

## How Malnutrition Affects Personality and Behaviors with a Special Emphasis on Short Bowel Syndrome

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### ABSTRACT

*It is known that the brain and the gut work together. They send signals back and forth all day long, letting us know when we are hungry, when we are full, and when we just do not want to eat. Though what if your brain or stomach was somehow damaged, either medically, physically, or traumatically. It can interrupt the signal patterns from the gut to the brain. In turn and over time, something starts to happen when the brain and gut are no longer together; our behaviors begin to change, and then our personality starts to shift soon after. The theory being evaluated in this review is to see whether if malnourished people have experienced any type of personality changes or behavioral changes.*

### Intestinal Failure

There are a multitude of digestive diseases and syndromes that people can acquire in their lifetime. Intestinal Failure (IF) is a rarity among them. It can be brought on suddenly, or it can happen gradually. When IF does happen, the body must make up for all of the lost nutrients. Irving described IF as a term that has "emerged approximately twenty years ago. It is now a well-defined syndrome with clear treatment pathways" [1]. The last five years IF has been the center point in the rare disease industry, with new emerging treatment options such as GATTEX, a growth hormone therapy that increases the villus of the intestine allowing for better absorption of nutrients [1].

IF is a condition that can be present in patients with normal, albeit, or dysfunctional length of bowel. It can be complete or partial, acute or temporary, or chronic and permanent describes Irving, going on to describe that four major underlining causes of IF are Short Bowel Syndrome (SBS), Crohn's disease, motility disorders, and small bowel fistulation [1]. Treatment is complicated Irving states, as "IF has at its core the provision of nutritional support, principally through the intravenous (IV) route". Irving also described that IF can be rehabilitated through intestinal rehabilitation programs and dietary support [1].

SBS is the best known and most understood form of IF [1]. It

results from extreme small bowel resections and it can be caused congenitally, like gastroschisis where the intestines are outside the body in utero, or traumatically which can be caused by a volvulus, defined as intestinal twisting of the mesenteric artery [1].

Irving designates Short Bowel Syndrome has many subsequent associations to other medical issues, such as gallstone formation, kidney and liver issues, and dietary management and support. Patients often experience abdominal distension, vomiting and intermittent intestinal bacterial infections, known secondary as small bowel bacterial overgrowth [1].

IF patients are medically managed by an intestinal rehabilitation team or intestinal transplant team, depending on the severity of the syndrome. Home Parenteral Nutrition (HPN) is also an effective method, as in a single institution review, Irving said of 225 patients requiring HPN has demonstrated a 92% probability of five years survival for patients with inflammatory bowel disease, 60% for ischemic bowel disease, and 48% for motility disorders, this study all patients were under the age of 40, which increased their likelihood of survival to 80% and for those over 40 years of age, their survivability decreased to 30%, respectively [1].

Outcomes for HPN patients is in the keys to success of line care. HPN is delivered via a central venous artery, usually placed under

the collar bone adjacent to the heart. The most serious complications with any type of IV line or port are sepsis and thrombosis, if the catheter is compromised or not taken care of [1]. Irving explained that one of the important outcomes of HPN is the quality of life.

Studies have revealed that HPN reduces quality of life for patients, to the same extent patients experience on home dialysis [1]. Over the past fifteen years, the quality of life has improved for HPN patients as patients now have freedom to leave the house with a backpack system. J. Voss stated that advancements in HPN and enteral feeding systems have been made to make them more compact and user friendly [2]. Her son who is on twenty four hour feeds, is still able to march in the school band, while infusing due to this backpack system.

There are two surgical treatment options for IF patients. The first is called the Bianchi and was founded in Manchester. Surgical dilators are inserted into the bowel to widen it. Dr. Bianchi has since updated his procedure [1]. The second was founded at Boston Children's Hospital by Dr. Tom Jasick, called the serial traverse enteroplasty procedure. Surgical staplers are used to create triangular cuts along the intestine, making it stretch in length. Both have mixed success rates of survival, around 40% [1].

IF at its worse can be terminal for the patient. In the last ten years advancements have been made in the areas of intestinal transplantation. There are several problems with this procedure and its outcomes. First you must find a donor, and that donor must be dead, the intestine does not regenerate like the liver does. It is the largest internal organ. If a donor is found, then the main concern after the procedure is immunosuppression or "rejection." Irving described that IF patients with isolated intestinal grafts are more preferred than transplanting several organs at once. Though multivisceral transplant initially appeared to yield better results [1].

