

Article

The Effects of a Collegiate Recovery Community Psychotherapy Program Incorporating Equine Interaction during the COVID-19 Pandemic on Young Adults with Substance Abuse Disorder

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Abstract: While psychotherapy incorporating equine interaction (PIE) has proven to be a viable therapeutic intervention, it is not a common mental health service found on college campuses. Nevertheless, with the rise of mental health challenges on campuses after the COVID-19 pandemic, a need for effective therapeutic solutions is warranted. Therefore, the objective of this study was to determine the effect of a collegiate recovery community (CRC) PIE program for substance abuse disorder (SUD) compared to that of traditional cognitive behavioral therapy (CBT) and to determine whether physiological synchronization occurs between the human and horse during the therapy process. College-aged adults were recruited during the COVID-19 pandemic for two types of short-term SUD therapeutic interventions, CRC-PIE and CBT. Both groups completed a self-reporting survey assessing emotional safety. Vital signs measurements for human and horse participants within the CRC-PIE were collected prior to and after the first and last therapeutic sessions. Results concluded that although emotional safety did not improve significantly for PIE participants by the last therapy session ($p = 0.85$), emotional safety scores were significantly different between therapy types, with lower post-therapy scores for PIE ($p = 0.04$). As for physiological measures for PIE participants, respiratory rates (Human: $p = 0.01$; Horse: $p = 0.01$) and pain rating scores (Human: $p = 0.03$; Horse: $p = 0.01$) significantly decreased post-therapy and a strong positive correlation ($R = 0.73$, $R^2 = 0.53$) associated with vital signs was observed between humans and horses. This human–horse physiological synchronization during the therapeutic intervention suggests that the horse may be a viable tool within campus CRC programs for the development of therapeutic alliances within the therapy process.

Keywords: psychotherapy incorporating equine interaction; substance abuse disorder; student mental health; collegiate recovery community

1. Introduction

College students are prone to high levels of stress, anxiety, and depression that can have a negative impact on academic performance without programs to address these challenges [1]. Collegiate recovery communities (CRC) are organizations on college campuses used to support students struggling with mental health disorders [2–4]. Within the United States, 138 campuses have CRCs integrated as a part of their student services [5]. These programs typically have a physical space on campus for students to find indirect and direct sources of support throughout the semester [2,4]. The CRC representatives work to provide community engagement opportunities, addiction education events, and regular

community member meetings [2]. The CRC mission is critical in creating an emotionally safe environment for college students grappling with their mental health as these issues can be a deterrent in the learning process [2,6]. Lower grade point averages, for example, were seen for college students reporting higher levels of anxiety and stress [1]. Mental health challenges commonly faced by today's college students can range from anxiety and depression to substance abuse and suicidal ideation [7]. Individuals who enter into a college degree program while facing these disorders can be negatively impacted academically if not supported properly [1,8,9]. Nevertheless, due to the negative stigma associated with mental health disorders, it can be challenging for students to seek out public services while on campus and this can, in turn, hinder the academic success of these students [6,9].

1.1. Mental Health and Equine Interaction

The COVID-19 pandemic was a deterrent to addressing the mental health of the college student as it limited community engagement options and in-person meetings, both on and off campuses [7]. This led to a significant increase in isolation, anxiety, and depression for college students [10] and a significant rise in drug abuse [7,11]. While the reintegration of students on campuses has slowly occurred moving into the post-COVID era, mental health services have been slower to emerge and have not met the rise in mental health issues associated with the trauma of the pandemic [7]. With the recent demand for campus-based mental health services, the introduction of therapeutic interventions incorporating animal interactions on campuses has been one way to offer a unique approach to mental health services [12–14]. On-campus canine programs, for example, have been utilized successfully to address a wide spectrum of various mental health issues that college students face [13,15]. The presence of the animal within the therapeutic environment seems to attract participation in the therapy and keeps participants engaged [16]. While less common on college campuses, psychotherapy incorporating equine interaction (PIE) is a form of this trend in therapeutic interventions including animals, but, instead of using a dog as the therapy tool, a horse is engaged. PIE is a non-traditional intervention method with proven results for improving the mental well-being of young adults through the development of an emotionally safe environment that is conducive to learning [17,18]. This intervention option is unique as the environment for equine interaction traditionally takes place within an outdoor setting, although cover may be provided, utilizing an open-air arena for riding activities [19]. The use of an outdoor recreational space has proven successful for the mental health community [20].

Another positive aspect of PIE is the human physiological response to the equine activities performed during therapy sessions. Unlike the more common approach of cognitive behavioral therapy (CBT) located within an office setting where the patient is usually static during the session as they work on verbalizing thoughts and feelings while building coping skills [21,22], PIE often consists of labor-intensive activities during the therapeutic process that may include leading, grooming, tacking, and/or riding a horse [16–18]. While both CBT and PIE are typically short-term therapeutic interventions, through the equine activities associated with PIE, the participant benefits from a form of exercise therapy that utilizes three types of exercise: flexibility, strength building, and aerobic capacity [23–26]. Exercise, particularly aerobic exercise, increases heart and respiration rates in humans [27,28] and horses [29,30]. Increases in heart and respiratory rates are indicators of stress, whether it is a physical stressor such as exercise or an emotional stressor such as anxiety, and this physiological response is seen in both humans [27,31] and horses [29,32]. While this similarity in physiological responses to the two types of stressors may infer a negative consequence of exercise for mental health patients, Liu et al. [33] reported changes in the hypothalamus–pituitary–adrenal (HPA) axis that were chronic and severe with emotional stressors that were not observed with physical stress such as those seen during exercise. These changes in the HPA axis hindered cognitive function. In fact, Mahindru et al. [34] documented that physical activity improved HPA regulation, resulting in a reduction of cortisol levels, a stress-related hormone. As for equine-based physical activity as observed

during PIE, while the HPA axis was not studied, equine interaction was reported to improve physiological measures within the human participant, including a reduction in cortisol concentrations [24,29,35]. Research has also indicated a physiological synchronization between humans and horses in regard to lowering heart and respiratory rates [29,36]. Klienbub et al. [37] reported the value of physiological synchronization within the therapeutic setting as this allowed for a positive therapeutic relationship between the therapist and patient during the therapeutic process, encouraging feelings of attachment and empathy. This physiological synchronization has also been observed between patients and canines during therapy sessions, with patients reporting an attachment to the canine that encouraged engagement and participation within the therapeutic process [38]. Feelings of connectedness during the therapeutic intervention were reported as being critical during the COVID-19 pandemic as feelings of isolation were prevalent due to social distancing guidelines [39]. Research, nevertheless, has remained limited as to this relationship between PIE and the body's response to this form of exercise within SUD patients [23,24]. Further, while Klienbub et al. [37] offer value in the understanding of human physiological synchronization within the therapeutic setting, this research has not extended to equine interaction within the therapeutic environment for the SUD patient.

