Overlooked Predispositions to Anorexia and Improving Treatment

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Abstract

Every year, more people are diagnosed with anorexia nervosa (anorexia), yet there is a lack of public awareness for the factors behind this psychological disorder (Holcombe; “What Is Anorexia: Symptoms, Complications and Causes.”). Neurobiological-based studies on patients with anorexia depict the chemical imbalances and cognitive functioning abnormalities contributing to the emergence of the eating disorder (Frank et al.; Lozano-Serra et al.). This review paper analyzes the psychopathology of anorexia relating to the formation and progression of the illness as well as discussing current treatment approaches. The brain-based anatomy of anorexia will be exemplified through a review of controlled experiments using brain scans, notably positron emission tomography (PET) technology. Qualitative data referring to the symptoms of anorexia and the thoughts and emotions that may accompany the disorder will be illustrated through the inclusion of podcasts hosted by young women who have had anorexia and peer-reviewed articles that include psychiatric evaluations for anorexia, interviews with patients, and longitudinal studies of patients throughout recovery. Treatment for anorexia is also reviewed. The unpredictability surrounding the intensity of the eating disorder through its development makes anorexia difficult to treat. Anorexia manifests differently in each patient, so a universal approach to treatment is not effective in curing a patient’s disorder (Kenny et al.). Furthermore, lack of understanding from clinicians and professionals weakens a patient’s chances for full recovery because staff do not know how to balance restoring physical health with psychotherapy (Hernberg; Paintain; Roloff). We present that if treatment is individualized to address the struggles of each patient’s case of anorexia, then patients are able to heal the causes that fueled the eating disorder, increasing the likelihood of staying healthy in recovery.

Keywords: anorexia nervosa, neurobiological, qualitative data, psychotherapy, recovery

Introduction:

Anorexia nervosa has the highest mortality rate among all psychiatric disorders (“What Is Anorexia: Symptoms, Complications and Causes.”). In the United States, ten thousand people die from eating disorders each year, equating to one person every hour (“Anorexia Statistics: Gender, Race & Socioeconomics”). From spring of 2020 to spring of 2021, the number of patients admitted to inpatient care for eating disorders more than doubled (Holcombe). Thus, there is a need for a greater understanding of anorexia and effective treatment for the disorder. However, when considering effective treatments, there is not a singular cause for an eating disorder (Klump et al.; Paintain; Roloff). A multitude of factors can lead to the development of an eating disorder (Frank et al., 2019; Holtkamp et al.; Kenny et al.).

The *Diagnostic and Statistical Manual for Mental Disorders, Fifth Edition* (*DSM-5-TR*; American Psychiatric Association, 2022) categorizes an individual as having anorexia nervosa if the following requirements are met: a significant restriction of energy intake resulting in a low body weight in the context of age, sex, developmental trajectory, and physical health; an intense fear of gaining weight or being fat despite being underweight; current disturbance with weight or shape which influences self-evaluation and denial of being underweight (“Anorexia Nervosa”).

Research in the field of anorexia has found commonalities stretching across individuals diagnosed with this disorder. Starvation does not allow the brain to function properly, and areas

of the brain are at risk of losing their proper ability to function (Frank et al., 2013). Individuals experiencing anorexia have a decreased ability to exhibit higher level cognitive functioning, for patients with anorexia record lower than average scores on tests measuring visual-spatial ability, visual memory, and executive functioning. This lack of ability then makes it more difficult for the individual to combat anorexia's influence (Lozano-Serra et al.). The body does not have enough energy to put towards fighting self-destructive coping strategies (e.g., eating disorder behaviors), and certain trait tendencies become more prevalent as the disorder develops. Specifically, perfectionism, cognitive rigidity, overcontrolled emotions, and obsessional behaviors are heightened with anorexia (Holtkamp et al.). Fortunately, through treatment, weight restoration takes the body out of survival mode. Energy can be distributed to areas of the body that are not deemed as essential for keeping oneself alive, so some areas of the brain normalize during recovery and weight restoration; nevertheless, trait tendencies persist even once the physiological functions of the body normalize (Bezance & Holliday; Frank et al., 2013). This review explores the theory that the neurobiological and psychological symptoms that remain present through recovery pre-existed the diagnosis of anorexia nervosa and were intensified by the mental disorder.

Characteristics of Anorexia

Dopamine

Dopamine pathways of the brain become retrained through the development of anorexia nervosa (Frank et al., 2013). Dopamine is a neurotransmitter responsible for feelings of pleasure and motivation ("2 Minute Neuroscience: Dopamine"). This chemical messenger is also linked to reinforcement and reward learning, memory, sleep regulation, and arousal ("Dopamine: What It Is, Function & Symptoms."). There is a positive correlation between the activation of the dopamine neurotransmitter and anorexia nervosa (Frank et al., 2013; Frank et al., 2019). When people with anorexia lose weight, the body wants to remain homeostatic, so the body increases its dopamine signaling, communicating the body's craving for caloric energy (Frank et al., 2019). The brain is then in a motivational state, where a reward is sought out, and an aversive stimuli is avoided ("2 Minute Neuroscience: Dopamine"). For the brain, the reward is food, and the aversive stimulus is hunger and a non-homeostatic state. The food is considered a reward to the point where there is a motivation to feed oneself and experience an associated pleasurable feeling. However, when a person has anorexia, the brain's dopamine pathways are modified; individuals do not see food as the rewarding stimulus, and starvation is the new reward (Frank, 2013).

