosis was not found to make a profound difference upon patients outside of their normal treatment (Garmany & Early, 1948). For this reason, in combination with rising skepticism of psychosurgery, electronarcosis research was largely abandoned.

Ethical Opposition to Psychosurgery

Ethical objections to psychosurgery began to arise in the late 1940s with the popularity of the transorbital lobotomy, however it was not until the late 1970s when controversy pertaining to psychosurgery came to a head. (Casey, 2015). Many objections to psychosurgery pertained to safety, efficacy, and questions of reliable testing. As previously discussed, the transorbital lobotomy became a large source of controversy as efficacy and safety of the procedure was called into question (Bauerle et al., 2023). Although Freeman and Watts may have data to reinforce their claims of safety and efficacy, Mashour et al. (2005) highlighted several factors that may have contributed to unreliable data. Firstly, due to the invasive nature of the procedures, there were no controlled placebo interventions used to compare improvement of symptoms to, thus leaving patient improvement and positive outcomes up to the physicians. Secondly, the physicians who were evaluating their patients' improvements were likely inherently biased in their assessment, which would artificially inflate statistics for positive outcomes. Lastly, in a similar manner, physicians may have under-reported poor outcomes in order to avoid speculation

of safety and efficacy. Ultimately, ethical concern led to the The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research limiting the continuation of psychosurgical intervention in 1977, which has been primarily maintained into the contemporary era (Casey, 2015).

Conclusion

Psychosurgery has a rich history dating back centuries, with techniques evolving as understandings of behavior changed. Trepanation is evidence of the earliest psychosurgical interventions, though its use quickly declined as phrenology and cerebral localization of function became popular theories. Although phrenology was discredited, physiological research lended to the development of new psychosurgical techniques. Although psychosurgical interventions were initially unaccepted, as evidenced by Burckhardt, further research and theoretical development allowed for the development of interventions like the leucotomy. By pioneering the leucotomy, Moniz began a new era for psychiatric interventions, with the leucotomy becoming a globally-instituted psychosurgery. The leucotomy was further developed in the United States by Freeman into the lobotomy, and was soon adapted to increase its accessibility. At the same time, new, more precise, and less invasive psychosurgical interventions, such as selective orbital undercutting, stereotactic procedures, and electrical anesthesia were being developed and tested, however they were largely overshadowed by the controversy and skepticism surrounding the transorbital lobotomy. In the present era, psychosurgery is practiced within a limited scope due contemporary limitations and ethical concerns, which are resultant from residual skepticism pertaining to twentieth century interventions.

Chapter 2: Effectively Treating Major Depressive Disorder with Contemporary Interventions

Major depressive disorder (MDD), commonly known as depression, is a mental health disorder primarily characterized by low mood, decreased energy, and anhedonia (Penn & Tracy, 2012). While these are the primary symptoms experienced by individuals with depression, other common symptoms include, but are not limited to, decreased concentration abilities, decreased self-esteem, appetite changes, sleep disruption, and onset of self-harm tendencies and/or suicidal thoughts, persistent for at least two weeks (Bains & Abdijadid, 2023). Per Bains and Abdijadid (2023), an individual must experience at least five of the aforementioned symptoms to be diagnosed with MDD, to be in accordance with the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition.

The exact etiology, or cause, of depression is unknown, but it is believed to have origins in a variety of genetic, biological, environmental, and psychosocial factors (Bains & Abdijadid, 2023). Early theories describing the origin of MDD focused on a potential link between lowered serotonin and depression, dating back to the 1960s. The validity of this hypothesis was seemingly explained by the ability of Selective Serotonin Reuptake Inhibitor (SSRI) antidepressants and other serotonin agonists to treat depression (Moncrieff et al., 2022). Furthermore, additional research found that individuals with suicidal ideation have been experimentally found to have " low levels of serotonin metabolites," which indicates low levels of serotonin (Bains & Abdijadid, 2023). While the serotonin theory of depression was initially widely accepted, more recent research shows no concrete evidence that lower serotonin concentrations cause, or are associated with, depression. Therefore, alternative treatments for depression may be more effective than traditional, serotonin-targeting pharmacological

interventions in the treatment of major depressive disorders. This paper will seek to review current literature pertaining to contemporary treatments for MDD.

