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Relations Among Clinical Factors After Behavioral Activation for Subthreshold Depression

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Abstract

The relations among clinical factors after behavioral activation for subthreshold depression remain unclear. This study was designed to assess relations among clinical factors after behavioral activation for subthreshold depression. This randomized controlled trial study examined 51 university students with subthreshold depression who had completed pre-treatment, post-treatment, and 1-year follow-up assessments. We examined relations among variables using structural equation modeling (SEM) based on maximum likelihood estimation. Fitted index values suggest that the proposed model is valid. Results indicate that the greater increase in activation from post-treatment to 1-year follow-up was associated with increased positive reinforcement from post-treatment to 1-year follow-up. Furthermore, the greater increase in positive reinforcement from post-treatment to 1-year follow-up was associated with decreased depressive symptoms from post-treatment to 1-year follow-up. To prevent worsening of depressive symptoms after behavioral activation, more attention must be devoted to changes in activation and positive reinforcement.

Keywords Behavioral activation · Late adolescent · Positive reinforcement · Subthreshold depression

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Introduction

Depression reportedly occurs in about 15–20% of university students (Benton et al., 2003). One report described that 20% of first-year undergraduate students in Japan had a major depressive episode during the prior 12 months (Tomoda et al., 2000). Subthreshold depression among adolescents, which has recently received increasing attention (Bertha & Balazs, 2013), is defined as clinically significant depressive symptoms that do not meet diagnostic criteria for major depressive disorder (MDD; Georgiades et al., 2006; Pincus et al., 1999). Subthreshold depression can engender severe functional impairment including negative effects on academic performance and social activity (Balazs et al., 2013). People with subthreshold depression face elevated risk for subsequent development of a major depressive episode (Bertha & Balazs, 2013; Johnson et al., 2009). Therefore, late adolescent university students with subthreshold depression have a high rate of prevalence of impairment and face risk of severe impairment including adverse effects on academic performance and social activity.

Behavioral activation is an empirically supported intervention for depression and subthreshold depression (Richards et al., 2016; Takagaki et al., 2016a). The Martell behavioral activation model (Martell et al., 2001) includes specific emphasis on avoidant behaviors. In the model, which is consistent with traditional behavioral models, behavioral activation is used to modify a person's environment through behavior change, which in turn increases access to positively reinforcing events and activities (Manos et al., 2010). In subthreshold depression, late adolescents with subthreshold depression exhibit characteristics that engender low frequency of environmental rewards (Takagaki et al., 2014). Lewinsohn explained the original form of behavioral activation as increasing potentially rewarding activities to increase the rate of positive reinforcement which a person obtains (Lewinsohn et al., 1980). Consequently, it is necessary to increase the rate of positive reinforcement to alleviate subthreshold depression. We conducted a randomized controlled trial (RCT) to assess the efficacy of a five-session behavioral activation program to alleviate subthreshold depression (Takagaki et al., 2016a). This behavioral activation specifically emphasized increased access to positively reinforcing activities to improve the rate of response-contingent positive reinforcement (Takagaki et al., 2016a). Late adolescent students treated in this manner were found to have significantly greater improvement of self-reported depressive symptoms than the assessment-only control group. The effect size was Hedges' g of −0.90 (Takagaki et al., 2016a). At 1-year follow-up, late adolescent students who had undergone five-session behavioral activation were found to have significantly lower BDI-II scores than those of control group students (Takagaki et al., 2018). Although the BDI-II scores of some participants indicated retention of low depressive symptoms, the BDI-II scores of other participants had increased scores from post-treatment to 1-year follow-up. Earlier reports have described studies showing that behavioral activation intervention effects against control conditions were slight and were not significant during 7–12-month follow-up (Cuijpers et al., 2007; Mazzucchelli et al., 2009). For subthreshold depression, the effects were significantly smaller than those of psychotherapy for major depressive disorder (Cuijpers et al., 2014). An important limitation of our follow-up study (Takagaki et al., 2018) is that relations among clinical factors after behavioral activation for subthreshold depression were not examined from post-treatment to 1-year follow-up. To address that shortcoming, it is necessary to identify relations among clinical factors after behavioral activation for subthreshold depression.

Regarding behavioral activation mechanisms, a report of an earlier study describes that mood changes occur following behavior that elicits positive reinforcement (Manos et al., 2010). Results of our earlier study conducted using mediation analysis indicate that behavior has a significant indirect relation to depressive symptoms through positive reinforcement, indicating positive reinforcement as a mediator in the relation between activation and depressive symptoms (Takagaki et al., 2016b). Moreover, the original behavioral activation model of depression relies on the assumption that a low level of response-contingent positive reinforcement provides a sufficient explanation of depression (Dimidjian et al., 2011). Therefore, change of behavior after behavioral activation might have some relation to change of positive reinforcement. Moreover, the change of positive reinforcement from immediately after behavioral activation to 1 year later might have some relation to depressive symptoms at 1 year later. Therefore, the hypothesized change after behavioral activation (Fig. 1) has indicated that (1) the change of behavior from immediately after behavioral activation to 1 year later has a significantly close relation to the change of positive reinforcement and depressive symptoms from immediately after behavioral activation to 1 year later, (2) the change of positive reinforcement from immediately after behavioral activation to 1 year later has a significantly close relation to the change of depressive symptoms from immediately after behavioral activation to 1 year later.