People with anorexia nervosa are likely to have increased prediction error signaling (Frank, 2013). An unexpected reward will trigger a spike in the firing of dopamine neurons, but the more the unexpected reward occurs, the brain begins to expect the stimulus (Humphries). Rewards are sought out to avoid an aversive stimuli, an unpleasant event that decreases the future action of the behavior causing the aversive stimuli, and a reward is a desirable object or action that reinforces the behavior resulting in the reward (Pritchard & Chong). On that account, an unexpected reward resulting from a certain action or behavior increases the likelihood of the individual engaging in the behavior again, and the reward is no longer unexpected (Garrison et al.). After habituating to the rewarding stimulus, more dopamine is released when the brain suspects the reward is coming, rather than releasing a greater amount of dopamine when the reward is actually delivered. After a predicted reward is received, dopamine levels return to baseline. However, if a reward is expected and no reward is received, dopamine activity falls

below baseline (Humphries). In a study performed by Frank (2013), adolescent girls were tested for prediction error signaling using a monetary task, where the participants learned to associate images with certain outcomes, so they could predict the consequences, as opposed to guessing what the effect of their associations would be. Participants were noted to have a higher rate of correctly pairing images with outcomes in relation to the control group, suggesting a higher sensitivity to rewards in patients with anorexia due to the quicker connections of causes and effects in the brains of patients with anorexia. This study also suggests that anorexia corresponds with more harm avoidance. Patients with anorexia tend to refrain from "normal" activities or behaviors in an attempt to avoid punishment. Those with anorexia when compared to a control group of those without the disorder tend to learn the associations between images and outcomes in the monetary reward activity faster because they are fearful of punishment. Dopamine levels in this experiment conclude that the participants with anorexia are more likely to accurately predict the reward, suggesting a higher cognitive ability to acquire information on the connections between a stimulus and its effect.

Patients with anorexia nervosa are apt to release more dopamine due to their conditioned understanding of reinforced behaviors (Frank et al., 2019). For those with anorexia, weight loss is predictable considering the low food intake and there is excitement surrounding weight loss (Coniglio et al.). Dopamine neurons habituate to the reward of losing weight, so as weight loss is expected by someone with anorexia, the excitement deriving from the activation of dopamine is occurring before seeing the weight loss (Humphries). The process of restricting food, exercise, or engaging in other eating disorder behaviors is what then triggers the release of dopamine (Coniglio et al.). As the antecedent stimulus becomes exciting, and as the latter stimulus continues to please the person due to eating disorder symptomatology, the cycle grows more powerful to encapsulate more of the eating disorder into the individual's daily life (Frank et al., 2019). The observable behaviors of an individual with anorexia derive from rewired motivational brain circuits, so their actions, while causing harm to themselves, are self-gratifying. Hence, dopamine's influence on a person with anorexia takes over primitive human functioning leading to significant changes in a person's behaviors (Frank 2013; Frank et al., 2019).

Exercise

Typically, exercise is important for the body to stay healthy, but for someone with an eating disorder, exercise can be dangerous (Archer; Coniglio et al.; Dittmer et al.). From a physiological perspective, blood flow to the brain is increased through movement, arousing areas of the brain. In particular, exercise is helpful for encoding memories and the process of learning. Brain cells receive more nutrients through increased blood flow, which promotes neuroplasticity. On top of that, physical activity releases more dopamine and endorphins while decreasing the amount of stress receptors in the brain, creating pleasurable experiences (McGregor). Yet with anorexia, a liking for exercise goes deeper than the physiological benefits. Exercise can be a way to alter shape, weight, and appearance, thus becoming a coping mechanism for someone with anorexia (Archer).

For people with anorexia, the primary reason individuals initially fall into a pattern of increasing exercise is to heighten positive affect (Coniglio et al.). Anorexia, aligning with symptoms of depression, takes away joy that was once found in certain activities, as seen through dopamine's influence on the brain (Frank, 2013). At a time when individuals are not finding pleasure in other aspects of their life, exercise elicits the desired positive emotions.

The positive correlation between eating disorders, cognitive rigidity, and easily becoming addicted to certain behaviors is seen through pathological exercise. Pathological exercise, although there is no universal definition, is reported by Dittmer as “excessive exercise that a patient feels driven to perform in response to an obsession or according to rules that must be applied rigidly, and exercise that is aimed at preventing or reducing distress or at preventing some dreaded consequences.” Exercise becomes pathological through building up a tolerance, meaning more exercise is needed to have the same effects on mood with beta-endorphins (Coniglio et al.). Anorexia drives patients to exercise because they feel the need to “burn off the meal,” or they may exercise in advance to “earn the meal.” Patients find a sense of comfort in exercise since it relieves the guilt surrounding food that is difficult for those with an eating disorder to get rid of (Dittmer et al.).

Along these lines, this definition of pathological exercise supports that people with anorexia are compelled to exercise in order to decrease negative affect. Experiments with animals depict that there is lowered availability of beta-endorphins in animals who exercise regularly, lowering the capability to produce the desired positive affect that comes from movement (Coniglio et al.). In Coniglio’s study, participants in the control group only mentioned exercise as heightening positive affect while patients with anorexia also reported exercise as removing aversive stimuli. Most compulsive exercisers continued to adhere to their routine even though they no longer found happiness in the activity, illustrating that as the eating disorder develops, the motivation of patients with anorexia to exercise changes from doing so to better their mood to then serving as a coping mechanism for emotions stemming from the eating disorder, such as shame and guilt (Dittmer et al.).

