

Attitudes Towards Antidepressant Medications Among Neuroscience Students

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Abstract

Stigma is a common reason many individuals do not seek out and adhere to treatment for mental health concerns, such as depression. Untreated mental illness can negatively impact an individual's function, mood, and in extreme causes can lead to suicide, thus it is imperative to find ways to reduce stigma. To date most interventions are targeted to reduce stigma towards individuals with mental illness, while few target stigma towards treatment of mental illness. The present study expands upon previous research on the utility of education in destigmatizing antidepressants. 257 undergraduate students enrolled in Introduction to Neuroscience completed a retrospective pre-post questionnaire to assess knowledge and level of stigma towards antidepressants. Wilcoxon signed-rank tests showed that from the beginning to the end of the course, students were significantly less likely to believe that antidepressants are addictive substances ($p < 0.05$), unnatural for the body and mind ($p < 0.05$), more bad than good ($p < 0.05$), and prescribed too frequently ($p < 0.05$). An additional exploratory analysis using a mixed model ANOVA was performed to examine differences between students interested in pursuing a healthcare career relative to students uninterested in healthcare. From beginning to the end of the course content, including topics such as mental illness, serotonin systems, and reuptake inhibition, students showed significant reduction of stigma. This suggests that education of the neurobiological basis of mental illness should be considered for future education-based interventions to minimize stigma towards medicative treatments of mental illness.

Keywords: Selective Serotonin Reuptake Inhibitors, Stigma, Neuroscience, Undergraduate Students, Antidepressant Medications

Introduction

Mental illness is a prevalent and pervasive problem that negatively impacts many individuals. One in three individuals aged 18-25 in the US have experienced a mental illness (National Survey on Drug Use and Health, 2020). These broad array of mental health conditions have broad spanning influences on the physical, psychological, social, and emotional wellbeing of affected individuals.

Anxiety disorders and depression are the most prevalent mental illnesses, affecting approximately 69 million US adults (National Survey on Drug Use and Health, 2020). Psychological disorders can potentially increase one's risk for substance misuse, discrimination, and homelessness (Mahmoud, 2012; Corrigan 2004). Furthermore, they can lead to suicidal ideation and behaviors. In the US, suicide is the second leading cause of death among individuals aged 10-14 and the third leading cause of death among individuals aged 15-24 (National Survey on Drug Use and Health, 2020). Relatedly, depression is the most prevalent mood disorder and is a major cause of suicide (Bear et al., 2020). Symptoms of depression include sleep disturbance, suicidal ideation, fatigue, and feelings of worthlessness. Depression is often comorbid with anxiety disorders, contributing symptoms of persistent worry, panic attacks, and avoidant behavior. Undoubtedly, these symptoms can impair an individual's thought, mood, and behavior, leading to decreased quality of life.

Historically, there has been a distinction between disorders of the brain and body. Disorders of the mind were considered moral and spiritual issues to be treated by religion, rather than having a biological basis that requires medical intervention (Bear et al., 2020). However, research has shown that mind disorders, such as depression and anxiety, can contribute to physical health problems, and vice versa. For example, HIV can have cognitive and behavioral implications and vitamin deficiency can cause depression (Bear et al., 2020). While it is important to recognize that the brain and body are connected, it is worth noting that

an individual can be physically healthy, yet still experience anxiety and depression potentially due to environmental stressors.

Emerging adulthood, a time of navigating a multitude of novel possibilities of careers, relationships, and responsibilities, is often a stressful time for individuals including college students (Mahmoud, 2012). Young adulthood is considered to be a time period that is both stress and anxiety provoking, during which maladaptation to environmental stressors can contribute to clinical symptoms, especially without treatment. Anxiety and depressive symptoms are increasingly common mental health concerns, afflicting 48% of young adults (Adams et al., 2022). Additionally, young adulthood often marks the onset of lifetime mental illness with 75% of all lifetime mental illness beginning by age 24 (National Survey on Drug Use and Health, 2020). Indeed interventions targeted to college students are essential as the developmental period is associated with novel stressors of increased intensity and emergence of lifelong mental health disorders. These targeted interventions could help mediate severity of symptoms and increase an individual's quality of life.

Despite the large population that is affected by mental illness, only 46.2% of US adults with mental illness received treatment in 2020 (National Survey on Drug Use and Health, 2020). Additionally, the average delay in onset of symptoms and treatment for mental illness is 11 years. Undoubtedly, barriers to mental health care exist and have detrimental implications for an individual's wellbeing.

1.1 Implications of Stigma

Beliefs about medication and its effectiveness have a significant impact on various aspects of mental health treatment. For example, public stigma which is defined as the stereotypes, prejudice, and subsequent discrimination impacts public opinion (Corrigan, 2004). When an individual internalizes public stigma, they adopt negative attitudes towards themselves, referred to as self-stigma. Stigma is one of the main reasons why individuals do not seek out or sustain treatment for mental health disorders. Many individuals consider how their

self and public perception would change by taking an antidepressant (Dohrewent, 2009) and worry that they will be perceived as “crazy” or “weak” for taking antidepressant medications.

Despite improvements in the treatment of psychiatric patients over time, prejudice and maltreatment still exists. Stigmatization of mental health has wide spanning implications on the wellbeing of individuals with mental illness. People with mental illness are less likely to be selected for employment opportunities, more likely to be falsely accused of a crime, and more likely to be perceived as dangerous (Corrigan, 2020). Unlike physical illness, individuals with mental illness are more likely to be seen as responsible for their own illness, leading to an invalidating experience.

