A feasibility trial of an instructed breathing course in prison to improve emotion regulation in people with substance abuse difficulties

Running head: Feasibility of an instructed breathing course

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Abstract

The recurring cycle of substance abuse can be associated with difficulties in emotion regulation. It has been proposed that advantageous emotion regulation is positively associated with heart rate variability (HRV), and that slow-paced breathing can increase values of HRV. We explored the feasibility of delivering a six-week, slow-paced breathing intervention in a prison setting, and investigated the effects of the intervention on indices of emotion regulation and psychological distress. The final sample consisted of seven male prisoners with histories of illicit substance and alcohol abuse who were identified as presenting with difficulties in emotion regulation. The intervention was delivered with the use of a device that provides a visual aid to encourage a cycle of breathing that corresponds to six breaths per minute (i.e., 0.1 Hz) over a series of instructed breathing sessions. Changes in scores for psychometric measures were analysed with the Reliable and Clinically Significant Change Statistic. Most participants reported improvements in scores for depression, anxiety, and stress. A qualitative account of interviews with participants and factors influencing successful delivery of sessions was also included for the purposes of triangulation and to inform on feasibility. It is concluded that further evaluation of the intervention is feasible, and that the intervention offers promise for improving emotion regulation in offenders with histories of illicit substance and alcohol abuse.

Keywords: substance abuse, emotion regulation, heart rate variability, offenders, intervention

Substance use disorder can be defined as a complex neurobiological condition

characterised by a recurrent pattern of substance intoxication despite negative consequences

(Goldstein & Volkow, 2002). It is estimated that about 30% of men in UK prisons suffer

from substance abuse and dependence, including illicit substances and alcohol (Fazel, Bains,

& Doll, 2006). Habitual substance use can be described as a recurrent pattern of substance

intoxication, craving, compulsive administration, and withdrawal (Goldstein & Volkow,

2002). The cycle of substance use disorder, particularly the craving and withdrawal stages,

are typically accompanied by adverse psychological symptoms, including depression,

anxiety, stress, and anger (Kober, 2014; Brady, 2005; Grant et al., 2004; Sinha, 2008;

Aharonovich, Nguyen, & Nunes, 2001). Relapse into substance abuse has been linked with a

strong need to take substances that have the propensity to both alleviate and cause the adverse

symptoms (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Kober, 2014). Hence,

substance abuse can be seen partly as a behaviour that aims to regulate the adverse

symptoms. Therefore, interventions aimed at improving relapse prevention outcomes may

benefit from alleviating the adverse psychological symptoms associated with substance abuse

by introducing alternative mechanisms of regulation.

Negative symptoms associated with substance abuse include an impaired ability to

effectively regulate emotions (Gross & Muñoz, 1995; Martin & Dahlen, 2005; Sinha, 2008;

Gross & John, 2003). 'Emotion regulation' can be described as the ability to modify one's

personal experience of emotion, or perception of an emotional event (Aldao, Nolen-

Hoeksema, & Schweizer, 2010; Gross, 1998). Theoretical models of emotion regulation list

various emotion regulation strategies that can be used to either up-regulate or down-regulate

an emotional response (Gillespie & Beech, 2016). According to the process model (Gross,

2014), these strategies fall largely in to antecedent focussed (for example, situation selection, distraction or reappraisal) and response focussed (for example, suppression) strategies. Two of the most cited strategies are cognitive reappraisal and expressive suppression (Gross & John, 2003). Reappraisal is a process of change in cognitive interpretation of an emotion-evoking situation, whereas suppression is a process of inhibition of emotion-related responses. Scores on measures of reappraisal, but not suppression, have been positively associated with desirable psychological characteristics (Aldao et al., 2010).

Mindfulness has also been described as a type of emotion regulation strategy (Chambers, Gullone, & Allen, 2009). Mindfulness is defined as acting with awareness in the present moment, and maintaining a curious attitude of openness toward thoughts, feelings, and sensations, allowing and acknowledging their presence with an orientation of acceptance (Bishop et al., 2004). Acting with awareness refers to attending to one's immediate experience by focusing on the here and now. Being non-judgemental is associated with being accepting of personal experiences without judgement of the self. Mindfulness based therapies have been reported to be effective in reducing symptoms of depression and anxiety (Hofmann, Sawyer, Witt, & Oh, 2010). Hence, therapeutic interventions aimed at reducing substance abuse problems may benefit from promoting desirable shifts in the ability to regulate emotions.