Anorexia escalates levels of cognitive rigidity and perfectionism, which are theorized to have existed prior to the eating disorder, notably observed in relation to exercise (Kaye et al.,; Lozano-Serra et al.; Nahman & Holland). A compulsive exerciser usually has a strict routine as to when the appropriate time is to exercise, for how long, the number of exercises done, and the order of the exercises. Individuals with anorexia take all of these factors into great consideration and some have voiced that they plan their day around exercise (Cresswell et al.). Perfectionists feel pressured to keep up with their exercise routine and continue to add to it as a way to maintain self-control and reach the feeling of achievement and reward, even though this is at the cost of the patient’s standards for exercise being unrelentingly high (Dittmer et al.). When any part of the exercise routine is in danger of not being at the “normal” standard for the person with an eating disorder, there is distress. Instead of sitting with that distress, patients note that their mind instantly directs its thoughts to be about how to compensate for not exercising to the full amount they would have liked to, whether that be through eating less or working out more the next day (Nahman & Holland; Roloff). Individuals with eating disorders have a hard time adjusting their thinking to fit the flow and uncertainty of life. Patients are constantly planning out their next moves in relation to the eating disorder that they become fully consumed by its influence (Dittmer et al.). Exercise impedes on daily life, taking away both mental and physical energy from a person with anorexia that used to be spent on more satisfactory activities and experiences.

On a neurobiological level, for patients with anorexia, exercise progresses into a compulsion that becomes independent from dopamine reward processes and, instead, is more dependent on corticostriatal connections in the brain, which are linked to habitual and addictive behaviors (Archer; Cresswell et al.). Archer conducted a study to decrease the synthesis and transmission of dopamine by applying acute phenylalanine and tyrosine depletion in patients

with anorexia and the control group. Patients with anorexia showed a higher motivation to exercise than controls, despite exercise being reinforced for both groups. In patients with anorexia, reduced levels of dopamine do not decrease an individual's motivation to exercise, but for healthy controls, their motivation to exercise did decrease. Although dopamine plays a crucial role in eating disorder behaviors being viewed as rewarding, the data indicated that anorexia continued to develop .

Trait and Cognitive Tendencies

Across people with anorexia, many similarities exist when observing cognitive abilities and character traits. Black and white thinking, cognitive rigidity, and perfectionism are the most common cognitive distortions, faulty inner mental thinking, perceptions or beliefs that increase misery and fuel anxiety, for individuals with anorexia to exhibit (Coniglio et al.; Lozano-Serra et al.). The question arises of whether or not default thinking patterns emerge as an effect of anorexia or if they predispose an individual to anorexia. Due to research showing that irrational traits and cognitive tendencies persist throughout recovery, it is suggested that these propensities are temperamental, existing before the eating disorder (Lozano-Serra et al.).

Although there are not any studies of individuals with anorexia before they developed an eating disorder, evidence from an individual's past can suggest the presence of certain cognitive distortions. Also prevalent in those with anorexia, patients indicate a history of trying harder than peers in school and exhausting themselves by putting more effort into academics, believing that if they did not, they would be seen as a failure. In her podcast, *Best of Bettina*, Bettina, a young woman in recovery from anorexia, discloses that growing up, she did well in school. She began to demand more from herself, putting in more effort than her classmates because it was the only way for her to feel a sense of pride and achievement. These unrealistic expectations Bettina set for herself are instances where, as an innocent child, years before the development of an eating disorder, her mind naturally thought in absolutes. Her unreasonable standards began to infiltrate her life as Bettina recalls the initiation of anorexia while growing up arrived when the voice in her head told her that since she was doing so well in school and succeeding in other areas of her life, she needed to turn that back to her body. Bettina began to strive for a perfect body as a result of having automatic, reactive thoughts in extreme measures. As a child, nobody was punishing her for not being the best student or solving arithmetic problems the fastest. Bettina's motivation to thrive academically was internal, and the motivation to meet a certain beauty standard was intrinsically motivated, as well.

In patients with anorexia, many cognitive distortions exist simultaneously, contributing to the deathliness of the illness, for 95% of people with anorexia suffer from another mental disorder ("What Is Anorexia: Symptoms, Complications and Causes."). Black and white thinking compels viewing either side of an argument, event, or action as extreme, which is convergent with perfectionism (Bezance & Holliday, 2013). Perfectionists are internally driven to avoid disappointment and seek out accomplishment. Perfectionism causes individuals to have a negative outlook on things on one end of the extreme ("*Perfectionism*"). With anorexia, perfectionism manifests as only eating foods when they meet a certain criteria. Sorting food labels also reflects black or white thinking, arguing whether foods are "healthy" or not (Frank et al., 2019). Brooke, an adolescent recovering from anorexia, remarks that while she was anorexic, her mind communicated, "If I eat, it's going to be worth it. Why am I eating this many calories if it's not going to be worth it. It's got to be perfect to me" (Paintain 33:45). Forming judgments about food, and then acting on that judgment enhances an unhealthy relationship

with food (Frank et al., 2019). The preceding worries and daily stressful thoughts that cognitive distortions communicate to individuals prior to the appearance of an eating disorder are continuously triggered through the eating disorder's progression, verifying why the layers to this mental health disorder are so dense (Cogiblio et al.). When multiple negative thought patterns occur continuously, they reinforce the eating disorder (Frank et al., 2019).