Medical professionals, who play an essential role in the treatment of mental health concerns, are also swayed by public stigma. A sample of nursing students were surveyed and found to have more negative attitudes of depression and antidepressants relative to the general public (Blanc, 2020). Medical professionals' attitudes impact the quality of care patients receive as well as patient prognosis. Negative beliefs or misconceptions about medication can lead to patient non-adherence, which can ultimately hinder the effectiveness of the treatment. Medication adherence, which is necessary for treatment of many mental health disorders, requires medical professionals equipped with accurate and nonjudgemental knowledge. Notably, 50-75% of patients discontinue antidepressant treatment, representative of poor adherence (Martinez, 2019). To increase adherence and subsequently improve the quality of life in individuals with mental illness, stigma reduction in the healthcare setting and general public is imperative.

Surveyed health care professionals who endorsed harmful stigmatization of mental health disorders were found to have the same beliefs when they were students (Yamaguchi et al., 2013). Therefore, interventions designed to disseminate accurate information regarding mental illness, correcting harmful misconceptions, should be implemented in students before they begin their careers, such as application in undergraduate curriculum.

1.2 Interventions to Reduce Stigma

To date, most research and educational interventions focus on destigmatizing depressive disorders themselves, rather than their treatment (Martinez, 2018). However, research examining interventions aimed at educating and reducing stigma related to antidepressant medications has shown promising results. Martinez et al. (2018) focused on examining the role of empathy and education in preventing harmful stigmatization of those taking antidepressants. Researchers found that participants held more positive views of antidepressants and individuals with depression after both educational interventions and perspective-taking approaches. In a cross-sectional study of nursing students, a survey including the Drug Attitude Inventory and Beliefs about Medicines Questionnaire was used to assess knowledge and beliefs towards antidepressants (Blanc et al. 2020). The group that received psychiatric education as an intervention showed improvements in knowledge of antidepressants, beliefs of effectiveness, and recommendation of treatment (Blanc et al., 2020). Other studies have further correlated accurate knowledge of antidepressants with more positive attitudes towards medication use (Roh, 2009, Schomerus et al., 2012, De las Cuevas et al., 2007).

While the extant literature has shown the potential of these interventions, they have methodological limitations that must be addressed. For instance, Blanc et al.'s experimental design did not allow for the examination of the "direct effect of education of the same individuals over time" (2020). Thus, the present study aims to improve upon previous research by sampling the same group of students from pre-to-post course content including the neurobiological basis of mental illness to better examine the impact of understanding the neurobiology of psychiatric medications on an individual's stigmatizing beliefs.

1.3 Selective Serotonin Reuptake Inhibitors

What differs between perceptions and subsequent treatment outcomes between individuals taking Penicillin and those taking Prozac? Selective serotonin reuptake inhibitors, such as fluoxetine (Prozac), citalopram (Celexa), escitalopram (Lexapro), paroxetine (Paxil),

sertraline (Zoloft), are commonly used to treat depression, OCD, and anxiety disorders.

Specifically, selective Serotonin Reuptake Inhibitors (SSRIs) inhibit the reuptake of serotonin, allowing increased availability of serotonin at the synapse (Lochmann et al, 2019).

Serotonin is a neurotransmitter that modulates behavior, mood, and sleep. Normally, serotonin is removed from the synaptic cleft by a specific transporter, but clinically useful antidepressants and anxiolytic drugs selectively inhibit serotonin reuptake allowing for prolonged synaptic availability. Selective serotonin reuptake inhibitors (SSRIs) can reduce target symptoms of depression and anxiety (Lochmann et al, 2019, Bear et al. 2020). This therapeutic effect is slow over weeks and requires regular dosing, suggesting that it is not an effect of immediate extracellular serotonin but some downstream effect that is currently unknown. There are many theories regarding how SSRIs alleviate target symptoms including the possibility that they might enhance feedback regulation of corticotropin-releasing hormone in the hypothalamus, thus reducing biological distress (Bear et al., 2020).

Previous research shows that SSRIs are effective in reducing amygdala response to negative facial affect in both control and depressed participants (Zangrossi et al, 2020). This decreased response may explain social appraisal and mood improvements following antidepressant usage, as the amygdala is associated with threat, stress, and fear. Many other experiments and theories support the proposed role of SSRIs in improving depressive and anxiety symptoms. Notably, in a meta-analysis of 522 randomized controlled trials, SSRIs and other antidepressants were more effective than the placebo in reducing symptoms of depression (Cipriani et al, 2018)

Unlike other antidepressant medications, such as tricyclics, SSRIs are selective only to serotonin receptors leaving other receptors and channels unaffected. Limiting drug targets to only serotonin receptors allows for decreased side effects. Furthermore, SSRIs can alleviate anxiety with less sedation and risk of misuse than benzodiazepines. SSRIs are generally well

tolerated and effective for treating anxiety and depression. Notably, SSRIs are taken daily as the medication's therapeutic effects are contingent on continuous usage and adherence.

1.4 The Present Study

Many neuroscience students plan to join pre-health careers following graduation, emphasizing the importance in correcting any misconceptions regarding SSRIs. To address the utility of neuroscience education, specifically the neurobiology of selective serotonin reuptake inhibitors, in reducing stigmatizing beliefs towards antidepressants, we utilized a survey to assess how students' beliefs surrounding mental illness changed following the completion of the Introduction to Neuroscience course. While Introduction to Neuroscience was not designed to target stigma specifically, course content covers antidepressant mechanisms of action, addiction in the brain, and biological mechanisms associated with mental illness. We hypothesized that at the end of course content, equipped with better knowledge of mental illness, serotonin systems, and reuptake inhibition, students would hold less stigmatizing beliefs from when they entered the course.