Engagement and retention within the therapeutic process are critical for the success of a therapeutic intervention [37]; however, dropout rates are quite high in the early stages of substance abuse treatment [23]. This timing of the loss of retention within the therapeutic intervention is attributed to the withdrawal stage during the treatment process for SUD. HPA axis regulation is altered during substance abuse, so the individual endures heightened stress responsivity including heightened levels of cortisol, which can, in turn, heighten drug cravings [40]. Chronic heightened levels of cortisol can further result in the hindrance of memory retrieval and memory organization, which are utilized within the learning of sober-living habits. Therapeutic strategies for the SUD patient that can overcome the negative impacts associated with HPA axis dysregulation are necessary for the retention of a patient within the therapeutic process. Equine interaction has been noted for its positive retention rates [23], although an investigation of HPA axis regulation has not been explored for SUD patients undergoing PIE. Friend et al. [24] studied the impact on cortisol within SUD patients undergoing withdrawal while being treated utilizing PIE, finding by the fourth week of intervention that cortisol levels decreased. As for further work investigating equines within the therapeutic intervention for SUD, Diaz et al. [23] performed a scoping review, reporting only nine papers that encompassed the treatment of SUD utilizing equine interaction. Further, only one of the reported papers within the review was published since the onset of the COVID-19 pandemic and none reported physiological measures. Thus, despite the positive qualitative measures reported in these previous studies, additional work is warranted to objectively determine the efficacy of this treatment approach, particularly as it pertains to physiological response.

1.2. Study Purpose

While equine interaction holds promise for addressing the mental health of the college student, research is limited specifically to the effects of this therapeutic intervention on the SUD participant. Therefore, the current study had three aims. The first aim was to determine the effects, both physiologically and behaviorally, on young adults participating in a short-term CRC-PIE program for SUD. The second aim was to determine whether physiological synchronization occurs between the human and horse through this therapeutic intervention. The third aim was to compare the behavioral effects of a CRC-PIE program to that of traditional CBT based within an indoor, office setting for young adults with SUD. This research is of value as this study measured the effects of therapy during the COVID-19 pandemic, when mental health challenges for the college-aged adult were on the rise and on-campus therapeutic interventions were limited. It offers an opportunity to review the effectiveness of such therapy approaches during the pandemic in addressing the mental health of the college student diagnosed with SUD.

2. Materials and Methods

2.1. Participants

2.1.1. Human Participants

Participants for this study were recruited by the mental health professionals associated with Dogwood Wellness Group in Starkville, Mississippi. Two groups of participants were recruited for this study, PIE participants and CBT participants. All participants were young adults diagnosed with SUD. PIE participants were recruited through a young adult short-term CRC-PIE program offered through Mississippi State University in Starkville, Mississippi, and conducted by the Dogwood Wellness Group, and the CBT participants were recruited from a young adult short-term CBT program offered through the American Addiction Centers' Oxford Treatment Resolutions Center in Oxford, Mississippi, working with the Dogwood Wellness Group. For both groups, Dogwood Wellness Group mental health professionals worked with participants during their therapeutic interventions and assisted researchers in tracking participant responses. Study participation was voluntary and open to all young adults participating in these programs during the recruitment period of the study. The recruitment period occurred during the first few months of the COVID-19 pandemic, between March and August of 2020. This period of recruitment fell within what was referred to as the 'first wave' of the COVID-19 pandemic, when anxiety levels were the highest within the young adult population due to risk perception [39]. All aspects associated with participation in this study were evaluated and approved by the Institutional Review Board at Mississippi State University prior to the onset of this study. For all human participants in this study, informed consent was obtained by the licensed mental health professionals associated with Dogwood Wellness Group and American Addiction Centers' Oxford Treatment Resolutions Center prior to the onset of this study. Consent documentation was in paper format and was stored at the treatment facilities associated with this study. All documentation was confidential.

For the PIE participants, a total of four young adults, 24 ± 1.4 years old, took part in a short-term CRC-PIE program for SUD. All activities for the program took place outdoors within the equine environment. The arena for the equine activities during PIE was an open-sided, covered arena. As for the CBT participants, a total of sixty-one young adults, 22 ± 3.2 years old, partook in a short-term CBT program for SUD. Since the drug of choice was reported not to have an effect on the physiological measures reported by Friend et al. [24] when investigating the impact of PIE on SUD during withdrawal, participants' drug of choice was not reported within the current study. All activities for the CBT program took place within an indoor, office setting. Both therapeutic interventions were conducted in a group setting with mental health professionals. According to the mental health professionals associated with these programs, each participant at the time of the study identified themselves as a healthy individual with no known health issues besides the prior diagnosis of SUD. All participants were documented by the mental health professionals for maintaining compliance in avoiding abusive behaviors related to any substance during their respective short-term therapy program associated with this study. During the study, the mental health professionals were responsible for monitoring the health status of the participants. Due to the physical nature of the activities related to the CRC-PIE program, vital signs were only measured during equine activities associated with this therapeutic intervention. The mental health professionals of the CRC-PIE program were responsible for monitoring these measurements. Vital signs measurements were utilized to track the physiological impact of the exercise intensity of the activities related to the CRC-PIE program and, thus, these measurements were not warranted for the CBT program participants.

2.1.2. Equine Participants

To determine whether a physiological synchronization occurs between human and horse participants within a PIE program, the horses participating in the short-term CRC-PIE program were engaged for this study. The horses included five adult horses (Age: 14.80 ± 5.40 years

including one gelding and four mares. According to the veterinary assessment prior to the onset of the study performed by the clinical professionals from Mississippi State University College of Veterinary Medicine, all horses were free of any health conditions impacting exercise tolerance and showed no gait abnormality that would impact soundness during the sessions. All monitoring of health status including vital signs measures were performed by these university professionals throughout the study. All horses were housed at the therapy facility associated with the university and had been regularly used in other PIE sessions prior to this study. Horses were housed throughout the study in paddocks with free-range pasture and were fed a diet of commercial forage and concentrate, along with being given free access to clean water. The housing and environment for the horses remained consistent throughout the study. All equine-related activities were evaluated and approved by the Mississippi State University Institutional Animal Care and Use Committee prior to the onset of the study.