It has been proposed that enhancing emotion regulation via slow-paced, instructed breathing techniques may be particularly effective for prison-based psychological interventions. This proposal reflects a research and practice driven consensus that difficulties in emotion regulation are typical for offenders (Gillespie, Garofalo, & Velotti, 2018; Gillespie, Mitchell, Fisher, & Beech, 2012; Gillespie & Beech, 2016; Day, 2009), and that there is a growing need to implement a *biopsychosocial* approach in the treatment of people with convictions, advocated by Carter and Mann (2016). Delivery of the interventions may

vary but in principle, all variants ask participants to slow the breath to approximately six breath cycles per minute and maintain the pace for a pre-determined number of minutes (Bernardi, Porta, Gabutti, Spicuzza, & Sleight, 2001). The technique does not need to be delivered by a qualified professional, nor does it require a high level of cognitive engagement, which often represents a difficulty with traditional cognitive behavioural therapies in forensic settings. Hence, the potential advantages may include favourability of the intervention by the participants, cost-effectiveness, and capacity of the institution to deliver the intervention. Importantly, slow paced instructed breathing courses are known to improve emotion regulation, and reduce symptoms of depression, anxiety, stress, and anger in non-forensic samples with various psychological and medical conditions, including general anxiety disorder, depression, and coronary heart disease (Mather & Thayer, 2018; Nolan et al., 2005; Renier, 2008; Karavidas et al., 2007). However, there is a limited account of the feasibility and potential effectiveness of using this type of interventions in prisons.

In this study we conducted an uncontrolled pilot feasibility study (Eldridge et al., 2016), to investigate the effectiveness and feasibility of delivering a slow-paced breathing intervention to male prisoners with illicit substance and alcohol use problems. The PICO framework (Richardson, Wilson, Nishikawa, & Hayward, 1995) was adopted to specify the study aims and objectives:

Population: Is it feasible to identify, recruit and retain male prisoners with substance abuse problems and difficulties in emotion regulation?

Intervention: Is the setup and delivery of the intervention feasible? Do participants find it difficult to follow instructions?

Comparison: This study did not aim to test the feasibility of a control arm.

Outcomes: Are the selected measures valid indicators of treatment effects? Do participants report treatment relevant effects during one-to-one interviews?

<center>**Method**</center>

Recruitment Criteria

The participants were recruited from a U.K. based, male only prison. Criteria for

recruitment of the treatment sample stated that participants had to be imprisoned, have a

documented history of any type of substance abuse, are receiving pharmacological treatment

for substance abuse and have recently experienced problematic emotion regulation,

evidenced by angry outbursts, low mood, or anxious demeanour. Exclusion criteria were

recent evidence of violence and an early release date preventing completion of the study. The

criteria were explained to qualified nursing staff who were asked to select up to ten

participants with the use of medical and offence related records. The nursing staff identified

ten candidates, all of whom were approached and successfully recruited by the nursing staff.

Psychometric Questionnaires[1]

Emotion Regulation Questionnaire [ERQ]. The ERQ (Gross & John, 2003)

contains a total of 10 items enquiring about the use of two separate strategies for emotion

regulation, namely Cognitive Reappraisal and Expressive Suppression. Respondents are

asked to rate each item on a seven-point Likert scale. Gross and John (2003) report alpha

reliability for reappraisal is α=.79, and for suppression α=.73.

Depression Anxiety Stress Scales 21 [DASS-21]. The DASS-21 (Henry &

Crawford, 2005) is a 21-item short form of Lovibond and Lovibond's (1995) 42-item self-

report measure of depression, anxiety, and stress (DASS). It measures the intensity of three

psychological constructs, namely depression, anxiety, and stress. Respondents are asked to

rate a series of statements on a four-point scale from zero to three. The authors reported alpha

reliability for depression equals α=.88, anxiety α=.82, and stress α=.90.

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[1] Alpha reliabilities for the current outcomes were not calculated due to the small sample size. However, reliabilities reported in previously published articles are included.