Method

2.1 Participants and Setting

The present study collected data during the fall semester of 2022 at the University of North Carolina at Chapel Hill. Participants (N = 257) were recruited from multiple sections of Introduction to Neuroscience both online and in-person. All sections of the course had the same textbook, *Neuroscience Exploring the Brain* (Bear et al., 2020), and course learning objectives. Research was exempt by the Institutional Review Board at the University of North Carolina at Chapel Hill (22-1985). In order to be eligible, students had to be enrolled in Introduction to Neuroscience and be at least 18 years of age. Participants were not required to complete the survey for course credit and could withdraw at any point. Additionally, participants were compensated for their time with extra credit points towards their final exam and entered into a raffle for fifty dollar gift cards.

2.2 Survey Design and Data Collection

Participants were asked to reflect on their knowledge and beliefs of SSRIs from the beginning and end of the semester with a single retrospective pre-post questionnaire that was distributed at the end of course content. Participating students completed an online survey adapted from the Drug Attitudes Inventory (Hogan, 1983), Beliefs about Medicines Questionnaire (Horne et al., 1999), and Family Practice Management's Patient Misconceptions about Antidepressants (Dohrenwend, 2009). Both the Drug Attitude Inventory and the Beliefs about Medicines Questionnaire have been validated and replicated. The Drug Attitude Inventory scores +1 to positive responses and -1 to negative responses, whereas the Beliefs about Medicines Questionnaire utilizes a likert scale on a continuum of strongly agree to strongly disagree. In our survey, we utilized a likert scale on a continuum of strongly agree to strongly disagree to better capture the degree of change of negative and positive beliefs from the beginning to the end of semester. The survey used to evaluate student stigmatization towards antidepressants is listed in Table 1.

Table 1. Survey Items

Measure	Survey Item	Item Adapted From
Physician Overconfidence and Adherence	"Individuals know better than doctors regarding when to stop taking antidepressants."	DAI
Addictive Substance	"Antidepressants are addictive substances."	BMQ
Unnatural for Mind and Body	"It is unnatural for the mind and body to be controlled by medications such as antidepressants."	DAI
Prescribed too Frequent	"Doctors prescribe antidepressants too frequently."	BMQ
Belief of Harmfulness	"In general, I believe the	DAI

	good of antidepressants outweigh the bad"	
Similarity to Recreational Drug	"Antidepressants do not make you feel high, change your sensory experiences or result in ups and downs."	Patient Misconceptions about Antidepressants

Note. In this questionnaire, respondents' level of stigmatization towards antidepressants was assessed. Adapted from the Drug Attitudes Inventory (Hogan, 1983) and the Beliefs about Medicines Questionnaire (Horne et al, 1999).

The survey also included a course content knowledge check question regarding the synaptic mechanism of SSRIs, ("You believe selective serotonin reuptake inhibitors impact the serotonin levels accordingly..."). The course content question, a multiple choice question with one correct answer, ("SSRIs increase the availability of serotonin at the synapse,") and multiple incorrect answers, was scored as accurate or inaccurate. Participants were also asked what influenced their opinions regarding SSRIs, whether that be Introduction to Neuroscience course content, content from another course in college, or experiences of themselves or close others. At the end of the questionnaire participants reported their demographic and academic information. Specifically, participants were asked to report their academic year, race, gender, major, and whether or not they intend to pursue a healthcare career in the future.

2.3 Data Analysis

The first step in the analysis was to remove any missing values from the data. The percentage of correct scores for content-related questions was then determined. Likert scaled questions were scored -3 to +3 with -3 being the more stigmatizing belief and +3 being the least stigmatizing belief. Following this, the Cronbach alpha of the scale was calculated, and the results showed poor internal consistency ($\alpha = 0.597$). This is likely because the questionnaire items measured stigmatizing beliefs that were too different to be combined into a cumulative score. In order to identify any significant changes, a paired samples t-test was conducted for each question from pre to post. An exploratory analysis using a mixed model ANOVA was also

performed to examine differences between students interested in pursuing a healthcare career relative to students uninterested in healthcare. A p-value below 0.05 was considered significant in all analyses, which were conducted using Jamovi software. Graphpad was used to generate figures.

Results

3.1 Participants

The sample of surveyed undergraduate students were mostly female (72.3%) intending to pursue a healthcare career in the future (66.8%). All of the participants were at least 18 years of age and enrolled in Introduction to Neuroscience. Illustrated in Table 2, 45.7% of students were White, 28.9% were Asian, 8.7% were Multiracial, 8.6% were Black, and 6.6% were Hispanic or Latinx. As displayed in Table 2, participants were representative of a variety of academic years and majors.