2.2. Participant Therapy Activities

All participants, in both the PIE and CBT programs, took part in a short-term therapeutic intervention for SUD that rotated through the following topics: separation anxiety, family dynamics, communication, internal and external triggers, boundaries, and powerlessness [22,23,41]. For the equine activities associated with these topics, the activities followed a similar formatting to that of the OK Corral Series curriculum created by Greg Kersten [18,24,42]. This curriculum had been utilized by the mental health professionals assisting with this study five years prior to the study and, thus, the staff and horses were well acclimatized to the curriculum prior to the study and no changes were necessary concerning the equipment and facilities utilized for the sessions. Each session of both therapeutic interventions consisted of group discussion and, since this study investigated the effects of short-term therapeutic intervention for SUD, the maximum number of total hours of therapy for both groups was six hours. The maximum number of hours per session for the CRC-PIE program was one hour to ensure the welfare of the horses, while the CBT program participants could complete their therapeutic program within three to six sessions. The CRC-PIE program participants performed their group discussion while carrying out hands-on activities both on and off the horse [24]. The CRC-PIE program participants rotated through each of the five horses during the sessions.

2.3. Emotional Safety Evaluation

All participants were given a self-reporting survey instrument as described by Cagle-Holtcamp et al. [43] for evaluating emotional safety immediately prior to the first therapy session (FS) and immediately after the last therapy session (LS) for both the PIE and CBT programs. The evaluation was a 60-question survey instrument compiled from the following previously validated evaluations to assess the four aspects of emotional safety (personal security, respect, self-esteem, and connectivity): the Emotional Needs Scale (Questions 1–10) [44] and the GAD-7 (Questions 11–17) [45] measuring personal security; the Trust/Respect Assessment (Questions 18–34) [46] measuring respect; the Self-Esteem Inventory (Questions 35–46) [47] measuring self-esteem; and the Social Connectedness Scale (Questions 47–60) [48] measuring connectivity. When scoring this survey, questions with a positive point of view were scored as follows: Always—1, Sometimes—2, Seldom—3, Never—4, and N/A—0. Questions with a negative point of view were scored in a reverse manner that included the following: Never—1, Seldom—2, Sometimes—3, Always—4, and N/A—0. Using this scoring system, a final score that reflected a healthy emotional safety would be a score of 60, with each category reflecting an ideal score when a score of 15 was reached. Reliability associated with the assessment of emotional safety within the young adult population for the survey instrument utilized for this study was reported by Holtcamp et al. [49].

2.4. Vital Signs Measurements

Vital signs measurements for both the participants and their horses during the PIE sessions were a part of the protocol for the CRC-PIE program utilized for this study. This was due to the exercise-based activities associated with this therapeutic intervention and, thus, these measurements assisted in monitoring the health of the participants and the welfare of their horses. For this study, these measurements were documented by the mental health professionals with the assistance of the researchers to determine the effect of this therapeutic intervention, including potential physiological synchronization between human and horse. Specifically, heart and respiratory rates were documented to evaluate the stress level of the CRC-PIE program participant as these vital signs measurements have been shown to be indicators of stress in both humans [27,31,33] and horses [32]. Further, vital signs measurements for the CRC-PIE program included participant pain rating to track potential physiological stress, in which the Wong–Baker Faces Pain Rating Scale was utilized for monitoring participant pain associated with the activities within the CRC-PIE program [50–52]. Similar to the Wong–Baker Faces Pain Rating Scale for the participants, the following pain-related measurements of potential physiological stressors within the horse were taken to evaluate stress associated with the PIE activities: Equine Utrecht University Scale for Composite Pain Assessment (EQUUS-COMPASS) and Equine Utrecht University Scale for Facial Assessment of Pain (EQUUS-FAP) [50,53,54]. All of these measurements, both for the participants and their horses, were taken within ten minutes of the beginning (BS) and end (ES) of each session for the first session (FS) and last session (LS) of the CRC-PIE program. This timing for measurements was to document vital signs prior to complete recovery from exercise to resting rates [55–59].

2.5. Statistical Analysis

Statistical analysis including software utilized for analysis followed that of Friend et al. [24] and was selected due to the similarities in the nature of the studies performed. Descriptive statistics (means and standard deviations) were analyzed for each evaluation method performed in this study. A Shapiro–Wilk test for normality was performed resulting in $p > 0.05$ and, thus, a normal distribution of data was indicated. Data were analyzed using the MIXED procedure of SAS for the fixed effects of age, drug of choice, number of therapy sessions, and their respective interactions. An interaction was removed from the model when $p > 0.10$. All interactions met the requirement for removal (SAS software version 9.4, SAS Institute, Cary, NC, USA). A two-sample t-test was performed to compare post-therapy emotional safety scores taken at LS for CBT and PIE participants. For PIE participants, paired-sample t-tests were performed to compare emotional safety scores taken at FS and LS and vital signs measurements taken at FS and LS, including horse measurements. A second paired-sample t-test was conducted to compare vital signs measurements taken at BS and ES during FS and LS for PIE participants and their horses. A multivariate linear regression analysis was conducted to determine for PIE participants if a correlation was present concerning emotional safety and vital signs measurements. An additional regression analysis was utilized to identify a relationship between human and horse vital signs measurements and between human emotional safety scores and horse vital signs measurements. Statistical significance was set at 0.05.

3. Results

3.1. Emotional Safety Evaluation

For the CRC-PIE program participants, the mean total score for emotional safety measured prior to the first therapeutic session (FS) was lowered closer to the ideal score of 60 by the last therapeutic session (LS) of the program, but the change was not statistically significant ($p > 0.05$, Table 1). Respect was the only category in the emotional safety evaluation that saw an increase by the LS, but it was not significant ($p > 0.05$). When comparing the PIE and CBT programs, the outcome between the two programs indicated that total emotional safety scores were significantly lower in the PIE participants by the

end of the short-term therapeutic intervention ($p < 0.05$, Table 2). While all scores were lower in the PIE participants, personal security was the only category that was significantly different between the two programs ($p < 0.05$).

Table 1. Means (standard deviations) of the emotional safety evaluation taken prior to the first therapeutic session and after the last therapeutic session for college students in a short-term collegiate recovery community psychotherapy program incorporating equine interaction for substance abuse disorder.