### Issues of Nutrition for People Living with Chronic Illness

The terms malnutrition and under-nutrition have been used interchangeably in literature and have differing definitions of them according to varying institutions, disciplines, and cultures, describes [3]. Malnutrition is the insufficient dietary intake of essential nutrients, and protein-energy under-nutrition. It is a faulty, yet inadequate nutritional status; under nourishment it is characterized by poor dietary intake, poor appetite, muscle atrophy, and weight loss [3]. Kralik asked what it is like for a person experiencing living with an altered state. Given the complex and person sociocultural meanings that are labeled to foods and the activities that surround it, it is an important gap to address [3].

The incidence of malnutrition increases with age [3]. With the increase of the older people in our population, it can be expected that issues regarding poor nutrition will become more salient [3]. Poor nutrition is also a hot topic among communities. In a research study that assessed the nutritional status of 500 people on admission to discharge from an acute hospital, it was found that 40% of people were "under nourished" and this figure increased to

75% at the time of discharge [3].

People who are living with a chronic illness may become more socially isolated as a result of the loss of partners, friends, reduced social networks, disabilities, reduced mobility, and poor health overall [3]. They may live and eat alone, lowering motivation to prepare and eat food. The strong emotions of grief, depression, and loneliness can diminish appetite and motivation to take care of oneself. Therefore adequate nutrition may fall on the "wayside" [3]. The tasks that are crucial to maintaining adequate nutrition such as grocery shopping, and food preparation becomes more difficult and sometimes impossible. Assistance with these tasks may not be available, or the person may not feel comfortable reaching out for assistance with these tasks [3].

From a psychological perspective, living with a chronic illness with malnutrition is associated with a range of changes, some which directly impact nutrition, others impacting the behaviors around food and in general. There are reduced salivary glands and secretions; oral health diminishes, affecting the ability to chew [3]. A person with a chronic illness may not feel hungry; furthermore changes in intellectual capacity, such as memory loss or retention can occur. Inadequate nutrition can aggravate these symptoms [3].

Kralik suggests that there is a perceived lack of knowledge about nutrition among some health professionals and a reluctance to be involved in this work. Each individual varies in their nutritional requirements due to unique and multiple factors [3]. Malnutrition is difficult to reverse and can lead to an excess of adverse health events, such as infections, delayed wound healing, pressure ulcers, slow drug metabolism, and impaired cognitive functioning [3]. Ultimately malnutrition leads to multiple and increased hospital stays, complications, readmissions, premature dependence on institutional care and increased mortality [3].

Nutritional screening is a tool to identify markers associated with malnutrition to identify those at risk, or potentially at risk of malnutrition and to identify those who are malnourished [3]. Screening is the first step that may or may not lead on to a nutritional assessment, it is considered to be "a simple process which aims to identify those who are malnourished or at significant risk of malnourishment" [3]. Assessment on the other hand is more complex, involving several measures to determine nutritional status. The ultimate outcome of screening is to identify people who are in need of further assessment and support [3].

Kralik also found a significant issue emerging from literature and related it to the imbalance between the bio-medical approach to nutrition and the rights of the patient [3]. While as healthcare professionals accept that it is an individual's right to make decisions, to exercise self-determination about their health. This has been a topic in recent news, however, even though a patient has rights when admitted to a hospital, it seems that the medical perspective can emphasize the benefit of a certain intervention and impose it without concern for the social, emotional, spiritual, and cultural considerations [3]. Topics of poor nutrition or

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malnutrition are serious and prevalent problems for people living with chronic illness. Nutrition is a central health concern and such, health professionals play a vital role in identifying people at risk, support nutritionally susceptible people and carry out nutrition interventions to improve nutritional status where possible [3].

### **A Son Living With Intestinal Failure and Behavioral Issues**

To better understand the effects of malnourishment on a person and how it can alter ones personality or behaviors, three interviews were conducted. Jeanne Voss, a registered nurse from Parker, CO, is the mother of a 14 year old boy with malnutrition and mental health issues.

Jeanne, the subject's mother detailed that her son was born with malnutrition related to malabsorption secondary to a bowel resection within twenty-four hours of his birth due to malrotation of the small intestine. He was born at 34 weeks (six weeks premature and no prenatal care). The malrotation was caused secondary to a birth defect related to the overuse of codeine by his birth mother. He was adopted at birth, and did not eat solid foods by mouth until the age of three. His only source of nutrition was Total Parenteral Nutrition (TPN) from birth until age four. He started twenty four hour enteral stomach feeds starting at six months of age till present day 2015. Today he lives with very little small intestine and is classified as a SBS/IF patient [2].