Table 2. Participant Demographics

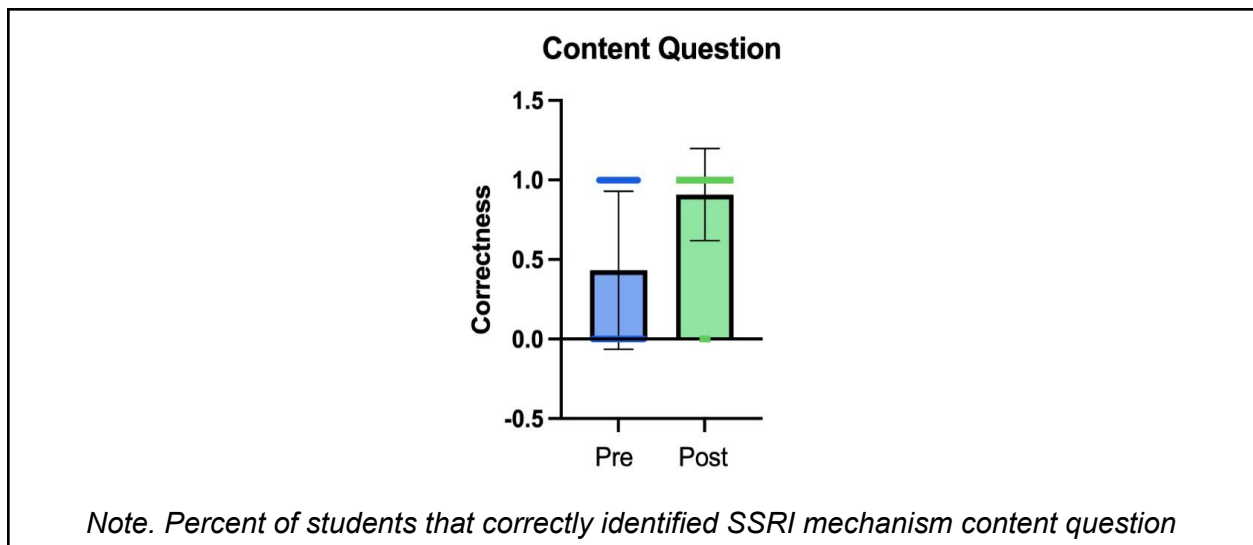
Variable	Result
<i>Race, n (%)</i>	
Indigenous American or Alaskan	0 (0%)
Asian	74 (28.9%)
Black or African American	22 (8.6%)
Pacific Islander	0 (0%)
Hispanic or Latinx	17 (6.6%)
White or European American	117 (45.7%)
Multiracial	22 (8.6%)
Prefer not to respond	4 (1.6 %)
<i>Academic Year, n (%)</i>	
Freshman	67 (26.2%)
Sophomore	101 (39.5%)
Junior	65 (25.4%)
Senior	23 (9.0%)
<i>Major, n (%)</i>	
Neuroscience	93 (36.3%)
Biology	34 (13.3%)
Chemistry	1 (0.4%)
Exercise and Sport Science	13 (5.1%)
Psychology	30 (11.7%)
Computer Science	6 (2.3%)
Double Major	54 (21.2%)
Other	24 (9.4%)

Note. N = 257

3.2 Self-Reported Confidence and Knowledge-Based Questions

Students reported their confidence in correctly identifying the mechanism of antidepressants from the beginning to the end of course. As shown in Table 3, a Wilcoxon signed-rank test showed statistically significant increase in students' understanding of antidepressant action ($p < 0.05$). Additionally, students were assessed on whether or not they could correctly identify the mechanism of action of selective serotonin reuptake inhibitors from multiple choice options: (1) SSRIs increase the serotonin available at the synapses rather than the body's overall concentration of serotonin (2) When taking SSRIs the body becomes dependent on the medication to produce serotonin (3) SSRIs increase the body's overall concentration of serotonin. As seen in Graph 1, 43.2% of students identified the correct answer at the beginning of the semester compared to 90.8% by the end of the semester.

Graph 1.



3.3 Beliefs Modified by Introduction to Neuroscience Curriculum

A Wilcoxon signed-rank test showed that from the beginning to the end of the course, students were significantly less likely to believe that antidepressants are addictive substances ($p < 0.05$), unnatural for the body and mind ($p < 0.05$), and prescribed too frequently ($p < 0.05$). Additionally, students were more likely to believe that the good of antidepressants outweighs the

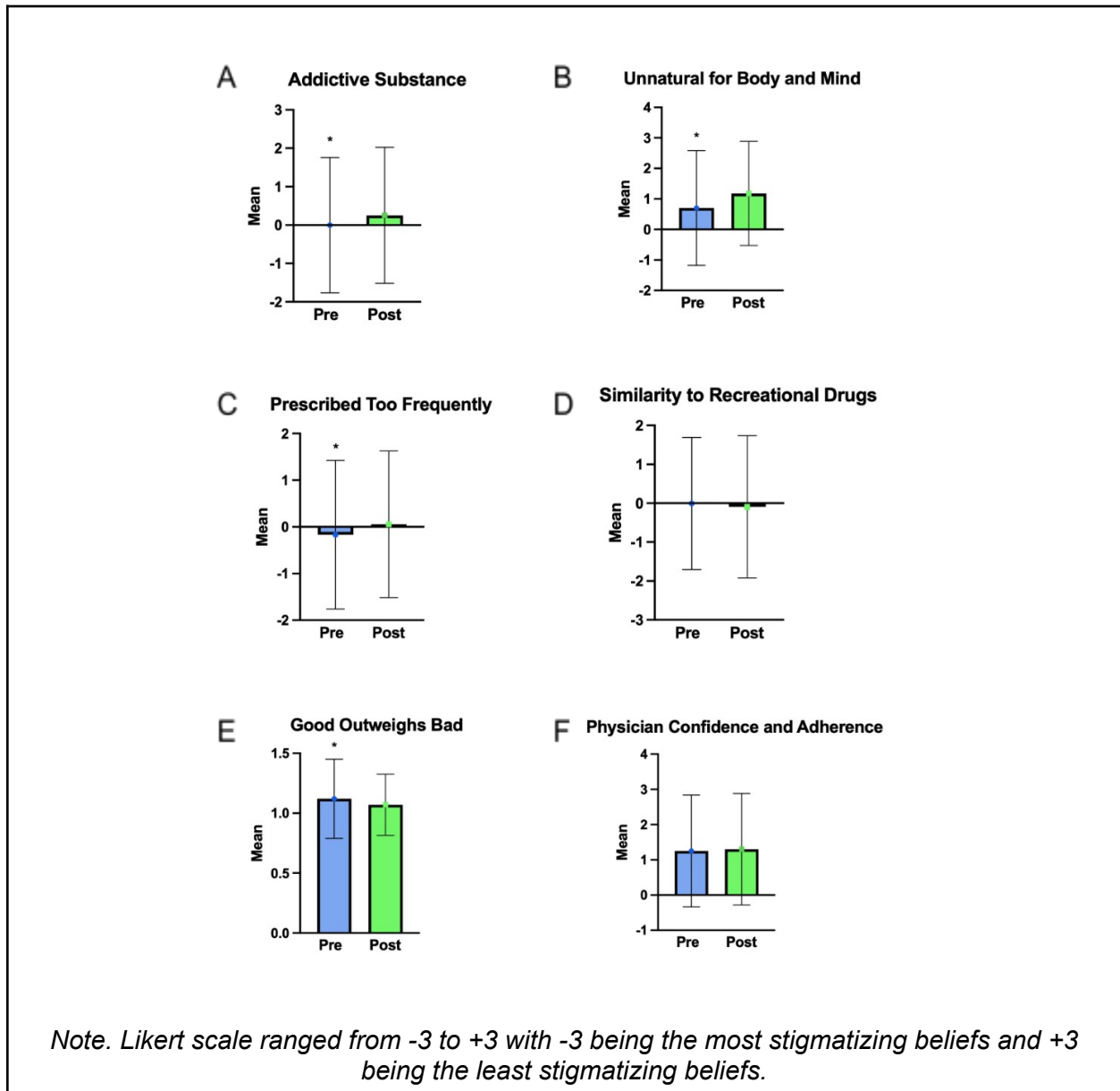
bad ($p < 0.05$). However, the amount of students who changed their opinions regarding doctor's versus individual's expertise in taking antidepressants was insignificant ($p > 0.05$); with a majority of students strongly agreeing that "individuals know better than doctors when to stop taking antidepressant." Likewise, students did not significantly change their beliefs that antidepressants result in a "high" or changed sensory experience ($p > 0.05$). A likert scale between -3 and 3 was used to rank agreement or disagreement of antidepressants ability to change one's sensory experience; median scores were both 0.00 from pre-course to post-course.