In addition to cognitive distortions, people with anorexia display depressive, anxious, and obsessive-compulsive behaviors. Recorded in a study conducted by Holtkamp et al., even after ten years following discharge from an inpatient setting, the majority of patients with anorexia continue to display these behaviors. Further, compared to the control group, former patients with anorexia recorded a higher level of interpersonal sensitivity, including feelings of inadequacy, inferiority, and lower self-image. It is important to note that none of the patients from this study met the full criteria for any other mental health disorders other than anorexia, despite embodying some behaviors and symptoms that align with depression, anxiety, and obsessive-compulsive disorder. One possible explanation for the enduring behaviors is that starvation and weight loss, primary symptoms of anorexia, triggered these traits, and they remained throughout recovery as a result of the eating disorder's influence.

Various behavioral tendencies portrayed through research experiments in those with anorexia validate the theory that when the brain is deprived of energy, behaviors and motivations seen in the average person also decline. For example, Klump et al. measured personality characteristics of women during a period where they met criteria for an eating disorder and then through recovery. Data from this study shows that women with anorexia tend to be more nervous in new situations and refrain from typical behaviors as a means of avoiding judgment from others. Coined "harm avoidance," feelings of fear and shyness triumph over the standard emotions of relaxation and optimism found in participants without anorexia (Markett et al.). Likewise, the concept of novelty seeking – behavioral activation to pursue rewards – negatively correlates with the development of a restrictive eating disorder where internal motivations, seen in the brain's production of dopamine, are lessened; for patients with bulimia nervosa, levels of novelty seeking were closer to the levels of novelty seeking in the control group than the levels of novelty seeking in the group of patients with anorexia, which were noticeably lower. The lack of care for goal or reward in patients with anorexia highlights the decreased activation of the amygdala, the part of the brain responsible for regulating and releasing emotions. Yet when levels of novelty seeking are measured again during recovery, the scores of patients who previously had anorexia increased, presenting scores more relative to those of the control group (Klump et al.). It can be postulated that when the brain is not receiving enough caloric energy as a result of significantly lowering food intake, areas of the brain begin to shut down as a means of saving energy for essential functions that keep the body alive, and once the intake of food escalates with recovery, previously "dead" regions of the brain come back to life as a result of the body having an adequate amount of energy.

From a neurobiological perspective, brain scans emphasize a more specific idea pertaining to the state of the amygdala during starvation. Anxiety is commonly tied with anorexia due to deeply rooted fears surrounding food, body image, and other eating disorder idealizations, including the intense motivation to exercise, eat in public, or discuss food ("Anorexia Nervosa"; Seeger et al.). Positron emission tomography (PET) scans of women with anorexia reveal anxiety as it is fueled when patients are shown target images related to the body or food (Fig. 1). The prefrontal lobe and anterior cingulate cortex are more activated with the photographic models, proving that the brain spends more effort processing visual food

stimuli (Frank et al., 2004). The prefrontal lobe and anterior cingulate are responsible for interpreting visual stimuli and pairing those visuals with complex cognitive functions, ranging from the experience of feelings of empathy to impulse control and decision-making (Marusak et al.). The ability of the anterior cingulate to trigger higher-level thoughts enables the amygdala to be more sensitive to food and body-related images (Frank et al., 2004). The minimal supply of energy that the brain can utilize is fully absorbed and manipulated by the anorexia-related symptomatology, so any area that is not related to the eating disorder essentially does lose the extent to which it used to be activated prior to the illness.

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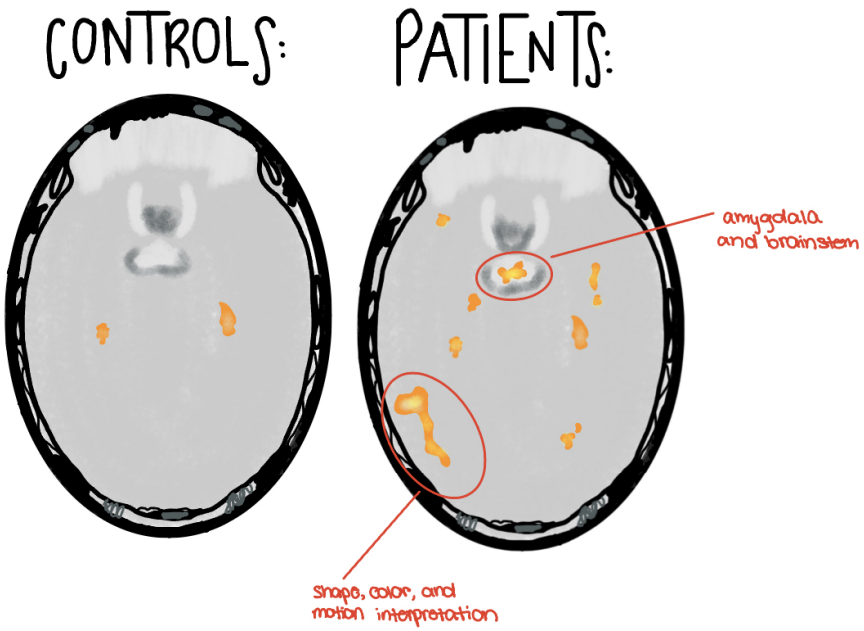

Fig. 1: PET scans portray that target stimuli (visuals relating to food and body image) elicits activity in the amygdala, brainstem, and visual processing areas of the brain in patients with anorexia but not the controls.

cycle emerges between different process centers of the brain, beginning with the visual input being transcribed in the prefrontal lobe and anterior cingulate. Once the image is interpreted, emotions stemming from the eating disorder relay the amount of fear and degree to which the disorder is activated, and the negative emotions stemming from the eating disorder lead to an individual giving in to the judgments and processing of the images when shown to the patient again (Frank et al., 2013). Because patients with anorexia who were underweight and ill received low scores on a psychological evaluation specifying eating attitudes and symptoms, the results illustrate that their levels of cognitive processing are rigid (Lozano-Serra et al.). Inflexibility when it comes to thought increases the likelihood that negative beliefs surrounding food and weight appear more frequently, which fuels the cycle of disordered psychological symptoms that patients with anorexia experience (Marusak et al.).