The birth mother was on Prozac for depression during the pregnancy, and this is known to be his only family related psychiatric diagnosis. Due to the birth mother having no prenatal care and having a mental health history herself, her son has had mental illness since birth states his adoptive mother. He was diagnosed with attention deficit hyperactivity disorder (ADHD) in first grade, due to unable to sit in chair during class, poor problem solving, Pervasive Developmental Disorder which is on the end of the autism spectrum, poor at dealing with peers in school, and non-verbal [2].

Diagnosed with Generalized Anxiety Disorder at age four, and diagnosed with depression since age seven as verbalized by the patient. He can now eat normal food by mouth, but because of his g-tube feedings he always complains of being full. His usual transit time from mouth to gut is anywhere from 5-35 minutes [2]. He has a fluid restriction of 3100 mL per day, and he prefers proteins to carbohydrates. His enteral feeds are 3000/day 1 calorie per mL [2]. Jeanne said "He saw a psychologist and psychiatrist from first to eight grades before stopping. Though still struggles with anxiety, social relations deficit, depression, and ADHD. At the current time he is not medicated other than for ADHD, due to the malabsorption of medications due to the SBS" [2].

Anger is his first emotion in response to any unpleasant social interaction. He can have self-destructive behavior, though he never harms others, only himself and it only occurs about two to three times a year. Rather than deal with others he wants to isolate himself. His stress relief comes from drumming or

physical outbursts. Jeanne believes that malnutrition has played a significant factor into the mental health of her son. "Anyone would be a fool not to believe that a person with a chronic malnutrition state would not suffer from some sort of mental health effects, so yes, I believe!" [2].

Galler et al. examined the first year of life and personality at age 40 with those suffering with malnutrition [4]. "Malnutrition in infancy is known to be associated with cognitive and behavioral impairment during childhood and adolescence" [4]. Children with well documented malnutrition at age three (who likely have it chronically) started to exhibit symptoms of conduct disorder. Galler et al. [4] state, "Throughout their life span they can grow into young adults with early malnutrition in the first year of life are, narcissistic personality, high anxiety, depressed, angry hostility, impulsiveness are the main areas of concern." Obsessive compulsive disorder is another that ranks top among them.

To prevent these children from growing into adults who will not be able to control their emotions, intervention steps are beginning to form; through a two year enrichment intervention patients demonstrated fewer symptoms of personality disorders, especially in the areas of schizotypal personality disorder.

### **Living As an Adult with Short Bowel Syndrome**

D. Hansard is a fifty year old female, living in Atlanta, Georgia. Unlike the previous interview, this subject was not born with any digestive disease or syndrome, or any neurocognitive disorders. Her initial health event did not occur until 2007. In addition growing up she hit all her major milestones and had no developmental delays. The subject of the interview stated that emergency trauma surgery on her digestive tract is when her life started to change, caused by scar tissue strangulating the small intestine, both physically and emotionally. Since her initial surgery in 2007 and an additional two more surgeries, she does believe that there have been some personality changes and behavior changes in her since. Her husband also told her that he noticed changes in her that were not in her original personality before [5]. Before her health event the subject was 170 lb. After her diagnosis of SBS and Crohn's Disease she dropped down to 88 lb. After starting TPN, she is now 135 lb. and stable [5].

The subject does not see a psychologist due to previous past experiences [5], and saw a psychiatrist for a month and was diagnosed with Post Traumatic Stress Disorder and Clinical Depression. Thanks to psychiatric medication, the subject claims that she no longer has bursts of anger or rage, and that she tries to avoid conflict as it makes her more depressed. She stated that before her diagnosis she "loved to argue and strike conflict with others, but realized life was too short to stress over the small things." Hansard claims that her stress relievers are reading, walking, pet therapy, and wine [5].

The subject is classified as an adult SBS patient and failure to thrive. She lives with an ostomy, and is runs TPN, 1.5 liters over ten hours, seven nights a week. She no longer believes she is

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malnourished, and eats all day long with a diet consisting of no sweets, no veggies, little fruit, high sodium, high carbohydrates, and low fiber. She has no history or family history of mental illness prior to her digestive health event. She eats three true meals a day, three mini meals a day. She stated she is still learning what she can and cannot have. She does eat foods that can make her output more frequent, knowing that consequence she states, “I deserve treats once and awhile, though it goes right through me” [5].