Table 3. Change Neuroscience Student's Beliefs Towards Antidepressants

Measure	Baseline		End of Course		p
	Mean	SD	Mean	SD	
Doctor expertise in medication adherence	1.25	1.59	1.30	1.58	0.373
Addictive substance	-0.004	1.76	0.252	1.77	<.001
Unnatural for mind and body	0.703	1.88	1.18	1.71	<.001
Prescribed too frequent	-0.167	1.59	0.055	1.57	<.001
Good outweighing bad	1.12	0.331	1.07	0.256	0.015
Change in sensory experience	-0.008	1.70	-0.095	1.83	0.428

Note. All measures were significant except (1) Doctor expertise in medication adherence and (2) Change in sensory experience

Graph 3. Change Neuroscience Student’s Beliefs Towards Antidepressants

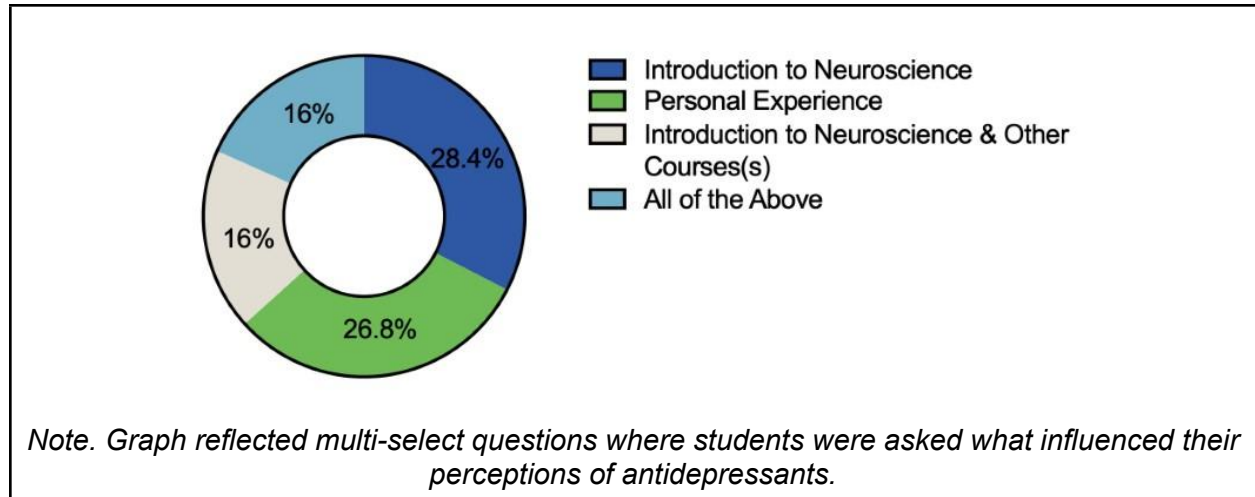


3.4 Factors that Influenced Students Perspectives

28.4% of students surveyed reported that in Introduction to Neuroscience they learned things that corrected some of their previously held beliefs surrounding psychiatric conditions and/or treatment. 26.8% of students reported that both the experience of themselves or close others taking antidepressants shaped their opinions. 16.0% of students surveyed reported that content from Introduction to Neuroscience and other college courses changed their perceptions

of psychiatric disorders and/or treatment. 16.0% of students reported that a combination of all three factors previously listed contributed to their opinions regarding psychiatric treatment.

Graph 3. Influence of Students' Beliefs



As an exploratory analysis, a mixed model ANOVA was used to compare how changes from the beginning to the end of the semester differed between students who identified as interested or uninterested in pursuing a healthcare career. As displayed in Table 4, there were significant baseline differences for students intending on pursuing healthcare careers and students uninterested in pursuing healthcare when asked to what degree they believed antidepressants are addictive substances ($p < 0.05$). When asked about addiction, there was a significant main effect of interest in pursuing a healthcare career $F(1, 505) = 14.48, p < 0.05$. As shown in Graph 4, students interested in pursuing healthcare held more stigmatizing beliefs at baseline than peers uninterested in pursuing healthcare. Students who did not intend on pursuing healthcare careers did not believe antidepressants were addictive substances in the beginning of the course.