State Trait Anger Expression Inventory [STAXI-2]. The STAXI-2 (Spielberger, 1999) is a comprehensive anger assessment questionnaire. There are four subscales of the STAXI-2. Anger Expression Out measures the frequency of verbal and behavioural expression of anger. Anger Expression In evaluates how often the person inverts anger on himself. Anger Control Out measures how often the person succeeds in controlling angry affect. Anger Control In assesses how often the person attempts to calm himself down. Each of these subscales comprises eight questions answered on a four-point Likert scale. According to Lievaart, Franken, & Hovens, (2016), alpha reliability for these scales are α=.80, α=.71, α=.87, and α=.89, respectively.

Five Facet Mindfulness Questionnaire Short Form [FFMQ-SF]. The FFMQ-SF (Bohlmeijer, Klooster, Fledderus, Veehof, & Baer, 2011) is a 24-item short form of Baer and colleagues 39-item Five facet Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). This scale is formed of five factors, namely: Observing, Describing, Acting with Awareness, Non-judging, and Non-Reacting. The Observing factor refers to attending to personal sensations, such as emotions and sights. Describing refers to verbalisation of subjective experiences. Acting with Awareness denotes concentration of undivided attention to the present moment. Non-judging measures a nonevaluative approach to individual experiences. Non-reacting represents a fluent flow of thoughts and feelings. Asensio-Martínez et al. (2019) report acceptable alpha reliabilities for these scales: α=.65, α=.79, α=.80, α=.73, and α=.68, respectively.

Instructed Breathing Software and Associated Hardware

A commercially available electronic device was used to display a visual aid for timed breathing (Relaxing Rhythms; Wild Divine, 2004). Participants were instructed to adjust their pattern of breathing so that it was in-time with the movements of the visual aid. This resulted in a pattern of breathing that was characterized by six breaths per minute, that is, five seconds

inhalation, and five seconds exhalation (i.e., 0.1 Hz). It has been suggested that this pattern of breathing is most appropriate for paced breathing interventions (Bernardi et al., 2001). The device also included an inbuilt sensor that, when applied on a finger, detects moment-to-moment fluctuations in interbeat intervals of the heart. This information corresponds to the breathing pattern and is graphically depicted on laptop screen as a sine wave. Participants were instructed to aim for a steady wave pattern, and this information acted as a biofeedback prompt that the individual used as an error signal in order to adjust the pattern of breathing. The researcher was occasionally present either inside or outside the room to approximate participants performance based on apparent attentiveness and the appearance of the sine wave. Participants who appeared inattentive and whose sine wave was unusually diminished were asked about the reasons for their unusual performance and offered further guidance. The software also featured relaxing music, which was played automatically during the session.

Procedure

Participants were provided with an information sheet and asked to sign their informed consent. Participants who consented to take part were asked to provide responses to psychometric questionnaires before and after completion of the course in a set order: ERQ, DASS-21, STAXI-2, FFMQ-SF. The post course questionnaires were only administered to participants who completed all 15 sessions.

The recruited group was asked to participate in a six-week instructed breathing course with sessions available three times per week. During that time, each participant was asked to take part in 15 sessions. Occasionally, participants had to postpone sessions, and this resulted in variation in the dates of course completion. Sessions were administered for up to two participants at a time. During a single, 30 minutes session, each participant set up the electronic device, regulated the pattern of his breath for about 15 minutes, and, on occasions

when the researcher was not present, collected and returned the device to a safe room under supervision of prison staff.

The sessions were facilitated in a prison that was divided into house blocks, each holding over 100 inmates. The instructed breathing sessions were held in a room located on the landing area that was less noisy compared to the wings where prison cells were located. When not in use, the electronic devices were stored in a secure cabinet under lock and key. Devices were allocated to participants by either the researcher or prison staff after confirming the participants identity. The participants were then allowed to enter the designated room where they independently operated the device. Participants who were booked for the first and the final sessions of the day were responsible for collecting and returning the devices respectively. Both staff and participants received training on the procedure and the guidance was printed and displayed in designated areas. The participants received training on how to operate the devices and how to regulate their breathing pattern. The entire procedure was frequently overseen by the researcher to ensure quality and safety standards were maintained.