Accordingly, it might be a result of the state of starvation that deprives an individual with anorexia from the ability to counter intrusive eating disorder thoughts and feelings (Frank et al., 2019; Lozano-Serra et al.). As starvation continues, the connection of white matter from the frontal cortex to the amygdala is weakening, which can eventually lead the prefrontal brain region to be incapable of controlling and countering the hypersensitized amygdala that has been affected by the eating disorder (i.e., calming oneself down) (Frank et al., 2013). The reinforcing mechanism is to avoid the anxiety and fear stemming from the eating disorder, so the individual engages in behaviors that will make them feel better on the inside, lessening the emotional pain that is experienced (Paintain). The cycle is fed through the desire to alleviate the uneasiness that a patient with anorexia faces, yet the eating disorder does not allow the patient to see the danger in their actions, presuming that the damage done to the brain is worth the risk to satisfy the goals of the eating disorder (Frank, 2013; Frank et al., 2019).

Treatment Flaws

Overview of Treatment

Despite the prevalence of anorexia nervosa within society, with 1.2% of Americans over the age of 15 meeting the criteria for anorexia, in comparison to other mental disorders (ie. depression, anxiety, obsessive-compulsive disorder), little research on anorexia has been performed ("Anorexia Statistics: Gender, Race & Socioeconomics"). From studies that have been conducted, most are only composed of white females, making the results of the experiments difficult to generalize to other patients (Frank et al., 2004; Holtkamp et al.; Kenny et al.; Seeger et al.). Further, data across different studies is not always the same, illustrating that there is no "one size fits all" policy when it comes to assessing and examining anorexia. Experiments regarding principle symptoms and areas of neural activation when examining the brains of patients with anorexia can show different results as to the severity of symptoms or regions of the brain where the most activation occurs (Frank et al., 2004; Kaye et al.; Seeger et al.). The ambiguity and large range of personality characteristics, cognitions, and actions endured by individuals with this specific eating disorder make it hard to identify what recovery is and how it is achieved (Bezance & Holliday; Kenny et al.; Paintain).

Across all studies included in this review that include personal perspectives from patients with anorexia, the patients voiced concerns in regards to the definition of anorexia focusing on weight and food intake while excluding what they believe to be crucial aspects of the disorder. Treatment is based upon targeting the clinically agreed upon definition from the *DSM-5-TR*, and when that definition leaves out important factors, medical professionals may not address every aspect of the psychological illness (Bezance & Holliday; Cook et al.; Holtkamp et al.; Kenny et al.; Klump et al.; Paintain; Roloff). The foundation from which anorexia emerges, negative thought patterns and behaviors, continue to eat away at the individual's healthy self (Hernberg). It is the responsibility of the specialists in the eating disorder field to care for each of the illness's facets as symptoms that remain post-treatment are prone to inflict pain in the future (Bezance & Holliday; Kenny et al.). The second part of this review discusses the shortcomings within the current treatment system for anorexia nervosa, emphasizing the need for individualized treatment plans in order to meet the definition of recovery that each individual is striving to reach.

Absence of Universal Definitions

Although many note anorexia recovery as including weight restoration, the absence of eating disorder behaviors, healthy organ functioning, proper food intake, and the ability to exercise in a healthy way, there is no set definition that the medical community provides for recovery from anorexia (Herberg; Roloff) . Because there is no operationalized definition of recovery, it is left up for interpretation. Treatment is not comprehensive since some centers focus more on quantitative data (e.g., Body Mass Index (BMI), weight, heart rate, blood pressure) as opposed to psychological recovery (Holtkamp, et al.). Without a standard for what recovery looks like, patients with anorexia are dismissed from treatment centers at different stages in recovery (Paintain; Roloff). Furthermore, it is hard to compare scientific data through research experiments that included recovered patients because across multiple studies, all patients were not necessarily at the same level of recovery whereas in one study, all fit the provided definition of recovery. A medically appropriate specification for defining recovery from anorexia would benefit all individuals struggling with this psychological disorder.

Clinical studies range from providing explanations for long-term recovery versus short-term recovery, incorporating psychological testing into the analysis of recovery, or focusing mainly on weight (Bezance & Holliday; Kenny et al.). Holtkamp defines long-term recovery for females as a time period of at least three years when there are normal menstrual cycles, a stable weight, no “weight phobia” (i.e., anxiety around weight and body image when it comes to food and eating), and does not meet the criteria for any eating disorders. The criteria here for long-term recovery includes both physical and psychological measures, but there is vagueness as to the concept of “weight phobia.” Like most definitions of recovery, this one is all-or-nothing, where failing to meet one of these qualifications within the three year period results in that individual not being categorized as being in long-term recovery. However, that raises questions as to where the individual stands. For example, if a patient who previously had anorexia has been in recovery for two years, has maintained a stable weight and normal menstrual cycles, but has a slip where compulsive exercise occurs, there is a question as to whether or not that individual is no longer in long-term recovery. The all-or-nothing emphasis of the requirements to fit this definition of recovery separates individuals into two groups, ignoring those who do not clearly fit into either category. Many definitions of recovery do not take into account that recovery is not linear, which devalues the effort that an individual has put towards recovery.