Categories of Emotional Safety *	First Session	Last Session	<i>p</i> -Value
Personal Security	36.50 (15.02)	34.25 (8.50)	0.85
Respect	23.50 (5.26)	23.75 (6.19)	0.97
Self-Esteem	25.50 (9.47)	22.25 (4.99)	0.67
Connectivity	30.50 (3.00)	30.50 (7.77)	1.00
Total Scores	116.00 (28.12)	110.75 (25.42)	0.85

* The ideal score for the emotional safety evaluation is 60. Total scores lowering towards 60 are considered improvements.

Table 2. Means (standard deviations) for emotional safety evaluations for young adults with substance abuse disorder after participating in a short-term cognitive behavioral talk therapy (CBT) compared to those participating in a short-term collegiate recovery community psychotherapy program incorporating equine interaction (PIE).

Categories of Emotional Safety *	CBT (<i>n</i> = 61)	PIE (<i>n</i> = 4)	<i>p</i> -Value
Personal Security	39.98 (14.23)	34.25 (8.50)	0.04
Respect	27.86 (8.75)	23.75 (6.19)	0.17
Self-Esteem	26.00 (9.41)	22.25 (4.99)	0.59
Connectivity	32.63 (9.07)	30.50 (7.77)	0.73
Total Evaluation Score	126.47 (36.18)	110.75 (25.42)	0.04

* The ideal score for the emotional safety evaluation is 60. Total scores lowering towards 60 are considered improvements.

3.2. Vital Signs Measurements

3.2.1. Human Measurements

During the short-term CRC-PIE program, all human heart and respiratory rates that were measured fell within normal healthy adult ranges (Figures 1 and 2) [60,61]. For heart rate measurements, there were no significant differences between the first (FS) and last (LS) therapeutic sessions for those measurements taken at the beginning of the session (BS) ($p = 0.42$) or those taken at the end of the session (ES) ($p = 0.18$) (Figure 1). When heart rate measurements from LS and FS were combined (LFS), a lack of significant difference was further observed in comparing BS and ES measures ($p = 0.06$, Figure 1).

For respiratory rate measurements, there were no significant differences between the first (FS) and last (LS) therapeutic sessions for those measurements taken at the beginning of the session (BS) ($p = 0.23$) or those taken at the end of the session (ES) ($p = 0.63$, Figure 2). When respiratory rate measurements from the first and last therapeutic sessions were combined (FLS), a significant difference was observed when comparing BS and ES measures ($p = 0.01$, Figure 2).

For perceived human pain rating scores, there were no significant differences between FS and LS for BS scores (FS = 1.0 ± 1.0 , LS = 0.0 ± 0.0 , $p = 0.23$) or ES scores (FS = 0.0 ± 0.0 , LS = 0.0 ± 0.0 , $p = 1.00$). When pain scores from the first and last therapeutic sessions were combined (FLS), a significant difference was observed when comparing BS and ES scores (BS = 0.88 ± 1.37 , ES = 0.25 ± 0.79 , $p = 0.03$).

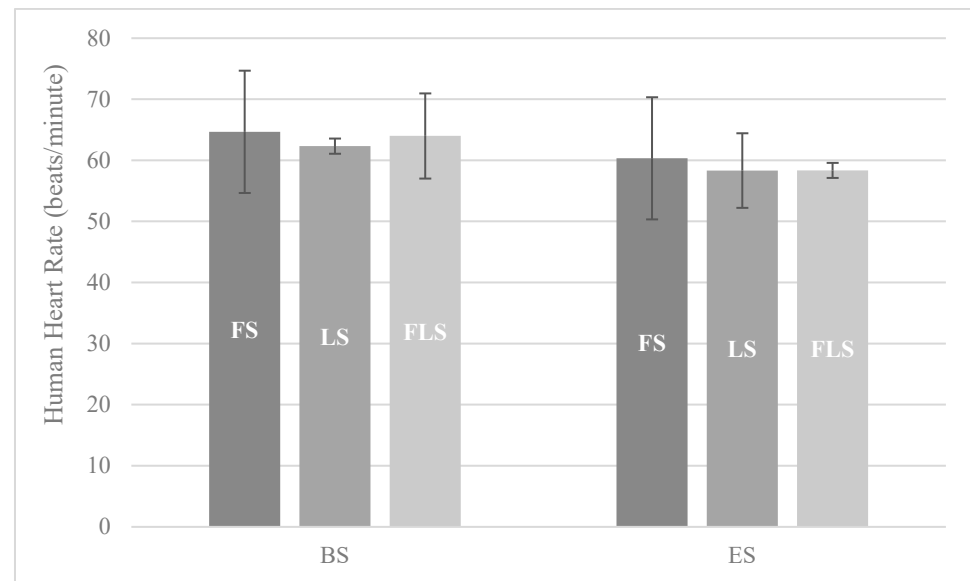


Figure 1. Human heart rate measurements recorded at the beginning (BS) and end (ES) of the first therapeutic session (FS) and after the last therapeutic session (LS), along with combined measures of the first and last therapeutic sessions (FLS) for a short-term collegiate recovery community psychotherapy program incorporating equine interaction for substance abuse disorder. No significant differences were observed between measurements ($p > 0.05$).

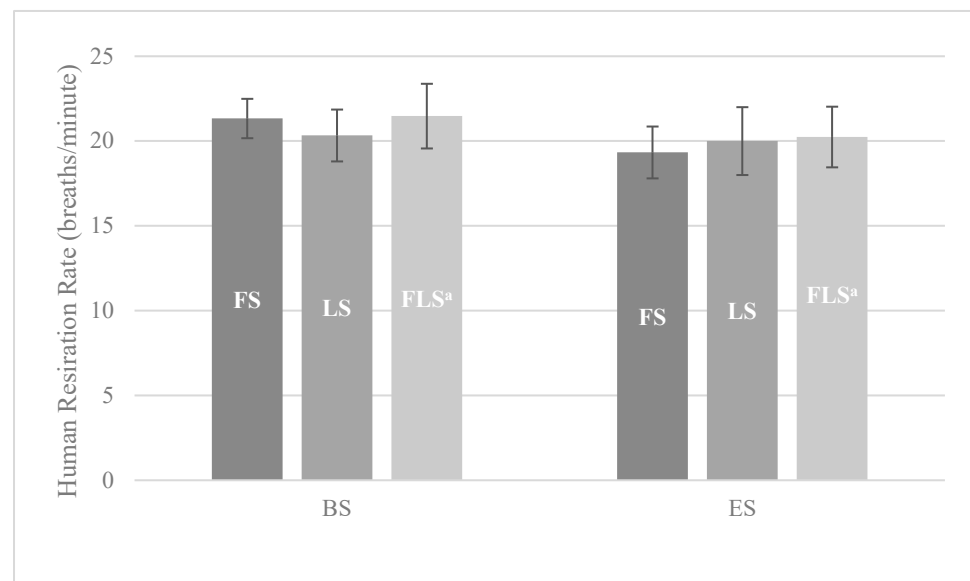


Figure 2. Human respiratory rate measurements recorded at the beginning (BS) and end (ES) of the first therapeutic session (FS) and after the last therapeutic session (LS), along with combined measures of the first and last therapeutic sessions (FLS) for a short-term collegiate recovery community psychotherapy program incorporating equine interaction for substance abuse disorder. A similar superscript ('a') is utilized within the bar label to indicate a significant difference between FLS measurements ($p < 0.05$).

