**Supplementary Material**

**Treatment Adherence**

Summary of the adherence checks for BAG (Figure S1) and BAG+ (Figure S2) according to each category. The mean rating for the presence of evidence in each category is presented below the legend in each figure.

**Figure S1** *Adherence to the BAG Treatment Protocol (N=3)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Category mean rating | 12%\* | 0% | 3% | 14% | 29% | 44% |

*\**Expect use of implementation intentions to be rated N/A

**Figure S2** *Adherence to the BAG+ Treatment Protocol (N=8).*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Category mean rating | 1% | 0% | 2% | 11% | 34% | 51% |

**Sample Demographics**

Table S1 presents the summary of sample demographics and clinical features of the entire sample who received BAG prior to matching and according to BAG/BAG+ cohort.

**Table S1** *Demographics and Clinical Features of Entire Sample, Unmatched BAG sample and the BAG+ Sample.*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Entire sample  | Unmatched BAG  | BAG+ |
| *Demographics* | (*N*=192) | (*n*=161) | (*n*=31) |
|  | Mean age (SD) | 39.0 (16.1) | 38.5 (16.3) | 41.8 (14.9) |
|  | Gender % Female (*n*) % Male (*n*) | 54% (104)46% (88) | 54% (87)46% (74) | 55% (17)45% (14) |
|  | Ethnicity  % White (*n*) % Minority group (*n*) % Missing | 87% (166)5% (11)8% (15) | 86% (139)6% (10)8% (12) | 87% (27)3% (1)10% (3) |
|  | Median IMD decile (1-10)  | 5 | 4 | 6 |
|  | Employment status % Employed (*n*) % Other (*n*) % Missing (*n*) | 28 % (54)71% (136)1% (2) | 26% (41)73% (118)1% (2) | 42% (13)58% (18)0% (0) |
| *Clinical features* |  |  |  |
|  | Mean PHQ-9 score (SD) | 17.5 (4.2) | 17.3 (4.3) | 18.4 (4.0) |
|  | Mean GAD-7 score (SD) | 12.9 (4.8) | 12.9 (4.8) | 13.0 (5.0) |
|  | Mean WSAS score (SD) | 23.1 (7.5) | 22.7 (7.3) | 24.9 (8.1) |

**Table S2** *Characteristics of the BAG and BAG+ samples.*

|  |  |  |  |
| --- | --- | --- | --- |
| Pre-treatment characteristic  | BAG(*n*=31) | BAG+(*n*=31) | X2(*p* value) |
| Gender (% female) | 17 (55%) | 17 (55%) | 0.00 (*p*=1.00) |
| Ethnicity (% minoritised ethnicity) | 4 (13%) | 1 (4%) | 1.65 (*p*=.199) |
| IMD deciles 1-10 (median) | 5 | 6 | 11.46 (*p*=.246) |
| Antidepressant use | NA | 21 (69%) | - |
| Depression severity (PHQ-9) Moderate Moderately severe Severe | 5 (16%)13 (42%)13 (42%) | 4 (13%)17 (55%)10 (32%) | 1.04 (*p*=.596) |
| Anxiety severity (GAD-7) Minimal Mild Moderate Severe | 0 (0%)5 (16%)12 (39%)14 (45%) | 2 (7%)6 (19%)11 (36%)12 (39%) | 2.29 (*p*=.515) |
| Impaired functioning (WSAS) Subclinical (<10) Significant impairment but less  severe symptomology (10-20) Moderate/severe psychopathology (>20) | 3 (10%)7 (22%)21 (68%) | 1 (3%)6 (19%)24 (77%) | 1.27 (*p*=.528) |

*Note:* NA: not available in the historical data accessed for BAG cohort due to constraints on service data fields that were shared. Medication data was collected directly for the BAG+ sample. BAG; Behavioural Activation in Groups (existing intervention cohort), BAG+; Behavioural Activation in Groups (augmented intervention cohort), IMD; Index of multiple deprivation, PHQ-9; Patient health questionnaire, GAD-7 Generalized anxiety disorder scale, WSAS; Work and social adjustment scale.