Quantitative Analyses

The Reliable and Clinically Significant Change (RCC; Jacobson, Roberts, Berns, & McGlinchey, 1999) analysis consists of two criterions, namely the Reliable Change Index (RCI) and the Clinically Significant Change (CSC) statistic. The RCI is used to determine whether a change in participants scores, from before to after intervention, is large enough to account for the measurement error. The index is a function of standard deviation (SD) of measure scores obtained before intervention and the reliability of the measure. To calculate the index, the current study used SDs from the study sample and Cronbach's Alpha values from measure validation papers. The CSC is used to define cut of values for which scores on measures are considered to be within the 'normal' range. Jacobson et al. (1999) outline three methods of calculating CSC cut off scores based on availability of normative values. In the

present study, method C was calculated with reference to normative data and data obtained from participants prior to the course. Values for the two criterions were calculated with a dedicated online based resource prepared by Evans (1998) and rounded to the nearest integer in Microsoft Excel. Descriptive statistics used in the analyses can be found in Table 2.

When combined, the two criterions can be used to form outcome categories used for determining the impact of the intervention. In the current study, participants' whose change in test scores from before to after intervention are greater or equal to the RCI (i.e., reliable) and greater or equal to the CSC cut off (i.e., clinically significant) are classed as either 'Recovered' or 'Deteriorated' depending on the direction of change. Participants whose changes in scores are reliable but not clinically significant or were clinically significant prior to intervention are classed as either 'Improved' or 'Deteriorated' depending on the direction of change. Therefore, criteria for deterioration are more prevalent than for recovery. If scores have not passed the RCI threshold, the participants are classed as 'No change'. The results for all measures used in the study are expressed in percentages of participants included in an outcome category.

Qualitative Analyses

After completion of the instructed breathing course, participants who attended all 15 sessions were interviewed by one of the researchers on a one-to-one basis. The participants who dropped out of the research refused to take part in the post-course interviews. The interviews were held in therapy rooms located in the prison house blocks. The aim of the interviews was to obtain participants' impressions of the effects of the course. A semi-structured approach was taken to collection of the data whereby the participants were asked questions aimed to focus the interview on general experience, and effects of the intervention. Occasionally, when the topic of the interview was of direct relevance to the course, the conversation was led by the participant.

Prison policies did not permit audio recording equipment on site. Instead, the researcher took written notes of the participants' accounts. The final notes were supplemented by relevant medical information obtained from the nursing staff, criminal history obtained from the prison database, information on factors observed to impede successful delivery, and information from a list of participants' observations that was collected by the researcher on a day-to-day basis. The circumstances surrounding the data collection (e.g., lack of an audio recorded interview and aggregation of various types of data from different sources) mean that the data could not be subject to a formal qualitative analysis. Instead, an ontological and deductive stance was chosen to lead data interpretation, whereby the notes were screened for relevance to feasibility, overt meaningful patterns of commonality in experience, and for any positive and negative impressions. This approach allowed us to identify potential themes portraying feasibility of the study, details of changes in psychological characteristics and behaviours that are not accounted for by the questionnaires, and to triangulate and cross-verify the psychometric data with a corresponding qualitative account. Davies, Howells, and Jones (2007) have suggested that such mixed methods approach to data collection may represent the most effective means for evaluating the effects of novel mental health related forensic interventions.

Ethical approval for this project was granted from Her Majesty's Prison and Probation Service, formerly known as The National Offender Management Service.

Results

Characterisation of the treatment sample.

Demographic, medical, and offence related information was obtained from medical notes and forensic records with the help of nursing and prison staff. At the time of testing, most of the men who took part attended one-to-one meetings with their key workers and were medicated with methadone. However, many of the participants had also been prescribed other

types of medication. These are listed in Table 1. The participants were awaiting sentencing for various offences with the majority of offences being motivated by financial gain. Moreover, the participants had a history of illicit substance and alcohol abuse, most frequently classed as poly-substance abuse.

Following the recruitment criteria, 10 individuals aged between 25 and 54 years ($M = 35.7$, $SD = 9.50$) were recruited to take part in the course. Three participants (30%) dropped out before the end of the intervention and did not complete post-intervention measures. Two of the participants who dropped out were previously diagnosed with psychotic-like symptoms. Reasons for withdrawing from the study were also related to personal circumstances, such as respiratory illness and work responsibilities.