3.2.2. Equine Measurements

All equine heart and respiratory rates measured throughout the short-term CRC-PIE program fell within normal ranges for healthy adult horses (Figures 3 and 4) [56,62]. For heart rate measurements, there was a significant difference between FS and LS for those measurements taken at the beginning of the session (BS) ($p = 0.01$), but not for those taken at the end of the session (ES) ($p = 1.00$) (Figure 3). When heart rate measurements were

combined between the first and last therapeutic sessions (FLS), a significant difference was observed when comparing BS and ES measures (Figure 3, $p = 0.01$).

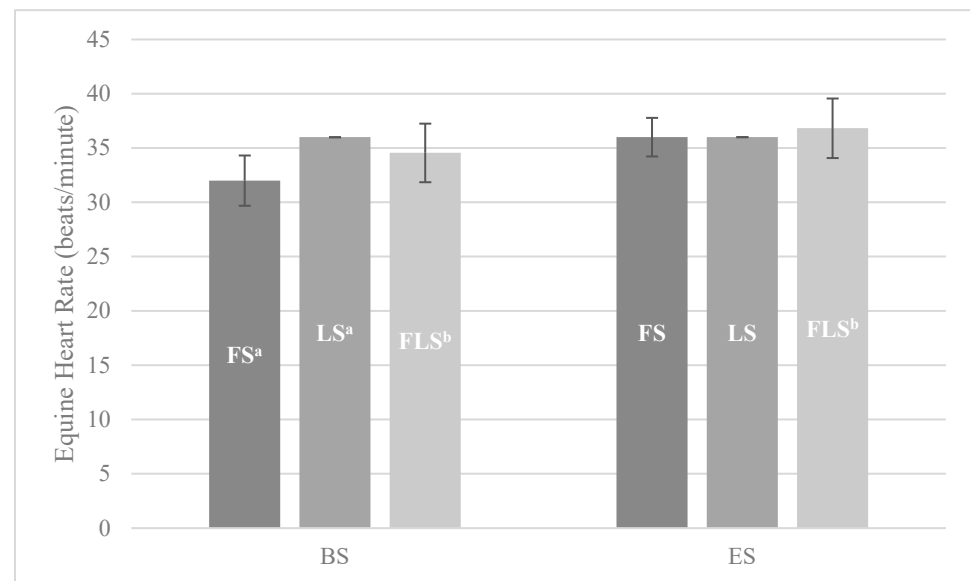


Figure 3. Equine heart rate measurements recorded at the beginning (BS) and end (ES) of the first therapeutic session (FS) and after the last therapeutic session (LS) along with combined measures of the first and last therapeutic sessions (FLS) for a short-term collegiate recovery community psychotherapy program incorporating equine interaction for substance abuse disorder. Similar superscripts are utilized within the bar labels to indicate significant differences between FS and LS measurements associated with BS ('a') and between FLS ('b') measurements ($p < 0.05$).

As for comparisons between emotional safety and physiological measures, comparisons were made between emotional safety scores and both human and equine vital signs measures. As for the relationship between emotional safety and human vital signs measures, no correlations were observed between emotional safety and heart rates ($R = 0.19$, $R^2 = 0.04$) or between emotional safety and pain rating scores ($R = 0.14$, $R^2 = 0.03$). A positive correlation was found between emotional safety and respiratory rates ($R = 0.68$, $R^2 = 0.47$). When heart and respiratory rates were combined with pain rating scores, a perfect linear relationship was found with emotional safety ($R = 1.00$, $R^2 = 1.00$). As for the relationship between emotional safety and equine vital signs, no correlations between emotional safety and respiratory rates ($R = 0.01$, $R^2 = 0.00$) or between emotional safety and pain rating scores (EQUUS-COMPASS: $R = 0.13$, $R^2 = 0.02$; EQUUS-FAP: $R = 0.00$, $R^2 = 0.00$) were observed for equines. A weak positive correlation was found between emotional safety and equine heart rates ($R = 0.49$, $R^2 = 0.24$). When heart and respiratory rates were combined with EQUUS-COMPASS scores for equines, a perfect linear relationship was found with emotional safety ($R = 1.00$, $R^2 = 1.00$). No correlations were found with any of the comparisons given above when EQUUS-COMPASS scores were replaced with EQUUS-FAP scores ($R = 0.00$, $R^2 = 0.00$).

For respiratory rate measurements, there was not a significant difference between FS and LS for those measurements taken at the beginning of the session (BS) ($p = 1.00$), but a significant difference was noted for ES measurements ($p = 0.01$) (Figure 4). When respiratory rate measurements from the first and last therapeutic sessions were combined (FLS), a significant difference was further observed when comparing BS and ES measures (Figure 4, $p = 0.01$).

When evaluating the equine pain rating scoring (EQUUS-FAP and EQUUS-COMPASS), no significant differences were found between FS and LS for BS scores (Table 3, $p > 0.05$) or ES scores (Table 3, $p > 0.05$). A significant difference was found between BS and ES when FS and LS scores were combined (FLS) for the EQUUS-FAP scores (BS = 0.18 ± 0.41 ,

ES = 0.00 ± 0.00 , $p = 0.01$), although no significant changes were seen in the EQUUS-COMPASS scores (BS = 2.09 ± 1.30 , ES = 1.00 ± 1.00 , $p = 0.17$). Despite the changes observed, all scores recorded during the duration of the short-term program fell within a normal range for healthy adult horses [50,53].