**Table S3** *Treatment overview and session outlines for BAG and BAG+ (Augmentations in Italics)*

|  |  |  |
| --- | --- | --- |
| **Session** | **Common components across BAG and BAG+:**  | **Additional BAG+ components:** |
| Content described using patient wording (Homework activity) | *Dose-response psychoeducation and implementation intentions augmentations* |
| 1 | Learn your patterns and start to change them (Homework: Activity-mood diary) | *Dose-response psychoeducation sheet in group workbook and verbally reiterated at session 1 by facilitators.* *Additional homework task: Read psychoeducation sheet.* *‘Achieving your goals’ implementation intention information sheet added to group workbook and ‘if-then’ planning modelled by facilitators at session 1.* |
| 2 | Values: the guide to who we are (Homework: Committed-action exercise) | *At each group session use of specific ‘if-then plan’ worksheet in group workbook to plan and agree HW consistent with that session content.* *All ‘if-then’ plan silently repeated 3 times and once out loud to a co-partner in the group* |
| 3 | Getting out of the TRAPs and back on TRAC (Homework: Apply TRAP/TRAC handouts to tasks) |
| 4 | Taking action: a problem solving approach (Homework: Problem solving to change unhelpful behaviours) |
| 5 | Identifying unhelpful thinking, worry and rumination (Homework: Monitor rumination and use ‘two-minute rule’) |
| 6 | Developing responses to thinking, rumination and worry (Homework: RCA, mindfulness and self-soothing handouts) |
| 7 | Making changes one step at a time (Homework: ‘Short-term goals’ planning worksheet) |
| 8  | Building the relationships you want/tying it all together (Homework: Apply ACTION to everyday situations) |

*Note:* The BAG programme outlined in the table originated in the Sheffield NHS TT service, and was adapted from Martell et al.’s (2001) BA model and supplemented with the Martell et al., (2010) update. *Abbreviations:* HW; Homework task, TRAP: Trigger, Response, Avoidance Pattern; TRAC: Trigger, Response, Alternative Coping., RCA: rumination cues action, ACTION; assess, choose, try, integrate, observe, never give up.

**Treatment Augmentation Worksheet Examples**

1. **Dose-response Psychoeducation**

**Effectiveness of Behavioural Activation Group Therapy**

**What you need to KNOW about attending**

Evidence shows that behavioural activation groups (BAG) are effective at reducing symptoms of depression.

* Research has looked at which situations and circumstances BAG can be effective so you KNOW how you can benefit.
* Research has also looked at what predicts a good outcome following treatment and identified what you can DO which will be more likely to result in a better outcome.

Below are some findings that can help you understand how to get the best out of the group;

1. **You need to receive the necessary amount of therapy to experience any significant improvement.**

Think of BAG therapy as like a dose of antibiotics – you need to complete the full course of treatment to recover. If you walk away from the group (even if you are feeling better), you are at risk of not getting the full benefit and leaving your depression unaddressed.

The findings show that patients only reach recovery after attending at least 4 sessions of BAG (i.e. the more sessions you attend the more likely you are to see improvement).



So remember you may not see change immediately, if you still feel depressed stick with it!

1. **BAG is effective at treating all severities of depression**

BAG therapy can have a beneficial effect on all severities of depression. The findings showed BAG can reduce depression symptoms regardless of how severe your depression is.



So even if you are sceptical about your depression getting better, stick with BAG!

1. **BAG is also effective at reducing co-existing anxiety symptoms**



When you are depressed, it is common to also experience feelings of anxiousness and worry as well.

Although BAG is designed to treat low mood, the findings have shown that in addition to reducing depression symptoms, BAG can also reduce co-existing anxiety symptoms.

So you might find you get more benefit from BAG therapy than you expect.

1. **Implementation intentions**

**Achieving Your Goals**

**Why do people struggle to change their behaviour when they are feeling down?**

People often set goals to try and change their behaviour, but then find it difficult to put them into action. This is true generally, but really true when we are feeling down in the dumps. This can happen for two reasons, either 1) people have difficulty getting started and initiating the behaviour or 2) people get started and then encounter obstacles or barriers, which push them off track and prevent them maintaining the behaviour.

Common barriers that prevent people achieving their goal when feeling down include;

* Forgetting to do the new behaviour (e.g. make a good plan, but then it slips your mind when you really need it)
* Missing chances to action the new behaviour (e.g. don’t notice an opportunity)
* Having interfering second thoughts at crucial moments (e.g. doubting yourself / not backing yourself)
* Getting distracted by tempting alternatives (e.g. I’ll watch this, then I’ll do it)
* Falling back into unhelpful habits (e.g. putting things off)
* Allowing negative moods to justify not putting a new behaviour into action (e.g. I’ll do this when I feel a bit better)

**Helping you to achieve your goals**

Evidence has shown that specific ‘if-then’ planning really helps. ‘If-then’ plans are statements that identify the barriers might get in the way of achieving a goal and a pre-planned response for how to deal with them if they happen. So, simple planning in advance results in people being more likely to follow through and achieve what they want. This planning technique of clearly stating how you are going to achieve a goal is known as forming ‘implementation intentions’.

* The **‘IF’** part of the planoutlines the most likely barrier that might get in the way of a desired goal and when it might happen.
* The **‘THEN’** part of the plan outlines what the planned response to overcome that barrier will be.