One of the most popularly accepted descriptions of recovery from anorexia is the Bardone-Cone’s definition. Under this standard, full recovery occurs once the patient has a BMI greater than 18.5; has not engaged in fasting, purging, or binge eating in the past three months; and obtains a score on the Eating Disorder Examination – Questionnaire (EDE-Q) less than one standard deviation from the norm (Kenny et al.). This definition is more extensive and complete than Holtkamp’s definition of long-term recovery described above due to the specified behaviors listed. It could be implied to the public that the three noted behaviors in the Bardone-Cone definition are the most essential behaviors that distinguish an eating disorder, and that the other behaviors may not appear without partaking in the behaviors of fasting, purging, or binge eating. Nonetheless, considering that behaviors related to compulsive exercise, body checking, counting calories, and negotiating food preferences are excluded from the Bardone-Cone definition falsifies the criteria for recovery. There is room for someone who previously had anorexia to exhibit the less commonly known eating disorder symptoms while being told that they are progressing through recovery at a successful rate (Paintain). Hence, patients may be misguided throughout their treatment, for they are told that the more secretive behaviors are essentially fine to engage in.

Additionally, Bardone-Cone created a definition for partial recovery. Partial recovery is when someone who previously had anorexia has a BMI greater than 18.5, and has not engaged in fasting, binge eating, or purging in the past three months, but the individual scores higher than one standard deviation above the norm on the EDE-Q. The patient demonstrates growth in recovery, and a psychological breakthrough regarding eating disorder thoughts, voices, emotions, and goals (Kenny et al.). With two definitions pertaining to particular stages of recovery, there is an opportunity for patients and their treatment teams to see where the eating disorder is present and what is holding the individual back from full recovery. Plus, the larger idea of recovery is broken down into smaller steps, making goals seem more attainable.

The Bardone-Cone definition has received critical opinions from patients with anorexia who do not believe the provisions for recovery are realistic. For example, participants in Kenny's study expressed that a time frame for recovery is impractical. Depending on the amount of time that someone had an eating disorder and the severity of the illness, reaching goals in recovery looks different for each individual. A time frame can inaccurately categorize individuals as being recovered or not. Furthering this idea, recovery is more than the absence of eating disorder symptoms, but recovery is also the presence of normal aspects of life that were shadowed during the time of the eating disorder. This looks different for everyone based on what life looked like prior to the development of the eating disorder, and this is another complexity to the definition of recovery that needs to be considered (Hernberg; Paintain). In order for a patient, in their eyes, to truly recover, they must gain control back over their life, and that comes along with engaging in activities and experiences that they used to enjoy, without the effects of the eating disorder determining the thoughts, feelings, and behaviors during these times (Bezance & Holliday). However, the Bardone-Cone definition strictly fixates on the absence of eating disorder behaviors without mentioning the resurgence of positive life activities (Kenny et al.).

Considering the information highlighted above, there is discussion around having two definitions of recovery: one that can be used for research purposes and another that is individualized for treatment purposes (Kenny et al.). The medical model's definition of recovery mainly focuses on the behavioral aspect of the disorder, whereas the recovery model takes into account personal experiences that individuals with eating disorders face, which tend to dig deeper into the cognitions fueling the eating disorder (Bezance & Holliday; Klump et al.). We propose that the research definition of recovery should broaden, so more patients with anorexia can participate in certain studies. This way, the criteria does not exclude or attempt to categorize patients into groups. Everyone's eating disorder is unique, with one behavior coming up the most for one patient and never occurring for the other (Hernberg; Roloff). Therefore, patients should not be categorized into groups, for there must be one broader definition of recovery that encompasses the general idea of progress, moving towards a normal life that is free from the eating disorder (Paintain). With a specific definition of recovery for research and medical purposes, the goal is not to hone in on precise, elaborate standards, but rather for the definition to embrace the idea that recovery is not all-or-nothing (Hernberg); rather, recovery is an ongoing, never-ending process that is portrayed through the patient making steps in the right direction, slowly taking control away from anorexia (Kenny et al.; Klump et al.).

We put forward the idea that for treatment to be more successful, however, the definition of recovery must be individualized for each patient. With the help of professionals, patients immensely benefit from establishing goals to work towards, breaking down the long-term goal of full recovery into more attainable steps (Roloff). All patients who suffer from anorexia have their own primary urges, behaviors, and thoughts that cannot be categorized into short definitions

explaining recovery (Crow et al.). The definition of recovery for research purposes has the intent of being used for finding participants for certain medical studies, but applying this definition universally across treatment centers for anorexia is not useful; it would lead to patients being discharged without having the roots of their eating disorder addressed because a model of treatment that works for a few people is not guaranteed to work for everyone. In her podcast, *We're All Insane*, Devorah notes the importance of examining the initiating causes of the eating disorder. If an individual develops anorexia out of a desire for control, in recovery, that sense of control needs to be manifested in another area, not disregarded. Without this focus in treatment, with the internal need for control not acknowledged and addressed, it is likely that when the individual has the drive for control again, anorexia may reappear, for that is all the individual knows of how to take control (Frank et al., 2013).