Neurofeedback

Contemporary interventions for depression have begun to move beyond pharmacological approaches. Neurofeedback training, for example, is a nonpharmacological intervention that may be utilized in the treatment of depression. Neurofeedback training is described as a non-invasive technique that teaches patients to control their brain functions by recording brain waves through electroencephalogram (EEG) and providing some sort of signal in response (Marzbani et al., 2015). Per Patil et al. (2023), neurofeedback has been adapted to work in the psycho-physiological realm by training the brain waves specifically associated with depression.

Trambiolli et al. (2021) describe four primary steps of neurofeedback interventions. First, a primary neural target must be identified. As previously mentioned, certain brain waves can be isolated to train in order to alleviate depressive symptoms (Patil et al., 2023). According to Marzbani et al. (2015), alpha, beta, and theta brain waves can be targeted in neurofeedback for depression treatment. Alpha and theta brain waves are generally associated with relaxation and peacefulness while beta brain waves are associated with sustained attention and alertness. Individuals with depression appear to have underactivation of the right parietal region, which is indicative of decreased alpha wave activity. Therefore, using neurofeedback techniques to increase alpha and theta frequencies while simultaneously inhibiting beta frequencies have been shown to experimentally improve depression symptoms (Marzbani et al., 2015).

The next steps of neurofeedback training include recording and processing the neural activity of the neural target while controlling for artifacts, or features produced by the imaging modality that are not present in the brain, and then providing feedback to the user in real-time.

This feedback is provided through either visual or auditory modalities, vibrations, electrical impulses, or through proprioceptive modalities, which test the body's ability to perceive its own orientation and movement (Trambiolli et al., 2021). The ultimate purpose of the feedback is to provide constant updates to the trainee about their present neural state, enabling them to alter and improve strategies for controlling mind and behavior and providing the patient with improved self-regulation abilities, or the capacity to adjust and respond to outside stimulus, for neural activity (Birbaumer et al., 2013). Throughout various studies, results of neurofeedback training have shown to be promising as the vast majority of results have produced statistically significant clinical improvements (Patil et al., 2023). With this being said, limitations still exist within published literature. Specifically, many studies did not subscribe to best research practices, which may infringe upon the validity of the published results. Neurofeedback studies consistently lacked robust samples and struggled to differentiate between specific and non-specific effects, so future research in the field should focus on refining methodology to yield more reliable results (Patil et al., 2023; Trambiolli et al., 2021). Therefore, while neurofeedback studies have provided favorable results, further scientific research must be performed to confirm the effectiveness of neurofeedback training before it is widely adopted for treatment of MDD.

Ketamine

In addition to neurofeedback training, nontraditional pharmacological methods are being adopted for the treatment of major depressive disorder. Ketamine, for example, is a dissociative anesthetic used traditionally in the maintenance of surgical anesthesia, however it appears to have applications in the treatment of depression. Ketamine is an N-methyl-D-aspartate (NMDA) receptor antagonist, meaning it inhibits the action of the NMDA receptor (Iglewicz et al., 2015). Per Ates-Alagoz and Adejare (2013), the NMDA receptor subtype for the neurotransmitter

glutamate has been implicated in several neurodegenerative and neuropsychiatric disorders, including depression. Ketamine serves as an uncompetitive antagonist, meaning it prevents NMDA receptor subtype agonists from binding to the receptor allosterically. Therefore, ketamine does not bind to the active site of the receptor, where the neurotransmitter would typically bind, but instead binds to a different area of the receptor to inhibit glutamate.