**E.g.** ‘*If I am feeling anxious about attending the group, then I will accept that feeling, but remind myself that is understandable and turn up anyway.*’

Using this specific planning technique will really help you to put your behavioural activation homework into practice and will help to shift your depression.

**How will ‘if-then’ planning help you to put your plans into action?**

Forming plans to act to help reduce your low mood works because;

1. Pre-planning in advance removes distracting choices from everyday decisions we have to make
2. You learn to override what has in the past got in the way
3. Knowing your plan in advance will make it happen more automatically. This removes the possibility of overthinking which can derail us from taking immediate action.

***Using ‘If-then’ planning for each week’s homework***

Use the 6 steps below to make a specific homework plan;

1. Choose your homework goal for this week
2. Make a specific plan for how you will put your homework goal into action (what, where, when, who with)
3. Thank about the potential barriers that have stopped you in the past or are most likely to get in the way
4. Write an ‘If’ statement outlining what barrier might stop you acting and when it might happen (e.g. a situation or mood)
5. Write a ‘Then’ statement with a planned response to deal with that barrier (e.g. thinking, doing, acknowledging or accepting something).
6. Repeat your ‘if-then’ statement silently to yourself 3 times and then to your homework partner out loud once

***E.g.******Homework plan:*** *On weekday mornings set an alarm and get out of bed at 7.30am*

***If-then plan:*** *If when my alarm goes off I feel too tired and want to stay in bed, then I will remind myself how low it will make me feel later and immediately get up and go make a cup of tea.*

See the ‘Making My Plans Really Happen’ worksheet for a template for setting your behavioural activation homework each week. If needed, there is space to write multiple goals or alternatively think off two barriers which might stop you achieving your goal.

**Making My Plans Really Happen - Worksheet**

|  |  |  |
| --- | --- | --- |
| **Stage** | **Content** | **Session 1 Examples** |
| **Homework goal:** | ................................................................................. | Get up in the mornings  |
| **Specific Plan:**What / When / Where | …………………………………………………….........………………………………………………………….. | On weekday mornings set an alarm and get up at 7.30am |
| **Barrier:**Internal or External |  If | ……………………………………………………………………………………………………………………………………………………… | If when my alarm goes off I feel too tired  |
| **Response:**Thinking, doing, acknowledging or accepting something | Then | ……………………………………………………………………………………………………………………………………………………… | Then I will remind myself how low it will make me feel later and immediately go make a cup of tea. |

**Table S4;** *Comparison of baseline covariates and variances in BAG and BAG+ for the unmatched sample and PSM sample.*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Baseline Covariate  | BAGMean (SD)/ Frequency (%) | BAG+Mean (SD)/ Frequency (%) | Standardized Difference/ Proportion | Variance(BAG+) | Variance (BAG) | Ratio: BAG to BAG+ | Ratio diff. |
| *Unmatched sample* | (*n*=161) | (*n*=31) |  |  |  |  |  |
|  | Age | 38.5 (16.3) | 41.8 (14.9) | 0.20 | 221.38 | 264.69 | 0.84 | 0.16 |
|  | PHQ-9 score | 17.3 (4.3) | 18.4 (4.0) | 0.26 | 16.05 | 18.19 | 0.88 | 0.12 |
|  | WSAS score | 22.7 (7.3) | 24.9 (8.1) | 0.32 | 66.17 | 17.08 | 0.94 | 0.06 |
|  | Employment status Employed Other  | 41 (26%)120 (75%) | 13 (42%)18 (58%) | 0.37 | - | - | - | - |
| *Matched sample* | (*n*=31) | (*n*=31) |  |  |  |  |  |
|  | Age | 42.6 (14.3) | 41.8 (14.9) | **-0.06** | 221.38 | 202.91 | 1.09 | 0.09 |
|  | PHQ-9 score | 18.7 (4.1) | 18.4 (4.0) | **-0.07** | 16.05 | 52.93 | 1.25 | 0.25 |
|  | WSAS score | 24.6 (8.8) | 24.9 (8.1) | **0.04** | 66.17 | 77.85 | 0.85 | 0.15 |
|  | Employment status Employed Other | 13 (42%)18 (58%) | 13 (42%)18 (58%) | **0.00** | - | - | - | - |

*Note:* For continuous covariates mean and SD are presented; for categorical covariate frequencies and percentages are presented. **Bold:** Standardized differences in sample covariates <0.1 deemed representative of minimal difference between groups. Variances are provided for the unmatched and matched BAG+ and BAG samples for continuous covariates. Abbreviations: BAG; Behavioural Activation in Groups (existing intervention cohort), BAG+; Behavioural Activation in Groups (augmented intervention cohort), PHQ-9; Patient health questionnaire, WSAS; Work and social adjustment scale