At baseline, aspiring healthcare students and their peers held statistically different beliefs regarding whether or not it is unnatural for the mind and body to be controlled by antidepressants $F(1, 508) = 14.61, p < 0.05$; specifically students uninterested in pursuing

healthcare were more likely to strongly disagree that antidepressants allowed for unnatural control of the body and mind.

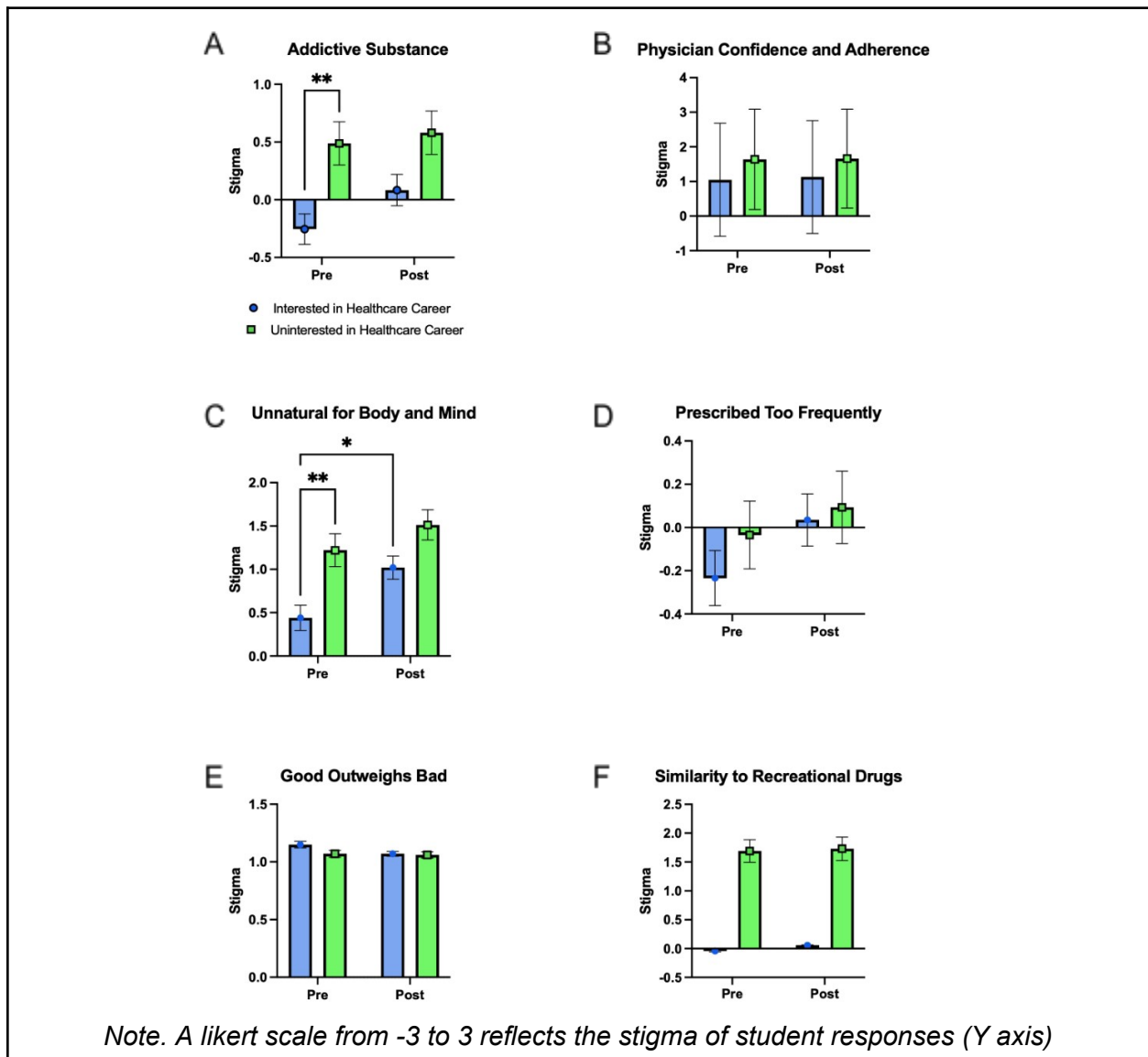
Participants intending on pursuing healthcare careers also showed differences pre-course and post-course regarding whether or not antidepressants resulted in “highs” or changed one’s sensory experience $F(1, 506) = 286.6$ $p < 0.05$. Displayed in Graph 4, pre-health students held more stigmatizing beliefs before the course and changed to hold less stigmatizing beliefs at the end of the semester. However, students interested in healthcare were unlikely to believe that antidepressants changed one’s sensory experience both at the beginning and end of the semester.

Table 4. Differences in Stigma between Student Interested and Uninterested in Healthcare Careers

Measure	Interested in Healthcare		Uninterested in Healthcare	
	Pre Mean + SD	Post Mean + SD	Pre Mean + SD	Post Mean + SD
Doctor expertise in medication adherence	1.05 + 1.63	1.13 + 1.63	1.64 + 1.45	1.66 + 1.43
Addictive substance	-0.25 + 1.71	0.08 + 1.76	0.49 + 1.74	0.58 + 1.75
Unnatural for mind and body	0.44 + 1.89	1.02 + 1.74	1.22 + 1.76	1.51 + 1.61
Prescribed too frequent	-0.23 + 1.66	0.04 + 1.58	-0.03 + 1.45	0.09 + 1.55
Good outweighing bad	1.15 + 0.36	1.07 + 0.26	1.07 + 0.26	1.06 + 0.24
Change in sensory experience	-0.04 - 0.17	0.06 + 0.06	1.69 + 1.81	1.73 + 1.88

Note. The following reflects mean and standard deviation of both groups of students, health and non-health, from baseline to post-curriculum.