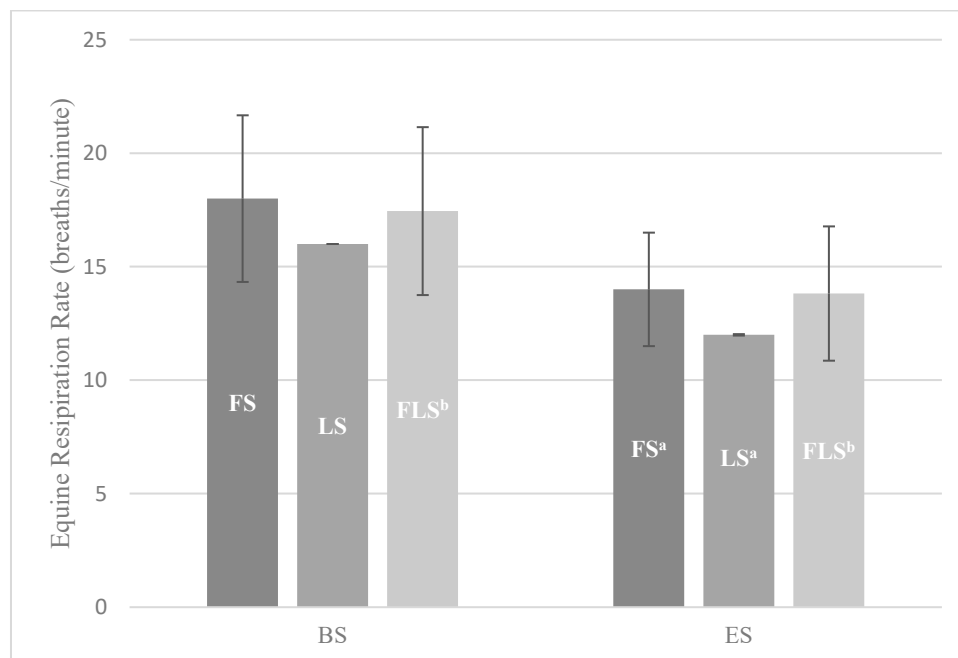


Figure 4. Equine respiratory rate measurements recorded at the beginning (BS) and end (ES) of the first therapeutic session (FS) and after the last therapeutic session (LS), along with combined measures of the first and last therapeutic sessions (FLS) for a short-term collegiate recovery community psychotherapy program incorporating equine interaction for substance abuse disorder. Similar superscripts are utilized within the bar labels to indicate significant differences between FS and LS measurements associated with ES ('a') and between FLS ('b') measurements ($p < 0.05$).

Table 3. Means (standard deviations) for equine pain rating scores (EQUUS-COMPASS and EQUUS-FAP) taken at the beginning (BS) and the end (ES) of the first (FS) and last (LS) therapeutic sessions for horses in a short-term collegiate recovery community psychotherapy program incorporating equine interaction for substance abuse disorder.

Pain Measures	First Session	Last Session	<i>p</i> -Value
EQUUS-COMPASS			
BS	1.00 (1.00)	1.00 (0.50)	1.00
ES	1.00 (0.50)	0.00 (0.00)	0.39
EQUUS-FAP			
BS	1.00 (1.00)	0.00 (0.00)	1.00
ES	0.00 (0.00)	0.00 (0.00)	1.00

EQUUS-FAP [33] was rated on a 0–2 scale, with 2 indicating severe pain. The EQUUS-COMPASS [32] was rated on a 0–3 scale, with 3 indicating severe pain.

In comparing vital signs measurements, human and equine participants demonstrated a moderate positive correlation in relation to the respiration rates ($R = 0.65$, $R^2 = 0.42$). Correlations were weaker between human and equine heart rates ($R = 0.54$, $R^2 = 0.21$) and human pain rating scores (Wong–Baker Faces Pain Rating Scale) and equine pain rating scores (EQUUS-FAP) ($R = 0.27$, $R^2 = 0.17$). When heart and respiratory rates were combined with pain rating scores (EQUUS-FAP), a strong positive correlation was indicated ($R = 0.73$,

$R^2 = 0.53$). No correlations were found with any of the comparisons given above when EQUUS-FAP scores were replaced with EQUUS COMPASS scores ($R = 0.00$, $R^2 = 0.00$).

4. Discussion

Overdose is the leading cause of death in young adults in the United States and the COVID-19 pandemic in 2020 created additional barriers for young adults trying to combat substance abuse [63]. While traditional intervention programs have offered some support for those college students in need of mental health support, these programs often faced hurdles in intergrading within a more intensive academic curriculum [64], and further challenges were encountered during the COVID-19 pandemic due to pandemic-related quarantine and social distancing protocols—these barriers persisted for years to follow [65]. To combat these hurdles, non-traditional approaches to mental health services such as PIE have grown on college campuses [12] and, thus, the current study aimed to determine the effect of a short-term CRC-PIE program for SUD on participants compared to that of traditional CBT and investigate the potential physiological synchronization within the therapeutic environment between human and horse. This study holds value as it encompasses the time period during the first wave of the pandemic when students faced heightened anxiety and stress [39]. The efficacy of this short-term therapeutic intervention as discussed within the following sections, even within the unique circumstance of the pandemic, holds promise in moving forward with this non-traditional approach in therapeutic interventions in addressing the needs of the college student struggling with SUD.

4.1. Human Physiological and Behavioral Responses

Although no significant changes were seen in self-perceived emotional safety scores, the total scores measured within this study did move closer to the ideal emotional safety score of 60 for the young adults with SUD participating in the short-term CRC-PIE program, and these scores were significantly lower than those seen with traditional CBT. In comparing other collegiate-based equine interactive activities, Evans et al. [66] evaluated self-esteem, one of the categories of emotional safety, within college students and reported that students improved their self-esteem by the end of a semester-long equine course centered around the therapeutic nature of equine interaction. Further, it is important to note that while the risk of working with horses may be a deterrent for colleges wanting to implement a CRC-PIE program for the general student population, both the current study and previous studies focusing on college-age adults engaging in equine interaction activities [49,66] did not encounter any incidences of participant injuries, either for humans or horses. As such, this lack of injury during equine activities may suggest the achievement of creating an emotionally safe environment for promoting learning, specifically as it relates to skill development associated with safe equine handling practices. While skill evaluation was not performed in this study, Cagle-Holtcamp et al. [17] saw a development of equine-based skills as emotional safety improved for at-risk teenagers participating in a four-week PIE program. Interestingly, the previous study determined a significant improvement specifically within the emotional safety category of personal security, which was the same category observed within this study that was significantly lower than for traditional CBT. Skill development may be reflected by personal security scores and, as such, future studies looking at the impact of PIE may consider incorporating participant skill evaluation as this may help to support improvements seen in emotional safety. Further, according to Lee et al. [48], college-aged students demonstrating improved equine handling skills also reported improved confidence. While not significant, the biggest change in CRC-PIE participants seen in emotional safety scores for the current study was in the category of self-esteem; thus, these scores could be reflective of skill development as a product of the PIE sessions. As for other emotional safety categories warranting further investigation, although respect was a category of emotional safety that showed minimal change within this study, Evans et al. [67] reported improvement in respect when assessing skill development associated with a youth livestock program. Development of skills indicates the ability to learn and, thus, cognitive function. Cognitive function within SUD patients, particularly memory development and organization, is hindered by HPA axis

dysregulation, which is commonly observed with chronic substance abuse [29,40]. As such, the learning of skills can indicate improved function within the HPA axis for SUD patients. With this in mind, the results observed in the current study and those of previous studies suggest that the assessment of skill development may assist in understanding the impact on emotional safety for participants by determining whether PIE promotes an environment conducive to learning.