Hansard claims that before her health event she had a very normal life. After her health event, she started seeing behavioral changes at home. “I have less desire to leave the house. I am not as concerned about the house being spotless and I have lost the ambition to do much of anything. I have no desire to be intimate with an ostomy, or to go anywhere or anything due to a fear of having a blowout. It is very isolating.” Hansard ends her statement with “I sleep much more than before, though I am getting better about it and getting out” [5].

According to Matsunaga et al. [6], “Those with eating disorders also can suffer from personality changes and disorders.” The authors completed a study “focusing on the personality disorders that could be exaggerated by malnutrition or Axis I disorders. Studying women who had recovered from eating disorders for at least one year to see if personality disorder symptoms persisted in the well state” [6].

Important factors to consider in this study are that personality disorders were evaluated in 10 women recovering from anorexia nervosa, and 28 women recovering from bulimia nervosa, and 16 recovering from both anorexia nervosa and bulimia nervosa. Fourteen of 54 subjects (26%) met the criteria for at least one personality disorder. Recovery from the eating disorders may have an attenuating influence in the symptoms of personality disorders such as if the personality disorder persists after recovery in the subject.

Findings from the study show that majority of the women had a diagnosis of depression or anxiety, with a majority of the subjects made distinguishing attempts to assess personality functioning while eating disorders may exert some influence on the assessment of the personality pathology.

Galler et al. 2011 conducted a study to examine the behaviors of this age group and why are some more prevalent to personality change in those who have experienced an episode of malnutrition in the first year of life compared to one of their healthy peers. The findings of the study show that “early childhood malnutrition has been implicated in subsequent cognitive and behavioral impairments in childhood and adolescence” [7]. This includes decreased attention, conduct problems, and lower IQ [7]. “Most published studies however are unable to distinguish among the effects of low birth weight, chronic malnutrition, and an acute episode of under nutrition during brain development” [7].

It is important to note in this study that “previously malnourished

children also displayed behavioral issues when they reached school age. A good example is that teachers reported a fourfold increase in attention problems in children, poor school performance, daydreaming, and often states the student does not listen” [7]. In return to this statement, children lash out in aggression from ages 9-15 years of age, has an effect that persists even after adjusting for ecological and socioeconomic factors in the home environment [7]. The authors state that “children at age 9-15, their aggressive behaviors were no longer present after correcting differences in home and school environments of the malnourished child” [7].

The results of this study conclude that early childhood malnutrition was associated with problems in executive functioning. Malnutrition was predicted in higher aggression levels at ages 9-15 rather than 11-17 respectively [7]. These findings were independent of baseline age, sex, household standard of living, maternal depressive symptoms, and problems in general after follow ups.

The above study looked at malnourished youth ages 9-17, with abnormal behaviors most prevalent at 9-15 years of age. Another study looks at early childhood malnutrition predicts depression symptoms in ages 11-17 [8]. The study looked at “Barbadian youth with histories of infant malnutrition and in a healthy comparison group. The extent of malnutrition was medicated and monitored by maternal depression” [8].

During the study it was discovered that ages 11-17 age group to have behavior deficits, poor grammar skills, and poor attention symptoms [8]. Many of these children have been labeled from a very young age as having attention disorders. A label they cannot get rid of easily. It was also found that the children who were malnourished all had some kind of abnormal behaviors and neurocognitive development disabilities.

The depressive symptoms were measured using the Minnesota General Adjustment and Morale Scale, an oral exam given by a psychologist. The youths and their mothers were studied separately, but were given the same assessment [8]. “Many youth with aggressive behavior can have it corrected with therapy by the age of 17” [8].

### **Emotional and Behavioral Problems in Adolescents with Chronic Diseases**

Is there an association between chronic illness and intellectual disabilities (ID)? A study done in the Netherlands, on children aged 12-18 in secondary school was to identify any emotional and behavioral problems in a large school-based sample in a study done by Oeseburg, Jansen, Groothoff, Dijkstra, and Reijneveld [9]. Parents of the children completed the Dutch version of the Strengths and Difficulties Questionnaire (SDQ) and questions about chronic diseases in their child and their child’s background [9].

Prevalence rates of emotional and behavioral problems were generally high in ID adolescents with chronic diseases (45%)

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compared to ID-adolescents without chronic diseases (17%) [9]. The study showed that chronic diseases in ID adolescents in particular mental chronic diseases largely increase the likelihood of emotional and behavioral problems [9]. Adolescents with somatic or mental chronic illness in the general population have a higher risk of emotional and behavioral problems, compared to their healthy peers [9].