Graph 4. Differences in Stigma between Student Interested and Uninterested in Healthcare Careers



Discussion

The findings of the present study suggest that understanding the neurobiological basis of mental illness, specifically understanding the mechanism of action of selective serotonin reuptake inhibitors at a synaptic level, provides a promising stigma-reduction in some college students. Negative attitudes towards antidepressants were significantly reduced following course completion. There was an overall effect of the Introduction to Neuroscience course in

stigma reduction. However, the destigmatizing effect was driven by the change in students interested in pursuing a healthcare career.

Roughly one third of students reported having their opinions regarding SSRIs change by Introduction to Neuroscience content alone. An additional third of students reported Introduction to Neuroscience curriculum and other factors, such as personal experiences or other courses, contributing to their opinions regarding antidepressants. By the end of the course, students were significantly less likely to believe that antidepressants are addictive substances, unnatural for the body and mind, and prescribed too frequently. Additionally, students were more likely to believe that the good of antidepressants outweighs the bad. These findings parallel previous research studies in that increased education regarding medications is effective at reducing stigma (Blanc et al. 2020, Roh 2009, Martinez et al. 2018). Moreover, these findings are supported by the prevalent theory that contact and curriculum are effective strategies for stigma reduction (Corrigan 2004, Dalky 2012.)

Additionally, an insignificant number of students changed their opinions that antidepressants resulted in a “high” or changed sensory experience. Students may have interpreted changed sensory experience as the alleviation of anhedonia and mood improvements following antidepressant usage. Students overall did not believe that antidepressants are addictive substances, suggesting students are able to distinguish antidepressants from recreational drugs.

In nursing students, the level of stigma against depression was stronger and higher compared to the general population (Blanc, 2020). In the present study, the baseline level of stigma was higher in individuals intending on pursuing a healthcare career than those who were not. Interestingly, aspiring healthcare students showed greater change in their beliefs from pre to post than their peers. Students who reported being uninterested in pursuing healthcare held less stigmatizing beliefs at baseline but these beliefs did not have a pronounced change from pre to post. Differences in burn-out in students on the pre-health

track may account for these differences in stigmatizing beliefs found in the current study.

Pre-medical undergraduate students experience higher rates of burn-out than their peers (Grace, 2018). “You can’t pour from an empty cup” is empirically supported as burn-out has been negatively correlated with empathy in a multitude of studies (Wilkinson et al., 2017). To reduce stigmatization of mental health treatment, curriculum could be coupled with self-care and self-compassion to decrease feelings of burn-out and promote empathy. Many students reported an interest in pursuing a healthcare career, meaning they are going to have an essential role in treating mental illnesses. Accurate knowledge about antidepressants is important whether or not you are a patient or a healthcare provider as implications and predominance of mental health disorders are wide spanning.

As the neurobiological basis of mental illness is shown to be effective at reducing stigma, the current study could be replicated with other undergraduate students or healthcare students. In undergraduate students, reduction of stigma could promote help-seeking behaviors and reduce public stigma. Additionally, reducing stigmatizing beliefs in students pursuing healthcare could allow for better patient outcomes in the future. Moreover, the current study could also have potential utility in destigmatizing other mental health disorders and treatment such as treating substance misuse, which is highly stigmatized.

4.1 Limitations

One major limitation of this study is that it was conducted as a retrospective pre-to-post questionnaire taken once at the end of the semester, which could result in inaccurate or inflated responses from the students, introducing some degree of bias into the study's results. Another limitation is the limited follow-up period, which makes it unclear how long the changes in students' opinions and attitudes towards mental illness persisted. Additionally, the study's sample was heavily homogenous in terms of gender, which may limit the generalizability of the findings to other populations with more diverse gender compositions. Furthermore, the study was limited to mostly neuroscience students who may already be more open to mental illness

treatment than other healthcare professionals, such as nurses. Therefore, the findings of this study should be interpreted with caution and may not be applicable to other populations, such as healthcare professionals with different backgrounds. To address these limitations, future research should consider conducting pre-to-post surveys, including more diverse populations, and implementing longer follow-up periods to assess the persistence of changes in attitudes and opinions towards mental illness.

Additionally, while the study asked if students' opinions were impacted by experiences of themselves or close others, individuals who took antidepressants were not screened out. De las Cuevas et al. (2007) supports that individuals who take antidepressants are likely to have more positive beliefs of antidepressants. Therefore, the decrease in stigmatizing beliefs could also be attributed to student antidepressant usage over the course of the semester.

4.2 Conclusion and Future Directions

To improve upon the findings of the present study, the study should be replicated utilizing the same survey administered at the beginning and the end of the semester. This will allow more accurate responses than asking students to reflect on their opinions from the beginning to the end of the semester.

Additionally, the current study was limited to Introduction to Neuroscience students who are largely neuroscience majors and minors. These students could potentially be more open-minded regarding antidepressants due to their potential interest in the mental health field. The present study could also be improved by utilizing exam questions to more organically reflect students' knowledge of SSRI mechanism of action. In a retrospective pre-to-post questionnaire, students' answers are likely not as accurate as a knowledge check before and after the course curriculum.

Overall, the present study emphasizes that neurobiology of mental health disorders and treatment has utility as an intervention in reducing stigma toward psychiatric medication. Perhaps understanding the biological mechanism of medications corrects previously held

misconceptions. Correcting misconceptions helps destigmatize treatment, which is shown to increase treatment seeking and treatment adherence (Corrigan, 2004). Subsequently, seeking and sustaining treatment is associated with better mental health outcomes, improved mood, and increased function. Curriculum that allows for increased knowledge and reduced stigmatization is especially relevant in college students as they are at an increased risk for mental health concerns. These implications span beyond an individual's desire to seek and sustain treatment as public beliefs are empirically influential on the actions of others. Decreased self and public stigma of antidepressants is likely to positively influence behaviors of many at risk individuals. Destigmatizing the treatment of anxiety and depression is imperative to tackle the problematic and pervasive effects of mental illness and improve the quality of life of millions of adults in the US alone.