Due to the outdoor, open-spaced environment available with PIE, the program did remain functional, even though on-campus programs remained limited during and after the COVID-19 pandemic. While larger participant numbers were available for the CBT program for this study, as there were 61 CBT participants compared to 4 PIE participants, the measures required for offering these sessions while following pandemic quarantine and social distancing guidelines may have resulted in the significant differences observed between the two therapeutic interventions both in total scores for emotional safety and for scores specifically for personal security. For the CRC-PIE program, each participant had space to self-distance while still partnering with a horse to complete the activities. The location was off campus and outdoors, which gave the participants an alternative space from that of their self-isolating pandemic routines, while also giving them access to physical exercise. Although this off-campus setting may have deterred some participants, this unique therapeutic setting may be more effective in facilitating the development of an emotionally safe learning environment. In fact, Friend et al. [24] noted a significant decrease in cortisol levels seen in SUD patients within the equine environment, even without the presence of a horse. Unfortunately, regarding comparisons of the two therapy types within the current study, it was not just the presence of the horse that distinguished the two therapies but also the differences within the environments as one was outdoors and the other was indoors. As such, further research should compare the two therapy types within the same setting. Nonetheless, additional investigation of an outdoor setting for the therapeutic environment is warranted as previous studies have noted improved psychological well-being with outdoor exercise in comparison with indoor exercise, allowing for an increased connectedness to nature [68–70]. With isolation being a leading cause of SUD relapse rates [7,11], this connectedness may assist in improving mental well-being [71].

The benefits observed within the current study, however, may be more related to the exercise itself, rather than the environment, as Doherty and Miravalles [72] reported that movement improves cognition, not only increasing vascularization within the brain that promotes the circulation of oxygen and glucose needed for neurofunction but also improving the responsivity of neurotransmitters that assist with neurogenesis and memory. For SUD patients where dysregulation of the HPA axis does occur, these changes within the brain due to movement can be extremely vital in learning sober-living habits [73]. In addition, although the emotional safety scores may have not reflected this improved mental well-being, the lowering of respiratory rates and pain rating scores by the end of the PIE sessions for human participants could be reflective of the lowering of cortisol levels, suggesting that the HPA over-activation commonly observed in SUD may have ceased during the therapeutic process, but further work is needed to test this possibility.

Interestingly, despite the lack of significant changes in emotional safety scores, a direct relationship was seen between vital signs measurements and emotional safety in the human participants. This suggests that the status of human physiological parameters can influence mental well-being, as supported by previous studies [33,74,75]. With exercise, it is noted the brain releases ‘feel-good’ chemicals, which, in turn, minimizes stress responses, resulting in the improved regulation of emotions, including decreased anxiety [76]. As such, the reductions seen in respiratory rates and pain rating scores are all reflective of this response achieved through exercise, even in the form of equine activities associated with PIE. Nevertheless, similar to any form of conditioning, longer training often results in the improved recovery of vital signs after exercise [77–79] and, thus, brings into question whether longer programming beyond the short-term period of this program might have brought about further improvement in vital signs. A potential need for longer programming may, however, be a deterrent to implementation within a more intensive

academic curriculum found on college campuses due to the rigorous scheduling of student coursework [64]. The shorter programming for the current study was due to restrictions associated with the COVID-19 pandemic. Nonetheless, while short-term programming is common in therapeutic interventions utilizing the horse, guidelines concerning the length of a treatment program for SUD are unavailable at this time. The extent of equine interaction found in previous studies concerning PIE can vary from 2 weeks to 24 weeks [18,24,80,81]. In addition, due to the fact that this was a short-term program, mounted activities on the horse were minimized; thus, longer, more riding-intensive programs may offer further changes in physiological measures than what was observed in this study. Nonetheless, this lack of program guidelines and variability between programming suggests that further research concerning PIE curricula and programming specific to SUD is warranted.

4.2. Human–Horse Physiological Synchrony

Heart rate has been documented to improve for individuals who participate in exercises for aiding cardiac rehabilitation [82], and perceived pain has been reported to decrease when individuals take part in general exercises [83]. In the current study, all human measurements decreased by the end of the PIE session, with both respiratory rates and perceived pain demonstrating a significant decrease. Interestingly, while human participant vital signs measurements decreased, the heart rates for equine participants significantly increased by the end of the PIE session, and the relationship between the heart rates of humans and horse was weak. Kleinbub et al. [37], on the other hand, found a synchronization of heart rates within the clinical relationship between patient and therapist. Although Kleinbub et al. [37] did not investigate the human–equine relationship, this synchronization within a therapeutic setting was further supported within the equine therapeutic environment between humans and horses, according to Guidi et al. [36]. Physiological synchronization is important within the therapeutic environment as it demonstrates cohesion and togetherness, promoting empathic conversations not only between therapist and patient but also between those participating in group therapy processes [37,84,85]. Although participants within the current study rotated through the horses utilized within the therapy sessions so that the human participant was not working directly with one horse throughout the entire therapy process, physiological synchronization within a group setting is noted by Gordon et al. [84] and Murata et al. [85], which was determined to create group cohesion and behavioral synchronization. Specifically, instead of direct interaction between the two individuals tasked with playing a game, Murata et al. [85] observed heart rate synchronization between the first and third person, a person playing a game, and the advisor for that individual. Gordon et al. [84] went on to document this form of synchronization observed through hearts' interbeat intervals taken from electrocardiograms within a group of college-aged adults tasked with drumming as a group. These studies, however, did not research synchronization within human–equine interaction. Nonetheless, the absence of heart rate synchronization within the current study may be due to the fact that horse recovery after exercise, as reported by Lindner et al. [30], is determined by each horse's resting heart rate. Furthermore, a horse's heart rate can be influenced by age, breed, and gender, and, in the case of this study, recovery from exercise could have been particularly impacted by the older age of the horses performing the therapy activities [62]. Additionally, in a similar study reporting the impact of therapeutic interactions on horses, Merckies et al. [86] reported that the experience of the human participant may have more of an influence on horse heart rate than the participant's disability and the activities of the session. If that is the case, then this may be a factor to consider with students participating in PIE. As such, the variability of heart rate suggests that heart rate may not be a reliable measure by itself for assessing the impact of PIE on therapy horses. While research has utilized cortisol measures to determine the impact of these interactions on the horse [24,87,88], limited research has utilized respiratory rates [87,88] and, to date, no studies have employed the use of pain rating scoring systems. Nonetheless, understanding the physiological impact that this therapeutic intervention has on the therapy animal is