Multiple research studies show ketamine is an effective antidepressant, with emphasis on the minimal latency between administration and effect. Unlike SSRIs or other traditional antidepressant drugs, ketamine treatments provided therapeutic effects for individuals with depression almost immediately, compared to the typical six to eight week window of onset for SSRIs (Iglewicz et al., 2015). Due to this quick onset, ketamine may be of interest in emergency depression treatments, especially due to its ability to decrease suicidal ideation (Peters et al., 2022). Additionally, decreased latency of onset may be of interest to hospice populations. While questions of safety may exist for the use of ketamine in treating depression in hospice populations, Iglewicz et al. (2015) showed 93% of hospice patients who had a dose of ketamine experienced relief of depressive symptoms on days 0-3, while 80% continued to experience therapeutic effects through days 4-7 in a randomized control trial of 31 patients. Similarly, in a population of individuals with a form of treatment-resistant depression, Peters et al. (2022) found statistically significant results supporting the effectiveness of racemic ketamine for the treatment of depression with minimal adverse effects through the analysis of a randomized control trial of 108 participants. Therefore, preliminary research shows promise for safe and effective treatment of MDD using ketamine.

Psilocybin

Psilocybin is another drug that appears to have antidepressive characteristics. As a hallucinogen, or psychedelic drug, psilocybin typically produces hallucinations when used recreationally, however novel research shows it may be used to treat MDD (Pearson et al., 2022). Like ketamine, psilocybin works more rapidly than traditional pharmacological measures, however, unlike ketamine, psilocybin is a serotonin agonist (Griffiths et al., 2016). While the exact mechanism for depression is unknown, psilocybin is hypothesized to work in various ways (Pearson et al., 2022). The first proposed mechanism is termed the 'Ebenezer Scrooge' model, where a sudden transformation in mood is brought upon by the drug experience. The second model is the adjunct to psychotherapy model, where it is hypothesized that the psilocybin leaves an individual in a state more susceptible to suggestion, enabling psychotherapy to be more impactful. The third and final model is the traditional pharmacological model, which proposes that psilocybin works as a serotonin agonist to produce antidepressive neurobiological effects (Pearson et al., 2022).

Regardless of the mechanism, research shows abundant evidence of rapid and successful treatment of MDD using psilocybin. Per Griffiths et al. (2016), a single dose of psilocybin had antidepressant effects in 73% of patients with life-threatening cancer for at least six months. Pearson et al. (2022) performed a review of several studies using psilocybin to treat depression, which all yielded similar positive results. These findings provide an evidentiary basis for the future use of psilocybin as an antidepressant intervention.

Limitations and Conclusion

While novel pharmacological interventions appear promising, a major limitation to their usage is accessibility. Intravenous ketamine is highly costly, making it inaccessible to off-label

use for depression (Peters et al., 2022). While ketamine is used medically, psilocybin is not as it is currently considered a Schedule I drug, meaning it has been deemed illegal by the federal government of the United States. Other nations have also begun research on the use of psilocybin for the treatment of depression, and have yielded similar results. Per Rucker et al. (2022), research in London has shown psilocybin was effective in reducing symptoms associated with MDD in 67% of patients, although it is considered illegal in much of Europe. Therefore, in order to make psilocybin treatments accessible, a reclassification of psilocybin would have to occur internationally (Pearson et al., 2022; Rucker et al., 2022).

While contemporary treatments for major depressive disorder show promise, especially due to their latency of effect, it is evident that further research needs to be done before widespread adaptation of these measures can occur. Therefore, it is difficult to conclude with certainty that alternative treatments for depression are more effective than traditional, serotonin-targeting pharmacological interventions in the treatment of major depressive disorders, however it is valid to say these contemporary interventions are promising. Future research should focus predominantly on optimizing trials pertaining to the interventions mentioned above, as well as the exploration of potential future interventions to effectively treat major depressive disorder.