In addition, adolescents with ID also have a higher risk of emotional or behavior problems compared with their peers without ID [9]. A few studies examined the occurrence of both emotional and behavior problems in those adolescents who had both issues, ID, and one or more chronic illness, these studies were focused on (a) the presence or absence of a somatic disease or physical complaints without taking into account the number and nature of chronic diseases, and (b) one specific chronic issue such as epilepsy, autism, cerebral palsy, or attention deficit disorder without taking into account the presence of chronic illness [9].

An association, if found would inform early intervention and treatment strategies by allowing identification of individuals who are at greater risk of emotional and behavioral problems. Prevention of mental health in ID-adolescents is important because mental health can have profound effects on participation in education programs [9].

### **Chronic Diseases**

Chronic diseases in ID-adolescents were measured by the National Permanent Survey on Living Conditions Questionnaire (POLS): module health and labor, part chronic diseases in children. POLS part chronic diseases in children cover the most prevalent chronic diseases such as ear, eye, skin, nervous system, musculoskeletal, respiratory, digestive, nutritional, metabolic and ADHD. They could also fill in specific diseases not listed [9]. This study done by Oeseburg et al. allowed for better knowledge of each chronic illness population [9]. The subjects of the three interviews conducted for this paper all live with chronic digestive diseases, of the rare kind.

### **Evaluation of Emotional and Behavioral Functioning**

Emotional and behavioral functioning was measured by the Dutch version of the SDQ [9]. The SDQ is a 25 symptom list describing positive and negative attributes of children and adolescents [9]. The 25 questions are divided between five scales: emotional problem, conduct problem, inattention-hyperactivity, peer problem, and prosocial behavior [9]. Each item is scored on a 1-3 point scale with 0 = not true, 1 = somewhat true, 2 = currently true. The SDQ has proven to be a successful tool in reliability and validity [9].

### **School Success**

School, its peer relationships, interactions with teachers and staff, and social activities occupy a large portion of a child's life, describes Bethell et al. [10]. The assessment of school success commonly focuses on lagging indicators of attendance, grades, and standardized achievement scores [10]. School success also involves development of competence and social belonging, which

when achieved facilitate school engagement and the motivation to learn, are indicators of academic performance [10].

Engaged and motivated students show more achievement-orientated behaviors, such as effort and participation, and less likely to undermine school success [10]. School attendance and participation in the school environment and extracurricular activities are not only essential, but predictive of enhanced peer to peer relationships and overall school success [10]. Chronic health conditions for which children require special health care needs and services in childhood present challenges to school success, affecting the child's learning capabilities, and it also affects their engagement in the learning process and the desire to learn [10].

School officials agree that the outcome for these special needs children is mixed. Many teachers are not trained in special education and therefore the child's health or special need is more of a burden to the teacher and class [10]. Many of the children were given the label ADHD or attention deficit disorder (ADD), and agreed that children with emotional and behavioral issues are often most likely to have challenges succeeding in school.

Bethell refers that many states require schools to use case management for their special needs children, and the specific requirements for state mandated case management for students varies across state to state, but is generally expected to include elements to ensure that school health officials and primary care physicians are part of a team which prepares students to be ready to learn and achieve in the school setting [10].

School success factors have three outcome variable assessing and promoting or impeding school success [10]. Promoting school success is when the child/youth is usually or always engaged in school. Behaviorally and cognitively does all required homework, participates in extracurricular activities, and usually always feels safe at school [10].

Factors that can impede school success are, missing eleven or more days of school in a year. Repeated any grade since beginning kindergarten, has school related problems which results in three or more phone calls home on conduct disorders in the past year [10]. Approximately 60% of all school age children and half of all children with special health care needs experienced all three factors promoting school success, where the other 40% of children with special health care needs experienced impeding school success and found difficulty in their studies [10].

### **Mind the Gap: Differences in Child Special Health Care Needs**

Children with poor health are three times more likely to have poor adult self-related health, and twice as likely as having a work-limiting disability or chronic health issue, describes Leiter and Reiker [11]. Child health may affect adult health across a wide range of conditions and syndromes, from common to rare. It has both direct and indirect effects on adult health and socioeconomic

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status [11]. Children with disabilities are much more likely to survive into adulthood than in previous years, and mental health conditions often arise early in life [11]. Half of all lifetime cases of mental health conditions start by age fourteen and three quarters begin by age 24 [11].