References

- Bear, M. F., Connors, B. W., & Paradiso, M. A. (2016). *Neuroscience: Exploring the brain*.
- Blanc, J. -, Mouchabac, S., Nuss, P., Malandain, L., Lapidus, N., & Ferreri, F. (2020). The effects of education in psychiatry on attitudes towards antidepressants in nursing students: A cross-sectional study. *Nurse Education in Practice*, 45, 102781-102781. <https://doi.org/10.1016/j.nepr.2020.102781>
- Cipriani, A., Furukawa, T. A., Salanti, G., Chaimani, A., Atkinson, L. Z., Ogawa, Y., ... & Egger, M. (2018). Comparative efficacy and acceptability of 21 antidepressant drugs for the acute treatment of adults with major depressive disorder: a systematic review and network meta-analysis. *The Lancet*, 391(10128), 1357-1366.
- Corrigan, P. (2004). How stigma interferes with mental health care. *The American Psychologist*, 59(7), 614-625. <https://doi.org/10.1037/0003-066X.59.7.614>
- Dalky, H. F. (2012). Mental illness stigma reduction interventions: Review of intervention trials. *Western Journal of Nursing Research*, 34(4), 520-547. <https://doi.org/10.1177/0193945911400638>
- De las Cuevas, C., & Sanz, E. J. (2007). Attitudes toward psychiatric drug treatment: The experience of being treated. *European Journal of Clinical Pharmacology*, 63(11), 1063-7. doi:<https://doi.org/10.1007/s00228-007-0358-5>
- Dohrenwend, Anne, PhD., A.B.P.P. (2009). 11 patient misconceptions about antidepressants: How to respond. *Family Practice Management*, 16(3), 15-7. Retrieved from <http://libproxy.lib.unc.edu/login?url=https://www.proquest.com/scholarly-journals/11-patient-misconceptions-about-antidepressants/docview/221682883/se-2>
- Grace M. K. (2018). Depressive symptoms, burnout, and declining medical career interest among undergraduate pre-medical students. *International journal of medical education*, 9, 302–308. <https://doi.org/10.5116/ijme.5be5.8131>
- Hogan, T.P., Awad, A.G., Eastwood, R., 1983. A self-report scale predictive of drug compliance in schizophrenics: reliability and discriminative validity. *Psychol. Med.* 13, 177–183.
- Horne, R., Weinman, J., & Hankins, M. (1999). The beliefs about medicines questionnaire: The development and evaluation of a new method for assessing the cognitive representation of medication. *Psychology & Health*, 14(1), 1-24. <https://doi.org/10.1080/08870449908407311>
- Jihan Saber Raja Mahmoud, Ruth “Topsy” Staten, Lynne A. Hall & Terry A. Lennie (2012) The Relationship among Young Adult College Students’ Depression, Anxiety, Stress, Demographics, Life Satisfaction, and Coping Styles, *Issues in Mental Health Nursing*, 33:3, 149-156, DOI: [10.3109/01612840.2011.632708](https://doi.org/10.3109/01612840.2011.632708)
- Martinez, L.R., Xu, S. & Hebl, M. Utilizing Education and Perspective Taking to Remediate the Stigma of Taking Antidepressants. *Community Ment Health J* 54, 450–459 (2018). <https://doi.org/10.1007/s10597-017-0174-z>

National Alliance on Mental Illness. (n.d.). Mental health facts in America. Retrieved from <https://www.nami.org/mhstats>.

National Center for Health Statistics. (2020). Antidepressant use among adults: United States, 2015–2018. Centers for Disease Control and Prevention. Retrieved from <https://www.cdc.gov/nchs/products/databriefs/db377.htm>.

Parcesepe, A.M., Cabassa, L.J. Public Stigma of Mental Illness in the United States: A Systematic Literature Review. *Adm Policy Ment Health* 40, 384–399 (2013). <https://doi.org/10.1007/s10488-012-0430-z>

Roh, M. S., Jeon, H. J., Kim, H., Cho, H. J., Han, S. K., & Hahm, B. J. (2009). Factors influencing treatment for depression among medical students: a nationwide sample in South Korea. *Medical education*, 43(2), 133-139.

Rüsch, N., Angermeyer, M., & Corrigan, P. (2005). Mental illness stigma: Concepts, consequences, and initiatives to reduce stigma. *European Psychiatry*, 20(8), 529-539. doi:10.1016/j.eurpsy.2005.04.004

Schomerus, G., Schwahn, C., Holzinger, A., Corrigan, P.W., Grabe, H.J., Carta, M.G. and Angermeyer, M.C. (2012), Evolution of public attitudes about mental illness: a systematic review and meta-analysis. *Acta Psychiatrica Scandinavica*, 125: 440-452. <https://doi.org/10.1111/j.1600-0447.2012.01826.x>

Wilkinson, H., Whittington, R., Perry, L., & Eames, C. (2017). Examining the relationship between burnout and empathy in healthcare professionals: A systematic review. *Burnout Research*, 6, 18-29. <https://doi.org/10.1016/j.burn.2017.06.003>

Yamaguchi, S., Wu, S. I., Biswas, M., Yate, M., Aoki, Y., Barley, E. A., & Thornicroft, G. (2013). Effects of short-term interventions to reduce mental health–related stigma in university or college students: a systematic review. *The Journal of nervous and mental disease*, 201(6), 490-503.