Chapter 3: The Nursing Shortage and its Possible Solutions

Around the globe, there exists a drastic international shortage of nurses working on nursing units, with pre-COVID estimates of deficits ranging from 300,000 to over a million in the United States alone by 2025 (Aiken et al., 2009). This shortage has increased following the onset of the coronavirus pandemic, with an estimated deficit of over six million nurses worldwide in 2021 (Catton & Iro, 2021). This deficit comes in addition to the necessary replacement of almost five million nurses set to retire over the next decade, meaning the nursing profession will need over ten million nurses worldwide within the next decade to effectively meet the needs of both the community and the United States as a whole (Catton & Iro, 2021). Therefore, it is pertinent to discuss both the causes of the nursing shortage, as well as potential resolutions.

Causes of the Nursing Shortage

The problem of the nursing shortage is multifaceted, with several factors contributing to global nursing deficits. Shortages of nursing faculty prevent a greater number of students from training as nurses, due to limited resources. With one-third of the nursing workforce set to retire in the next decade, including nurse faculty members, nurse educator roles will need to be filled as well. If these roles are unable to be filled, the number of seats in nursing programs will have to be reduced, leading to decreased nurse output from various nursing programs (Haddad et al., 2023; Siela et al., 2008). Additionally, nursing programs as a whole are trending towards the elimination of certificate programs. This means higher level academic degrees, specifically Associate degrees and Baccalaureate degrees, are becoming required in nursing, which therefore means nurses need increasingly higher certifications to serve as nurse educators, serving as a barrier for more nurses becoming nurse educators (Aiken et al., 2009).

Nursing migration also leads to regional inequities of workforce dispersion as nurses are unevenly distributed across the country. In the United States, there are regional differences in growth, with the Western and Mountain regions having the greatest growth potential while also maintaining the lowest population density (Haddad et al., 2023).

Burnout in healthcare, specifically in nursing, is another major contributor to the nursing shortage, likely due to its poor work-life balance, specifically as it pertains to parenthood, as well as the somewhat violent nature of the profession (Haddad et al., 2023). According to Reith (2018), burnout, which is especially prevalent in individuals employed in healthcare, such as physicians, nurses, and other staff, can be defined as "a combination of exhaustion, cynicism, and perceived inefficacy resulting from long-term job stress" (p. 1). Per Buchanan and Aiken (2008), a majority of nurses are women, which may encroach upon an individual's work-life balance, especially once they and thus make those nurses more prone to burnout. Burnout is significant in the nursing shortage as it leads to early retirement or premature departure from the profession (Haddad et al., 2023). Per Reith et al. (2018), 43% of nurses experienced symptoms of emotional exhaustion, which leaves these individuals more susceptible to burnout and early departure from nursing, further contributing to the nursing shortage.

Clinical Relevance

The nursing shortage is of clinical concern as it leads to decreased nurse-to-patient ratios, which in turn may produce poor patient outcomes (Haddad et al., 2023). According to Reith et al. (2018), burnout in healthcare professionals leads to an increase in prevalence of major medical errors, patient mortality, and spread of hospital-transmitted infections. According to Haddad et al. (2023), high patient loads increase propensity for burnout, meaning that the nursing shortage contributes to the aforementioned negative patient outcomes. Additionally, high staffing ratios

contribute to unsafe discharges as units cannot accommodate all patients in need, so patients who still require care are transferred out of the unit or discharged to locations with inadequate intensities of care available. These inappropriate discharges may contribute to negative outcomes and increased mortality outside of the hospital.

Potential Solutions

While there are several theoretical solutions for resolving the nursing shortage, none have actively been implemented, nor is there one single solution to eliminate the nursing shortage, due to the complexity of the problem (Buchanan & Aiken, 2008). Involving nurses in dual-role positions would increase the number of nurse educators in the classroom, which would in turn increase the number of students able to participate in nursing programs. Therefore, the number of nurses graduating from these programs annually would increase, contributing to the diminishment of the nursing shortage (Siela et al., 2008). A drawback, however, is that moving nurses who actively serve in the clinical setting into the classroom, even for one shift a week, may leave clinical units immediately understaffed, which is counterproductive to diminishing the negative effects of high nurse to patient ratios. This also may leave nurses more susceptible to burnout as they are spending more time at work or preparing for work, which may encroach upon work-life balance (Reith et al., 2018; Siela et al., 2008). Another limitation of this intervention is that it requires active nurses to receive higher education to become a faculty member. As previously mentioned, while most active nurses have Associate degrees and Baccalaureate degrees, Master's level degrees or higher are typically required to teach nursing education, which would be a deterrent in becoming an educator (Aiken et al., 2009).