Seven participants successfully completed the course and the before and after outcome measures. Data for these participants were included in the analyses. Table 2 contains the means and standard deviations and normative values for all variables included in the current analysis. Mean values for each variable obtained at the start of the intervention were compared to previously reported normative values found in samples consisting of male and female undergraduate students and in the general population. The participants scored lower than the general population sample on FFMQ-SF subscales Observe, Describe, Act Aware, and Non-judge. Furthermore, values in the treatment group were relatively high compared with normative values for ERQ Expressive Suppression, all DASS-21 subscales, Anger Expression In and Anger Expression Out, and FFMQ-SF Non-react. Mean scores were roughly similar for Cognitive Reappraisal, Anger Control In and Anger Control Out.

<center>FIGURE ONE HERE</center>

Reliable and Clinically Significant Change Analysis

The results of the reliable and clinically significant change analyses are reported in Table 3. Overall, the intervention had little effect on both the Reappraisal and Suppression

subscales of the ERQ. All participants showed 'no change' on the Reappraisal subscale, and all but one participant showed 'no change' on the Suppression subscale. The remaining participant showed reliable but not significant change in test scores (i.e., 'improved'). The results of the intervention were most promising for the DASS subscales. For example, the majority of participants 'improved' on the Depression subscale, with one participant having 'recovered'). Positive outcomes were also recorded for the Anxiety and Stress subscales, with over half of the participants classified as either 'improved' or 'recovered' on each. None of the participants 'deteriorated' on any of the DASS subscales. Overall, results were considerably less positive for the anger subscales. For the Anger Expression Out and In subscales, one participant each had 'recovered', with all remaining participants showing 'no change'. All but two participants also showed 'no change' on the Anger Control Out subscale, while one participant 'recovered' and one 'deteriorated' on the Anger Control In subscale. Findings in relation to mindfulness varied between subscales. For example, although two participants 'improved' and one 'recovered' on the Non-Judging subscale, two participants 'deteriorated' on the Describing subscale, and two more 'deteriorated' on the Non-Reacting subscale. Taken together, we recorded positive outcomes in particular on the DASS subscales, indicative of improved mental health, but outcomes varied more considerably between subscales for anger and mindfulness.

TABLE TWO HERE

Summary of Observations and Interviews

Screening of the final notes resulted in identification of three common themes that supplemented the quantitative findings. The themes were: 'Effects of participation'; 'Factors influencing successful delivery of sessions'; 'Effects of ingesting medication'.

Effects of participation. Consistent with the quantitative analysis, during the post course interview completers frequently described reductions in worry, ruminative thoughts,

and anxious feelings. Some participants commented on improved self-control; "[…] helped to control temper" [Participant 6] and "Mind over body – that's the message." [Participant 7]. Each of the participants reported using the slow-paced breathing technique outside the sessions. Moreover, a small number of participants reported improvements in sleep quality. However, some participants also reported negative impressions. These included anxious feelings when taking deep breaths, interpreted as a case of asphyxophobia, that is, the fear of being unable to breath. The participant explained the feeling, "[…] like I won't be able to exhale." [Participant 3]. Consistent with published literature, the participant was advised that it is highly unlikely he would not be able to exhale after taking a deep breath. Another participant, reported only short-term benefits, and expressed pessimism about the course, saying "It's not as good as you think." [Participant 4]. This participant showed increasingly disruptive behaviour which culminated in him being moved to a different house block.

Factors influencing successful delivery of sessions. Some of the participants had limited understanding of how to operate a laptop and varied in their levels of performance as depicted by the appearance of the sine wave, with participants occasionally needing additional guidance. Overall, participants appeared motivated to take part in the sessions. One of the participants described needing to, "Get into the zone," [Participant 7] which aided task focus. Another participant expressed that, "I would like the course to last longer," [Participant 2] when informed that the sessions were coming to an end.