Recovery looks different for all depending on how long the eating disorder has been present and the specific behaviors that were engaged in, as well as how much and what types of foods were eaten (Kenny et al.). Patients with anorexia even voice that with some eating disorder behaviors, other people who interact with the patient daily are not even aware that certain behaviors connect to the anorexia. Bettina voices that there is a difference between looking at a menu, picking the lower calorie option, and claiming that it is her taste preference versus ordering the meal she would rather eat. (Hernberg). Yet, the emergence of the eating disorder in more subtle ways, similar to this example, can be overlooked by family members, friends, and even treatment teams. As a result, patients are the ones who need to construct their own goals for recovery based on their experiences. Doctors and clinicians may be unaware of the thoughts and behaviors that contributed to the eating disorder. The return to a life free from the eating disorder cannot occur without the uprooting and weakening of these factors, which holds a huge role in recovery and is unique for every patient (Klump et al.).

Compliance

Most patients with anorexia put into treatment were done so against their will. Out of concern, family members or friends bring the individual struggling with anorexia to a doctor, and the doctor is the one referring them to a treatment facility (Kenny et al.). The truth for many people with eating disorders is that they will never believe that they are sick enough or require medical care (Roloff). As the eating disorder continues to accumulate power, the brain loses its ability for rational thought, and individuals do not nearly see the problem as intensely as the reality of it is (Lozano-Serra et al.). Given that many patients are forced into treatment, they struggle to adhere to the goals of treatment and to progress through the challenges their anorexia poses (Bezance & Holliday; Hernberg). Compliance rates with treatment are on the lower end. Research suggests ½ of patients recover with treatment, ⅓ of patients improve, and the remaining stay ill ("What Is Anorexia: Symptoms, Complications and Causes."). In order to advance through recovery, patients must abide by the goals of their treatment (Hernberg; Paintain).

The aspect of treatment where there is usually the most resistance is with medications (Crow et al.). The eating disorder influences how patients see themselves: as tied to the eating disorder, only acting in a way that aligns with the personality of the eating disorder (Klump et al.). Even if a patient wants to recover, there is a high tendency that they will struggle to agree to take a medication that ultimately reduces the symptoms of the eating disorder because it goes against the factors fueling the anorexia. Anorexia is prone to be ego-syntonic, so patients are

more likely to exhibit behaviors, values, and feelings that are in congruence with their ideal self-image. People with anorexia are in constant conflict over whether or not to support or abandon the eating disorder. Agreeing to take a medication that weakens the symptoms of the eating disorder is completely against the rules set for themself, and the individual may feel the need to punish themselves or continue to struggle in another area to compensate for feeling a lack of control (Crow et al.).

Relating to this idea, when one harmful coping mechanism is taken away, another replacement behavior, which is often a sabotaging one, will emerge. Even after recovering from anorexia, one study illustrated that most patients engage in obsessional behaviors, have inflexible thinking, and over-control their emotions and impulses (Holtkamp et al.). Additionally, patients in recovery have "increased perfectionism, and their most common obsessional target symptoms were the need for symmetry and ordering/arranging" (Kaye et al.). Likewise, Devorah mentions that "the beginning of recovery was even worse than just having the eating disorder" (Roloff). Hearing that taking away one coping mechanism only leads to the development of others can be demotivating in recovery; once a patient has initiated the beginnings of recovery, that does not mean that things will just start to improve (Bezance & Holliday). After one barrier is broken, and an unhealthy habit is destroyed, there are still more obstacles to work through, which may reinforce the idea that recovery is a never-ending journey (Holtkamp et al.). The harsh reality of treatment, where there are always battles to fight through, can greatly discourage an individual from committing to recovery because it is an arduous, exhaustive process, and if a patient begins to give up halfway through, they run the risk of sinking back to where they started or worse (Bezance & Holliday).

Another factor that influences willingness for engagement in treatment is the atmosphere that the patients are in (Roloff). Unfortunately, a large number of patients describe the treatment setting to be negative, and combining that with a patient's low amounts of motivation to recover, the individual is not set up to succeed (Paintain). One of the biggest critiques from patients who previously had anorexia revolves around conformity. When one motivated patient is surrounded by five patients who are refusing to cooperate in treatment and are not making any efforts towards recovery, it is very likely that the motivated individual will lose their desire to succeed in treatment (Bezance & Holliday). It can be seen as unfair to have to meet certain expectations when nobody else in the room is meeting them or appears motivated. Similarly, when patients spend the majority or all of their days in a treatment center, the idea of a normal life becomes more imaginative and obscure. Patients must put a pause on the development of social relationships, family connections, and fun activities, arguably all of which are aspects that make an individual who they are. Without the sprinkling of normal experiences into treatment, motivation to participate in treatment can decrease, for there are not any moments of joy that make the patient believe that recovery is worth the effort (Hernberg). Patients struggle to engage in treatment when there are no reinforcers and punishments (Bezance & Holliday).