Leiter states in the journal that most of the mental health cases are male and have adverse outcomes. The health measures are condition specific, while others summarize a broad range of health concerns or disabilities [11]. Boys are more likely to have chronic conditions and diseases than girls, have more activity restrictions, and more special healthcare needs. Boys are more likely to have school related disabilities, and non-school disabilities [11]. Boys account for 65% of infants and toddlers with developmental delays, such as motor, speech, and the ability to get along with others [11].

Girl's prevalence rates do eventually exceed boys, but not until later in adolescence in terms of overall health problems, and specific issues [11]. Is there a gender gap driven by behavioral conditions? Leiter described that, between 2007 and 2008, 91,642 telephone interviews were conducted to the adult in the household who was most knowledgeable about the child's health. Of these, 46.7% responded to the interview, excluding 66% as nonresidential phone numbers. Age, gender, and race were omitted from the interview. Many of the respondents have a diagnosis of ADHD or ADD. Among other healthcare issues that range across the spectrum from everyday illness to chronic disease [11].

Overall, 19% of the children are identified as having a special health care need, with 22.5% of boys identified as having a special health care need compared to the 16.2% of girls. Boys are also more likely to use medications, receive more care than typical, have limitations, received special therapies, or have been labeled as having educational or behavioral problems associated with a chronic condition. Boys are twice as likely report conduct disorders than girls [11].

One of the largest gender gaps Leiter explains is in the category of emotional disturbance; three fourths of students in special education who have been labeled with an emotional disturbance have been boys [11]. Boys are more likely to be identified through school based referrals, while girls are more likely to be referred to private therapists. Being placed in this category may have important consequences for the youth's future [11]. More girls than boys are going to college after high school. Research examines the role that boys overrepresentation in special education may play in shaping boys educational opportunities [11].

In regards to the current healthcare system, pharmaceuticals are critical. Medication use was most common out of the five indications of special health care needs analyzed [11]. Children and youth are increasingly likely to be prescribed medications of the psychotropic kind. This includes preschoolers and kindergarten children, resulting in more medicalized childhoods [11]. One out of 10 visits by an adolescent male to his doctor will result in a prescription. Psychotropic medication is significantly greater in

the United States (6.7%) than in the Netherlands and Germany [11].

#### A Son Who Lives With Intestinal Failure and Behavioral Issues

T. Vickoren, a registered nurse, spoke on behalf of her son, who is an eight year old boy who lives with IF and sensory/behavioral issues [12]. The subject of the interview, while living with IF, has also had many developmental delays, which transitioned into the school system [12]. Vickoren describes her son as someone who is very curious, because he never knows what is coming next. There has been a lot of poking and prodding in his short seven years alive, and lots of hospital admissions and surgical procedures. Vickoren believes that this has caused some developmental delays early on such as non-verbal, delay in motor skills, and the need to always be with his mother. He is resistant to many of his medications such as vancomycin and ciprofloxacin, two drugs that help yield the effects of small bowel bacterial overgrowth, which when exacerbated can cause behavioral issues, among other more serious medial health events [12].

Vickoren described that her son is home schooled and has not been able to go to school for some time now. Vickoren stated that they did try on several different occasions but the boy would get sick and be placed in the hospital for several weeks, or travel to Nebraska for intestinal rehabilitation management [12]. He has since found success in school in the homeschool system. Today, while he still lives with IF and its consequences, he is more verbal, caught up developmentally, cleared of being on the autism spectrum, and more like a seven year old boy [12].

From the studies outlined above, you can start to see a trend of mental health issues that form with malnutrition patients. Many start with anger and hostility problems, others depression and anxiety, others form neurocognitive diseases, and memory loss. Malnutrition can slowly reshape the brain pattern you were born with if not treated correctly. It is a slow progression over time for these patients, and few notice the change. There are only a few treatments for malnutrition, and usually malnutrition is caused by a medical event or self-neglect. In either case it must be managed effectively or else that person, who is suffering from it, can die as a direct result. So, how do you treat malnutrition?

#### Treatment Options in Malnutrition Patients

There are many different ways to treat malnutrition patients today, but it was not too long ago that only one treatment option was available, and it was not even a proven science until it got FDA approval. In 1977, Dr. Stanley Dudrick, MD, a cardiothoracic surgeon by trade, wanted to do more for his critical patients who were suffering the consequences of malnutrition. The patients on ventilators and other devices to where they could not eat by mouth. Using beagles as his research subject, he created IV nutrition and lipid therapy by raising a puppy to a full aged adult dog using only what is known as TPN.