important for ensuring animal welfare. Moreover, changes observed in the horse may be the result of negative physiological effects associated with the human participants within this therapeutic intervention, but further research is needed to make such conclusions at this time.

Pain rating scoring systems have been utilized as another form of measuring vital signs as pain is considered to be reflective of stressors within the animal [51]. As for the current study, a drop in pain rating scores for both humans and horses within this study was found by the end of the PIE sessions. A significant decrease in pain rating scores for horses, however, was only observed in one of the two pain scoring systems used and a correlation between pain rating scores for horses and humans was absent. Similar to this study, EQUUS-FAP has been utilized in equine clinical studies to detect pain in the horse, and these studies were able to track significant changes in pain within the horse, but, unlike this study, these previous studies reported that EQUUS-FAP results matched those measured using other pain rating scoring systems [54,89]. Unfortunately, the EQUUS-FAP was the only system finding significant results within this study for the horse over the time period tracked. In addition, although cortisol was not measured in this study, it has been used in tracking stress-related responses to therapeutic interventions in both humans [24,81,90] and horses [23,88,91,92]. However, the variability associated with cortisol measurements documented by previous equine studies limits the interpretation of such measurements [23,88]. In the end, further research concerning the tracking of physiological responses to exercise is warranted to determine what would be the most reliable and consistent measurement methodology for evaluating the impact of this form of exercise therapy and the potential physiological synchronization between human and horse during this type of therapeutic intervention. Nonetheless, while no single measurement was found to have a strong correlation between human and horse, the utilization of multiple assessments of physiological responses had the strongest correlation when assessing the physiological synchronization between human and horse. Interestingly, this relationship between human and horse can be further explored by examining the mental state of the human participant, as this study found a perfect positive correlation between emotional safety and horse vital signs. This link between physiological synchrony and emotional recognition was observed by Murata et al. [85] within a group setting and was credited with creating cohesion between the group members; however, this relationship has yet to be investigated within the therapeutic equine environment. Nonetheless, it is a combination of the vital signs measured that resulted in that correlation and, for pain rating scores for the horse, it was with EQUUS-COMPASS, not EQUUS-FAP, when combined with heart and respiratory rates that this relationship was present. As such, this emphasizes the need for a multi-assessment approach when evaluating this interaction between human and horse.

4.3. Limitations of This Study

Despite the environment allowing for the therapeutic intervention to occur when limited mental health programs were available during the COVID-19 pandemic, this study was limited in the number of participants for the CRC-PIE program as only four college-aged students with SUD signed up to participate. The convenience in location for participants associated with the CBT program allowed for a larger number of participants. Nevertheless, although our sample size for the PIE participants would be considered underpowered, limiting further statistical analysis, recruitment efforts for the study occurred during the COVID-19 pandemic, making it difficult to reach potential participants for this non-traditional treatment option. It is, however, important to note that the participation of young adults struggling with SUD in treatment programs is traditionally quite low [93–95]. In fact, this group can be one of the most difficult to recruit and maintain in treatment programs without intensive recruitment efforts due to the stigma associated with mental illness [96]. Additionally, due to the therapeutic interventions within this study taking place within active therapy programs instead of a research facility, data collection was limited to what was provided by the mental health professionals and, as such, pre-therapy

survey data were not available for this study for the CBT patients. Similarly, vital signs measurements were not considered necessary for CBT patients during their therapy sessions and, thus, these data were not available for further comparisons with the PIE participants. Although this limited the ability to conduct further comparisons of the two therapy types, the use of active ongoing therapy programs, rather than one facilitated within a research setting, was deemed valuable by the researchers as it directly depicted the effectiveness of therapy programs during the pandemic for addressing the needs of their patients.

Although participant numbers were low within the current study, it is important to note that all participants completed the short-term program, with all taking part in every activity required for each session of PIE, despite being off-campus and less convenient in comparison to the CBT program. With all participants being 100% compliant with the treatment process, this is quite an accomplishment for college-aged adults struggling with mental health. Similarly, Cagle-Holtcamp et al. [17] reported 100% compliance with teenagers labeled ‘at-risk’ participating in a weekly therapeutic intervention utilizing the horse. Researchers attributed the compliance rate to the ‘connectedness’ that teenagers established with their horses during the therapy process. In the end, 100% compliance rates are not typical for most mental health treatment programs working with young adults [41,94,97,98], and this high compliance rate found in the current study occurred during the pandemic while further barriers persisted. This is reflective of the retention rates seen in residential SUD programs where PIE was available, indicating that the equine environment may be conducive to participation in mental health programs [18,88].

5. Conclusions

Recovery communities on collegiate campuses are utilizing non-traditional options to keep college-age young adults engaged in the recovery process from substance abuse. These programs are critical for the college student that encounters high rates of stress, anxiety, and depression, and these programs offer an effective treatment option from that of traditional CBT in developing emotional safety, particularly as it pertains to personal security. Further, full compliance in the form of the completion of all hours associated with the therapeutic curriculum can be achieved with a CRC-PIE program for SUD and, despite the physical nature of PIE, participants can benefit from reduced physiological measures, specifically respiratory rates and pain rating scores. While short-term intervention may not be enough for self-perceived emotional safety improvement through PIE for college students with SUD, the tracking of emotional safety can reflect physiological measures in both humans and horses. Moreover, the tracking of physiological measures of the therapy horse can indicate the physiological impact of PIE on the human participant, suggesting a potential physiological synchronization between humans and horses during the therapeutic process. These assessment tools can assist in giving further insight into the potential benefits for colleges looking to implement PIE-based CRC programs for their students.

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