New Relationship with Exercise

The majority of anorexia treatment facilities do not include care or concerns for exercise reincorporation in the patient's life. Institutions tend to focus on the more vital aspects of recovery that can determine between life and death (Hernberg; Nahman & Holland;; Paintain). Correspondingly, the primary concern is weight gain and getting the patient to eat enough solid food (Kenny et al.). Treatment centers tend to view exercise as a secondary concern when it comes to initial recovery, leaving it up to other professionals and treatment team members who

help the patient progress through later levels of recovery (Roloff). However, even at the most intensive levels of care, it is crucial to acknowledge unhealthy exercise when present in a patient's eating disorder. At a time when alternative, healthy coping strategies are being learned to replace destructive eating disorder behaviors, leaving exercise out of the equation can lead to more harm when the individual is out of the treatment facility (Nahman & Holland). Thus, it is important to intervene on unhealthy exercise behaviors and patterns while in treatment as a way to establish a healthier relationship with the body and allow for personalized treatment.

One argument against addressing exercise in treatment is that it "increases staff workload" (Dittmer et al.). However, patients' needs should not be neglected due to the lack of knowledge that staff may have around exercise or because it requires more effort from the staff. The benefits of integrating exercise in treatment include preventing relapse (Nahman & Holland). Consequently, the system as a whole is responsible for this issue, and the patients should not have to receive inadequate treatment due to an institutional flaw.

The standard way for treatment centers to tackle the challenge of exercise as it relates to anorexia is by banning the patient from exercising and allowing them to return to movement once they are ready to discharge from the program (Cook et al.). Typically, patients are in distress when unable to exercise, for it has been a compulsive habit that their life had revolved around prior to treatment (Dittmer et al.). Nonetheless, it is not as though the patient is stress free while in treatment, and it is probable that distress is already experienced since patients are not allowed to engage in other eating disorder behaviors, such as restriction, purging, and binging (Holtkamp et al.). The negative emotions that stem from not being able to exercise derive from the eating disorder's control of the brain and rational mind (Frank et al.). In order for the eating disorder to be treated completely, it has to lose all control. The individual has to sit with the discomfort of not having the ability to exercise, or else, the patient runs the risk of the eating disorder maintaining control over that area of the brain pushing for compulsive exercise despite the eating disorder giving up other forms of control (Nahman & Holland).

Effective treatment includes learning healthy coping mechanisms, meaning there does not need to be one clear-cut answer as to what coping mechanisms should be turned to instead of compulsively exercising (Kenny et al.). There is a middle path for treatment centers to follow that does not require a specialized field of exercise treatment and does not have to cover all of the details surrounding compulsive exercise, but the simple task of discussing the aspect of exercise in a patient's life is a step in the right direction towards learning how to combat compulsions (Nahman & Holland). Discussions with a professional regarding thoughts and emotions around exercise provides an opportunity for the patient to realize when exercise becomes compulsive, driven by the eating disorder, and how to have control over urges to exercise (Cook et al.).

Fortunately, it might be easier than treatment centers realize to address compulsive exercise. Fostering discussions is the first step, and next, the question usually arises as to what patients are to do when they have the urge to compulsively exercise. The useful tool for treatment centers is that there are not specific solutions that relate to exercise urges specifically, but any healthy coping mechanism that professionals at a treatment center teach to patients can be used to replace the actions under the umbrella of unhealthy exercise (Hernberg; Nahman & Holland). All patients in treatment for eating disorders have unhealthy coping mechanisms (e.g., restricting as a way to control emotions), so throughout treatment, patients are taught many coping mechanisms that combat any eating disorder behaviors, including excessive exercise (Kenny et al.). For that reason, it does not require much additional effort by eating disorder

professionals to address exercise within higher levels of care that gravitate towards leaving this aspect of the eating disorder unaddressed. In the end, for patients who engage in compulsive exercise, relapse is not as worrisome since this aspect of the eating disorder would be dealt with during treatment (Dittmer et al.).

On top of securing a higher success rate through recovery for patients where exercise is dealt with throughout treatment, there is a positive correlation between individualized treatment and compliance from the patient (Bezance & Holliday; Crow et al.). When unhealthy exercise patterns are addressed by clinical professionals, treatment becomes individualized. Patients with eating disorders are more likely to comply with psychotherapy when the patient's feelings and thoughts behind the eating disorder are heard and valued (Kenny et al.). For a patient who is banned from movement while in treatment, having a therapist to talk to and create goals surrounding reincorporating movement in the patient's life can be internally motivating, increasing the likelihood of the patient actively participating in recovery (Dittmer et al.).

Conclusion:

Information from this review highlights the neurobiological and psychological complexities of anorexia nervosa, portraying the multitude of symptoms and effects this mental disorder has on individuals ("Anorexia Nervosa"). When the brain is starved, neural pathways are altered, which reinforces the eating disorder and triggers certain trait tendencies (Frank et al., 2013; Klump et al.). Every case of anorexia presents itself differently, and attempting to treat this mental illness using the same standards and techniques on all patients does not work (Bezance & Holiday; "What Is Anorexia: Symptoms, Complications and Causes."). The modern day treatment system does not cover every layer that comes along with the eating disorder as it develops, failing patients and their families as the eating disorder is not always weakened through treatment (Kenny et al.; Nahman & Holland). In the future, treatment needs to be individualized in order to support better results throughout recovery. Individualized treatment looks different for everyone and requires staff that is both knowledgeable and willing to listen to each patient (Hernberg; Nahman & Holland). When core aspects of the eating disorder are left unaddressed, and the more common symptoms are the ones corrected, the remaining behaviors and thought patterns continue to impede on an individual's quality of life (Frank et al., 2013; Kaye et al.). Additional research and training for clinicians specializing in anorexia is necessary in order to improve recovery outcomes.

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