According to Burness and McCormack [13], 40 years later a new therapy has come out for a special population of patients

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who live malnourished with a condition called SBS, GLP-2, otherwise known as teduglutide. This is the first effective therapy by increasing the intestinal villi so the patient can absorb more food orally, and decrease their time on TPN, with the possibility of coming off TPN completely.

What is TPN and does it help malnourished patients? As an example, a 25 year old male who has a chronic digestive disease burns off 2000-3000 calories a day through just walking. Tracking this information on his Fitbit, he needs to eat at least six to eight small meals a day to make up for those lost calories. At night he hooks up to twelve hours of TPN to replenish what was taken from him during the day [14]. Within a bag of TPN is protein, calories, vitamins, trace elements, minerals, and often times but not always lipids or fat. TPN is delivered through an aortic vein, and carries a large risk of infection complications.

Another way of feeding malnourished patients is through a stomach tube or nasogastric tube to deliver formula (specified medical formula) directly into the stomach for absorption [14]. This therapy is not as effective as TPN. Enteral feedings can cause dumping syndrome, which results in more nutrient losses and can cause more complications, such as memory retention and clarity.

Teduglutide, or in America known as the drug name GATTEX®, was the first targeted long term therapy approved by the FDA in the United States for adult treatment of SBS [13]. “The drugs purpose is to increase villus height and crypt depth, in addition it helped facilitate the reduction of parenteral support volume and provided days off of TPN in patients with SBS” [13].

Patients who are on GATTEX have found mixed results, and a few surprisingly had to quit from clinical depression symptoms, but were able to resume at a later date. Patients found themselves weaning off of TPN and finding more independence overall. Though GATTEX® is not for everyone.

There is much to know about how TPN affects the body and our personality. Flynn, Sciamanna, and Vigilante [15], conducted a study to determine the nutritional knowledge of physicians on the basic effects of diet on blood lipids and lipoproteins. It was found that even most gastroenterologists did not know how much was too much, unless they picked a disease specialty. Half of the physicians did not know how diet played into the blood patterns of their patients. Giving too much of anything can harm a patient [14]. It was commented in Wards literature that many different components go into the TPN regimen and if not done correctly can cause liver damage or even kidney damage, cause sepsis or even sudden death from hypoglycemic shock or hyperglycemic shock. It is a dangerous game to play in medicine.

### How does malnutrition reshape the brain?

The human brain and intestine is made up of signals and receptors, and when an organ is damaged or in this case part of the digestive tract, it disrupts the signals being sent from the gut to the brain and from the brain to the gut. These signals tell us when we are hungry,

thirsty, and full. They also tell us when we need to use to restroom, how tired we are, and what we feel like doing. This sounds like a lot but this information speeds through your mind a million miles a minute that you don't even notice.

Ward stated, “Malnutrition can reshape the brain in several different ways” [14]. An example is when lab results come back off the chart, as it is an indication that something in your body is not working correctly. The doctor will make adjustments to your medications, or TPN [4]. Though it is around this time where the personality can start to change, because the brain is not nourished enough, therefore it starts to atrophy or shrink and cells start dying away. Nutrition is vital to the brain, without it we don't think rationally, make choices that are best for us. Malnourished people can also turn on their friends and loved ones within a second. Damaging relationships and friendships in the process.

Malnourishment can cause a multitude of problems and if not treated corrected can lead to devastating effects, such as severe dehydration, which can lead into other health events, including death. Most of the time malnourishment cannot be helped and is medical, chronic, or traumatic. Though there are other times where the patient is at fault because of self neglect and care causing them to have an eating disorder, which often times is accompanied by a substance abuse problem.

### Examination of Local Community Awareness on Malnutrition and Personality

In a local community survey of students, medical health professionals, and mental health therapists, one hundred surveys were distributed in Lincoln, Nebraska, asking the question: “Does Malnourishment Affect Personality or Behaviors?” The survey consisted of ten questions, five yes/no, and five multiple choice questions with the choice to explain reasoning.

In a population of one hundred people surveyed, 63% vs. 37% of the public knew somebody who is malnourished. Interesting correlation to the second question of the survey, which asked “Do you know anyone who cannot eat orally,” 30% of the public answered yes; another 70% answered that they did not know somebody who could not eat by mouth.

Part of the survey wanted to know how the subjects feel when they are hungry. Survey's revealed and that another 67% reported that they felt angry, irritable, or “hangry.” 26% of individuals reported that they felt ok, in comparison to 7% who stated that they felt “good.” 58% of people eat three to five small meals a day. People with chronic illness or a health disorder who might need more nutrition are recommended to eat 6-8 small meals a day, and 4% of individuals reported doing so in the survey analysis. 38% of people eat 2-3 small meals a day, which is considered normal [16].