**Figure S3**;*Comparison of baseline continuous covariates in BAG and BAG+ in the overall unmatched sample and after PSM matching procedure*

**Exploratory Longitudinal Mixed-Model Analysis**

To investigate differences in session-by-session changes in depression (PHQ-9) scores between BAG conditions over the course of treatment, exploratory longitudinal mixed models were used. Following the recommended approach, sequential model building started with an unconditional linear growth model (with time as the only predictor) and tested the additions of random effects (slopes and intercepts), different time trends (linear, loglinear) and covariance structures (variance components, autoregressive heterogeneous [ARH1]). Maximum likelihood estimation was used to enable significance testing of deviances of nested models. Parameter additions were evaluated by comparing the -2 log likelihood (-2LL) values between nested models against a chi-square distribution, with any parameters producing significant improvements in model fit (indicated by a significantly smaller -2LL value) being retained in the model. Once the best fitting model was established, BAG condition (main effect) and the time\*BAG condition interaction were included as a predictors.

Model building selected a random slopes and random intercepts growth model with a loglinear time trend and ARH1 covariance structure as the best fitting model. Fixed effect and random effects results of the final model including predictors are reported in Table S5.

**Table S5;** *Fixed and random effects estimates for final longitudinal mixed model of effect of time on depression (PHQ-9) scores between BAG conditions.*

|  |
| --- |
| **Fixed effects of final model** |
|  | *Β* estimate | SE | 95% CI | p value |
| Intercept | 18.24 | 0.82 | 16.59 to 19.88 | <.001 |
| Time (log) | -1.77 | 0.50 | -2.79 to -0.76 | .001 |
| BAG condition (BAG+) | 0.33 | 1.17 | -2.01 to 2.67 | .778 |
| BAG condition (Ref: BAG) | 0 | 0 | - | - |
| BAG condition\*Time (BAG+) | -1.45 | 0.69 | -2.84 to -0.05 | .042 |
| BAG condition\*Time (Ref: BAG) | 0 | 0 | - | - |
| **Random effects of final model** |
| Residual variance | 9.32 | 0.95 | 7.63 to 11.37 | <.001 |
| Intercept variance | 13.77 | 3.76 | 8.06 to 23.53 | <.001 |
| Slope (time) variance | 1.98 | 1.25 | 0.58 to 6.81 | .112 |
| Intercept & slope covariance | 0.46 | 0.39 | -0.43 to 0.90 | .235 |

**Table S6;** *Recovery rates**for BAG and BAG+**based on the NHS Talking Therapies Recovery metrics combining depression (PHQ-9) and anxiety (GAD-7) outcomes.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Post-treatment combined PHQ-9 & GAD-7 recovery status | BAG(*n* = 31) | BAG+(*n* = 31) | Chi-squared(p value) | Odds ratioBAG:BAG+ (95% CI) |
| Recovery (caseness) | 10%(3) | 19%(6) | 1.17(*p*=.279) | 2.24(0.51 – 9.91) |
| Reliable improvement | 42%(13) | 52%(16) | 0.58(*p*=.445) | 1.48(0.54 – 4.03) |
| Reliable recovery | 10%(3) | 19%(6) | 1.17(*p*=.279) | 2.24(0.51 – 9.91) |
| Reliable deterioration | 7%(2) | 0%(0) | 2.07(*p*=.151) | 0.94(0.85 – 1.03) |

*Note.* BAG; Behavioural Activation in Groups (existing intervention cohort), BAG+; Behavioural Activation in Groups (augmented intervention cohort), PHQ-9; Patient health questionnaire, GAD-7; Generalised Anxiety Disorder-7 scale, CI; confidence interval.

Recovery rates have been reported according to the NHS Talking Therapies approach (NHS Talking Therapies, 2024) combining PHQ-9 and GAD-7 scores as follows;

**Recovery (caseness)** = PHQ-9 and/or GAD-7 score above the clinical cut-off before treatment and scores on *both measures* below the cut-off at the end of treatment.

**Reliable improvement** = PHQ-9 and/or GAD-7 scores have reliably reduced (according to reliable change criteria; >= 6 for PHQ-9 and >=4 for GAD-7) and neither measures scores have reliable increased.

**Reliable recovery** = criteria for both recovery (caseness) and reliable improvement have been met.

**Reliable deterioration** = PHQ-9 and/or GAD-7 scores have reliably increased (according to reliable change criteria; >= 6 for PHQ-9 and >=4 for GAD-7) and neither measures scores have reliable decreased.