Another potential to combat the nursing faculty shortage, suggested by Aiken et al. (2009), is to shift public policy towards funding more Bachelor's of Science in Nursing (BSN)

programs. The promotion of BSN degrees would more easily lend to the advancements of BSN nurses into an advanced Master's of Science in Nursing (MSN) degree, which would further increase the number of nurses eligible to be nursing instructors. Therefore, Aiken et al. (2009) proposes that, if public policy changes to support BSN programs, it would incentivize nurses to continue with their education in the future. One immediate limitation would be the desire for quicker gratification in the workforce. Part of the appeal of an ASN degree is that it lasts only two years, compared to four years for a BSN. Even with the provision of public subsidies for BSN degrees, it is difficult to anticipate if these subsidies will be greater than the amount of compensation ASN nurses would receive from an extra two years in the workforce and the lack of debt ASN nurses may have from two fewer years of school.

A potential solution to both increasing the number of nurse educators and increasing the number of nurses with baccalaureate degrees may be to provide incentives that would outweigh the drawbacks of extra education and increased hours through teaching hospital partnerships. For example, if institutions of higher learning were to partner with hospitals, a mutually beneficial relationship could be established to both increase the number of BSN nurses and enable current BSN nurses to pursue their MSN. If hospitals alter nurses' shifts to work with MSN courses offered by their partner institution and the partner institution provides some form of scholarship to these nurses, it would address concerns of both price of higher education and encroachment of work-life balance by providing support from both establishments and enabling them to continue to work. By supporting a partnership between university and hospital, MSN students would have a chance to practice as a nurse educator, while BSN students would have the ability to learn from experienced nurses, regardless of the degree the nurses currently hold. Additionally, enabling MSN students to serve as nursing instructors, like teaching assistants do in doctorate programs,

would increase the number of students able to enroll in BSN programs and would, in turn, increase the number of nurses entering the workforce each year.

Another approach to combating the nursing shortage is to focus on increasing retention by working to decrease burnout within the existing nurse population. One potential method of reducing burnout is the provision of mental health resources by hospitals in order to increase nurses' feelings (Catton & Iro, 2021; Reith et al., 2018). One limitation, however, to the provision of mental health interventions is the stigma surrounding mental health in healthcare professionals. Even if hospitals provided these resources, there is not a guarantee they would be utilized due to nurses' potential fear of stigmatization (Reith et al., 2018). One possible solution would be to preemptively combat stigma in the workplace in order to enable individuals to feel comfortable seeking help. This could be done through encouraging self-disclosure in the workplace or encouraging group discussion, perhaps to the extent of making it mandatory, about mental illness to allow individuals to be comfortable with seeking help without fear of retaliation and stigmatization.

Conclusion

The nursing shortage has been a long-term problem in the United States, however it is on the brink of becoming critical due to the effects of the COVID-19 pandemic. Although the exact cause of the nursing shortage is multifactorial, it is evident that, in general, the number of nurses entering the workforce needs to increase, as does the number of nurses who choose to become nurse educators, in order to resolve this crisis. Without resolution, the nursing shortage will continue to have negative implications on patient outcomes and patient care. Therefore it is pertinent to incentivize nursing students to enter the nursing workforce and incentivize presently

employed nurses to pursue higher education, while supporting current nurses' mental health to ensure they remain in the profession for longer.

Chapter 4 redacted to remove personal reflections and any identifying information.

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