When asked if the subject being surveyed felt if they had healthy eating habits, it was met with mixed results. 65% reported they try. 49% reported eating fairly healthy. 11% of individuals said they tried to make it a habit, compared to the 10% of individuals

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who never made it a habit at all. 55% of people surveyed said they have not observed someone acting out or irrational due to malnourishment or hunger, compared to the 45% who said they did, explaining that what they saw or experienced was “hunger, irritability, anger, hostility, acting out, diabetic spells, lethargic, acidotic, unfriendly, and on drugs.”

52% of individuals surveyed reported no memory or retention problems, compared to the 48% who said that they did experience memory and retention problems. 87% reported they knew someone who was always on the edge or defensive. 96% of people believe that malnourishment can cause depression and/or anxiety in people. The last question was focused around total parenteral support. When asked “Do you know anyone on nutrition support, whether it be IV access or through a g-tube,” 30% reported that they had personal expertise with friends or family. 17% reported that they knew someone on it, but that was about it. 53% reported they did not know anyone on nutrition support [16].

This survey had yielded interesting results, as many people know someone who is malnourished, and they do acknowledge that the nutrition depletion can cause depression and anxiety in the patients who are malnourished. Most people can relate to some of the more general questions, why those with advanced knowledge of nutrition and its support can be transparent through some of the more detailed questions [16].

## Discussion

The question stated in this thesis is “How does malnutrition affect personality and behaviors?” After being able to look over and analyze several peer-reviewed journals, conduct interviews with patients living with malnutrition, and a general population survey, my conclusion is that malnutrition can affect personality and behaviors, as evidenced by a general population survey of 100 people in Lincoln, Nebraska, who were students, medical professionals, and business associates.

67% stated that when they were hungry they felt irritable or angry, some used the term “hungry.” 30% knew someone who could not eat orally, and another 47% knew someone who was on nutrition support [2]. Interviews conducted on three IF patients revealed high prevalence rates of depression, anxiety, anger, and developmental delays when malnourished. When asked if that patient when receiving adequate nutrition via IV support, the three people interviewed all stated that their child acted normally or in the adult interview she claimed of “feeling better and able to do more” [5].

Anger was the main highlighting point in the community survey [2]. Many of the patients that I work with who live with SBS like myself, have anger or irritability issues themselves, or they battle it with their child. This is often voiced in support groups online on topics such as “How to control your child’s rage” and currently a nationwide infusion company, Thrive, is working on a webinar on mental health and IF patients.

For many years parents and patients of IF have questioned the mental health of their child or children due to the family situation they are placed in. It is a financial burden, and often one that removes one parent from the household to work several jobs to supplement the income. Many children as stated live with anger and rage issues, some parents also experience these symptoms. Some have sought out therapy; others like to deal with it head on. Parents of IF patients or patients with IF are not people who are told what to do, this condition takes over your life, and you make many sacrifices along the way. Intervention programs are not effective with this population, it only angers them if they are accused of being non-compliant, because they know exactly what they want [2]. They feel their suggestions should be taken into account and seriously.

Mothers are the backbone of these patients and must endure many trials and tribulations along their journey. Some spend eight to ten weeks or more in a hospital straight with their child, and their child is not really their child, they are sick, non-responsive, in surgery, having procedures done, and doctors always checking in [2]. It is heartbreaking to see them suffer and yet we can only hold their hand and comfort them, make sure they are comfortable and get what they need so they can go home, sooner than later, but that is about as far as our scope of practice goes in the medical world, even if one is a nurse [2].

Personalities can definitely change, stated Hansard [5]. “I noticed I was not my normal self after my initial surgeries, others noticed that I was changing as well. I felt down all the time, anxious all day long, fatigued, lashed out at others, and loved conflict and to argue with people. It was not until after a few years of managing my medical condition that I realized that I can be better, and don’t have all the time in the world left” [5].

## Conclusion

In conclusion, personality and behaviors can be affected by malnutrition. As outlined by the interviews, surveys, and journal reviews, there is evidence that, just like a switch of a hat, personalities and behaviors can change when under nourished. So it is vital that we keep eating the right balance of foods and nutrition, because if we don’t, then the body’s instincts will start to morph and very quickly. Malnourishment is not a disorder you want to play with. It is a potentially fatal disease if left untreated. For some it is chronic and permanent, such as those with Short Bowel or other digestive issues; for those individuals it is always an uphill/downhill battle.

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