Some of the participants were involved in physical altercations and were either restricted to their cells or had to attend the medical wing at the time of a session. On some occasions, participants had to attend chores and routine activities, such as meals, education, and exercise. On rare occasions, the status of a participant's sentence changed during the intervention, and this had an impact on their general mood or resulted in voluntary cell confinement. Lastly, staff availability to sign the hardware in and out and escort participants

was largely influenced by various factors, including staff understanding of the aims and procedures of the course, staff numbers, and violent incidents in the prison.

Effects of ingesting medication. Ingesting medication represents a routine activity on a house block for offenders with substance use issues. Ingestion of methadone prior to attending a session appeared to have an adverse effect on sessions, and this observation was independently supported by some participants. Surprisingly, one participant reported that methadone helped to prolong the beneficial effects of a single session. Several participants were also taking anxiolytic medication, and this appeared to have a general impact on participants presentation during sessions, with lethargy being the most noticeable overt symptom. Understandably, many participants requested that sessions should be arranged to fit around the times at which medication was distributed, which had implications for the organisation and running of sessions. Often, participants behaviour was clearly affected around distribution times.

Discussion

This study utilised the PICO framework (Richardson et al., 1995) to explore the feasibility of running an instructed breathing intervention in a prison setting, and evaluated course outcomes in a small sample of male prisoners with illicit substance and alcohol use problems and various forms of psychological distress. The data suggest that with some staff and researcher involvement, the delivery and evaluation of the intervention was feasible, with the majority of participants completing the course. Overall, the study helps to pave the way to similar, larger scale designs.

Reliable and clinically significant change analyses suggested that the therapeutic approach exerted positive effects on indices of emotion regulation, that is, the ability to modify personal experience of emotion or perception of an emotional event (Aldao et al., 2010; Gross, 1998). These findings are especially pertinent as difficulties in emotion

regulation have been linked with the recurring cycle of substance abuse (Fox, Hong, & Sinha, 2008; Xin et al., 2014) and with offending and recidivism rates (Roberton et al., 2014; Breedvelt et al., 2014). The results for levels of depression, anxiety and stress in particular are all the more striking given the various forms of psychological distress that were reported in medical case files. Another beneficial trend of chronic treatment was on the Non-judge facet of mindfulness. This shift indicates that some of the participants developed a less critical approach to their personal experiences, including judgements of the self and emotions.

The qualitative analysis of participants' experience helps to provide further insight and cross-validation. The participants reported positive effects of participation, including reductions in adverse psychological symptoms, most notably anxiety, and increased self-control. Furthermore, reports included the use of paced breathing technique outside the sessions and perceived improvements in the quality of sleep. These observations suggest actual attempts may have been made to regulate emotional experiences. Certain adverse events, including a case of asphyxophobia and elevated antisocial behaviour were also observed. These events call for careful monitoring and evaluation of program, participant, and facilitator-related factors, which can impact participants' experience of therapeutic interventions (Baer, Crane, Miller, & Kuyken, 2019). In summary, the findings of the interviews support the notion that offenders with substance use difficulties can benefit from prison-based interventions aimed at improving emotion regulation.

The qualitative account provided valuable insight into the feasibility of the course. It was noted that participants varied in their ability to use the relaxation software and the associated hardware, had challenges with focus during sessions, experienced adverse circumstances related to imprisonment and prison culture, and had a daily routine which occasionally conflicted with the delivery of the course. Future studies should pre-emptively

advise on some of these issues during structured orientation sessions, and by adopting a flexible approach to timetabling the course sessions. Furthermore, session delivery was related to staff availability and awareness of the course. Hence, future studies should emphasise a collaborative staff approach to delivering the intervention and organise training for prison officers and nursing staff. The training should explain the aims and benefits of the course and ensure procedural measures are understood.

Perhaps not surprisingly, medication treatment interacted with participants performance and general demeanour. Participants were overly focused on obtaining methadone and prioritised medication intake. Ingestion of the drug appeared to have an adverse effect on performance during sessions, but the specifics of the interaction between medication and the perceived effects were elusive. Future research should further investigate this apparent link by controlling for the effects of medication. Overall, there were several challenges to the delivery of the course, the majority of which were successfully managed.

The physiological mechanisms driving the observed beneficial effects of instructed breathing on emotion regulation cannot be discerned on the basis of the current data. However, it is possible, on the basis of previous published research, that our findings could reflect changes in HRV. Such changes are linked with augmented activity of the vagus nerve during slow breathing that simultaneously results in elevated activity in, and connectivity between, particular neuroanatomical regions (Chang et al., 2013; Smith et al., 2017). Critically, these changes in activation and connectivity have been most commonly observed in brain areas that are integrally involved in the processes of emotion regulation (Gillespie et al., 2018; Ochsner & Gross, 2005). Thus, it seems plausible that the improvements seen in emotion regulation following instructed breathing result from increases in HRV and associated changes in the neural circuitry of emotion regulation.

Despite the encouraging results presented here, the use of slow-paced breathing approaches to the therapeutic treatment of offenders should be approached with caution. As stated above, the presumed mechanism underlying the beneficial effects of the programme are increases in HRV. High HRV, however, is strongly associated with low resting heart rate (rHR; Berntson et al., 1997), and low rHR has been positively associated with incidences of several types of offending (Latvala, Kuja-Halkola, Almqvist, Larsson, & Lichtenstein, 2015; Brzozowski, Gillespie, Dixon, & Mitchell, 2018), and with the presence of psychopathic tendencies (Portnoy & Farrington, 2015). The causes of the robust relationship between low rHR and offending are still the subject of debate (Gillespie, Brzozowski, & Mitchell, 2017). However, Scarpa, Haden, and Tanaka (2010) found that high resting HRV is associated with proactive aggression, whereas low HRV is associated with reactive aggression. Thus, it could be that increasing HRV may encourage proactive tendencies and a pattern of more calculated risk-taking (Gillespie et al., 2017).

The outcomes reported here are subject to some limitations. For example, for the seven male participants who completed all 15 sessions, data on the frequency, severity and duration of their substance use problems was not collected. Hence, the current findings should strictly be interpreted as the results of a feasibility study and robust conclusions can only be drawn following larger scale, controlled trials. Another limitation is that the values for breathing frequency and HRV were not obtained. This limits the extent to which we can be certain about participants performance when not under observation and the extent to which meaningful conclusions can be drawn about the underlying mechanisms for the reported improvements. It should also be noted that participants who failed to complete the course of controlled breathing sessions declined to complete post-intervention measures and one-to-one interviews and were therefore excluded from analyses. The inclusion of these participants (n = 3), consistent with an intention to treat design from randomized controlled trials (Hollis &

Campbell, 1999), would have changed the overall pattern of results for reliable and clinically significant change and informed the qualitative account. Although the qualitative data are useful for the purposes of triangulation, the circumstances surrounding the data collection (e.g., a lack of an audio recorded interview and aggregation of various types of data from various sources) mean that the data could not be subject to a formal qualitative analysis. As such, conclusions should be drawn from these accounts with requisite caution.

The current research showed that running a slow-paced breathing intervention is possible in a prison setting. We have managed to recruit a satisfactory sample, a majority (70%) of participants completed the course, successfully completed all measures and attended post course interviews, largely adhered to the instructions, the selected measures were informative of treatment effects, and challenges associated with the prison-based setup and the novelty of the project were successfully managed. Following the end of the course, the majority of successful completers showed positive outcomes ('improved' or 'recovered') across several measures, with the most widespread benefits observed for the depression, anxiety and stress subscales of the DASS. However, several participants also showed deterioration on some measures, most notably on the Describe and Non-react facets of mindfulness.

It is concluded that larger scale, controlled trials should examine the therapeutic utility of slow-paced breathing interventions in forensic settings, and that these interventions may be of most benefit for participants with known problems in emotion regulation and with histories of illicit substance or alcohol abuse. Procedural and operational training should be organised for both participants and key staff, and the effects of medication should be accounted for. Careful monitoring should be devoted to participants with known high rates of proactive aggression. Based on outcomes reported here, a slow paced breathing course can be

successfully delivered in prison settings and can increase emotion regulation in offenders with mood and substance use problems.

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Table 1: Mental Health and Medication Glossary

Pseudo	Clinical Mental Health	Medication
Participant 1	Reactive anxiety, low mood	Methadone
Participant 2	Anxiety, depression	Methadone, Sertraline
Participant 3	Depression	Methadone, Omeprazole, Citalopram
Participant 4	Personality disorder	Lofexidine
Participant 5	None diagnosed	Vareniciline
Participant 6	Anxiety	Methadone, Sertraline, Olanzapine
Participant 7	Depression	Methadone
Participant 8	Depression	Methadone, Mirtazipine, Omeprazole, Simvastatin, Rampril
Participant 9	GAD, paranoia	Methadone, Pregabalin
Participant 10	Depression, psychosis	Methadone, Zopiclone, Quetiapine

Note. GAD – General Anxiety Disorder.

Table 2: Descriptive statistics for the treatment group ($N = 7$)

Variable	Before		After		Norm.	
	M	*SD*	*M*	*SD*	*M*	*SD*
ERQ Reappraisal	28.00	6.856	28.86	5.843	28.48	6.29
ERQ Suppression	18.43	6.294	15.86	7.267	14.91	4.67
DASS Depression	15.29	4.112	9.71	5.112	2.83	3.87
DASS Anxiety	15.14	3.976	8.43	5.192	1.88	2.95
DASS Stress	15.43	3.690	9.43	6.268	4.73	4.20
Anger Exp. Out	18.71	3.729	16.71	3.546	14.76	3.90
Anger Exp. In	22.00	4.655	19.00	3.055	17.48	3.89
Anger Cont. Out	20.57	5.159	22.43	3.867	20.96	4.26
Anger Cont. In	19.43	6.241	22.14	3.671	21.23	5.03
FFMQ Observe	11.57	2.820	11.71	2.628	13.20	3.60
FFMQ Describe	13.57	3.101	13.86	2.968	16.47	4.32
FFMQ Act Aware	13.29	3.817	14.57	1.618	20.00	3.72
FFMQ Non-judge	11.71	2.690	14.86	3.579	16.57	4.07
FFMQ Non-react	14.86	2.478	13.57	3.599	12.93	3.27

Note. Norm. = normative values; Exp. = expression; Cont. = control; ERQ = Emotion Regulation Questionnaire; DASS = Depression Anxiety Stress Scales (short version); FFMQ = Five Facet Mindfulness Questionnaire (short version); the anger variables were assessed using the State Trait Anger Expression Inventory (STAXI-2); Normative values reported by: Asensio-Martínez et al., 2019 (FFMQ-SF); Melka, Lancaster, Bryant, & Rodriguez, 2011 (ERQ); Lievaart, Franken, & Hovens, 2016 (STAXI-2); Henry & Crawford, 2005 (DAAS).

Table 3: Number of participants showing reliable and clinically significant change on each outcome measure ($N = 7$)

Outcome measure	Deteriorated n (%)	Unchanged n (%)	Improved n (%)	Recovered n (%)
ERQ Reappraisal	0 (0%)	7 (100%)	0 (0%)	0 (0%)
ERQ Suppression	0 (0%)	6 (86%)	1 (14%)	0 (0%)
DASS Depression	0 (0%)	2 (29%)	4 (57%)	1 (14%)
DASS Anxiety	0 (0%)	3 (43%)	2 (29%)	2 (29%)
DASS Stress	0 (0%)	2 (29%)	3 (43%)	2 (29%)
Anger Exp. Out	0 (0%)	6 (86%)	0 (0%)	1 (14%)
Anger Exp. In	0 (0%)	6 (86%)	0 (0%)	1 (14%)
Anger Cont. Out	0 (0%)	5 (71%)	2 (29%)	0 (0%)
Anger Cont. In	1 (14%)	5 (71%)	0 (0%)	1 (14%)
FFMQ Observe	1 (14%)	5 (71%)	0 (0%)	1 (14%)
FFMQ Describe	2 (29%)	4 (57%)	0 (0%)	1 (14%)
FFMQ Act Aware	0 (0%)	5 (71%)	2 (29%)	0 (0%)
FFMQ Non-judge	0 (0%)	4 (57%)	2 (29%)	1 (14%)
FFMQ Non-react	2 (29%)	5 (71%)	0 (0%)	0 (0%)

Note. ERQ = Emotion Regulation Questionnaire; DASS = Depression Anxiety Stress Scales (short version); FFMQ = Five Facet Mindfulness Questionnaire (short version); the anger variables were assessed using the State Trait Anger Expression Inventory (STAXI-2)