This study was designed to assess relations among behavior, positive reinforcement, and depressive symptoms to assess relations among clinical factors after behavioral activation for subthreshold depression.

Methods

Participants

Participants, all 18–19-year-old first-year students of Hiroshima University, met the following inclusion criteria: Beck Depression Inventory-II (BDI-II) score greater than or equal to 10, no major depressive episode during the year prior, and not undergoing psychopharmacological or psychological treatment. Exclusion criteria were the following: history of bipolar disorder, suicide attempt, difficulty understanding the study purpose, and difficulty completing self-report scales for severe mental state or severe physical disease. The study participants are the same late adolescent university students examined for an earlier RCT study (Takagaki et al., 2016a; Takagaki et al., 2018). These study participants were assigned randomly to the treatment group ($n = 62$) or to the control group ($n = 56$). Late adolescent university students of the treatment group completed pre-treatment ($n = 62$), post-treatment

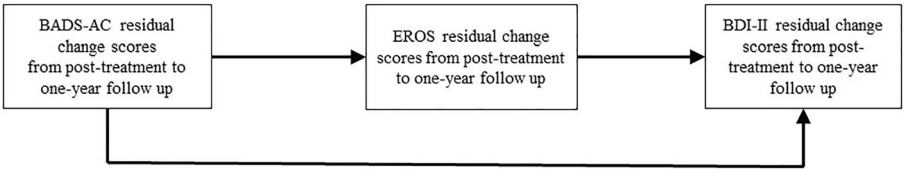

Fig. 1 Hypothetical SEM model. Abbreviation: BDI-II, Beck Depression Inventory-II; BADS-AC, Behavioral Activation for Depression Scale-Activation; EROS, Environmental Reward Observation Scale; SEM, structural equation modeling

(n = 61), and 1-year follow-up assessments (n = 51; 19 women, 32 men; mean age = 18.20; age range 18–19 years; SD = 0.40) in the RCT study.

Procedure

Participants were recruited from Hiroshima University over a 2-year period: 2013–2014. Recruitment took place through email on a public information sharing center. After a meeting held to explain the study contents, the attending participants signed a written informed consent form. Detailed descriptions of the participants have been presented elsewhere (Takagaki et al., 2016a). After receiving informed consent, a trained interviewer conducted a telephone interview using the Composite International Diagnostic Interview (CIDI). Participants also completed self-report scales during pre-treatment, post-treatment, and 1-year follow-up. We conducted the intervention to assess the efficacy of a behavioral activation program targeting late adolescent students with subthreshold depression (Takagaki et al., 2016a). Then we examined behavioral activation effects during 1-year follow-up (Takagaki et al., 2018). This study is part of an RCT (Takagaki et al., 2016a). However, because the purpose of this study is identification of relations among clinical factors after behavioral activation for subthreshold depression, the analyses included no control group.

Treatment

The treatment program emphasized increased access to positively reinforcing activities designed to improve the rate of response-contingent positive reinforcement. The activities consisted of five weekly 60-min sessions. The program included psycho-education about depression and behavioral activation (session 1), about assessing long-term and short-term goals (session 1), about developing activity monitoring (sessions 1, 4), about developing a behavioral hierarchy of about 10 tasks (session 2), and about behavioral experiments and increasing scheduled activities (sessions 2, 3, 4). Session 5 included a review of behavioral activation and creation of a plan for self-management of high-stress situations. Detailed descriptions of the treatment have been reported (Takagaki et al., 2016a; Takagaki et al., 2018).

Structured Interview

Composite International Diagnostic Interview (Kessler & Ustun, 2004)

The CIDI is used widely as a structured interview for mental disorder assessment. We used the computerized version (Kessler & Ustun, 2004). In addition, the lifetime history of each participant was assessed in terms of major depressive disorder and bipolar disorder. We used the Japanese version of the CIDI (Kawakami et al., 2005).

Measures

Japanese Version of the Environmental Reward Observation Scale (EROS; Kunisato et al., 2011)

The original EROS developed by Armento and Hopko (2007) consists of 10 items scored on a 4-point scale (1, Strongly disagree to 4, Strongly agree). It is used to

measure exposure to environmental rewards that are deemed necessary for increasing response-contingent positive reinforcement. Kunisato et al. (2011) developed the Japanese version of EROS and reported its reliability and validity. Results of an earlier study suggest that decreased positive reinforcement is associated with increased depressive symptoms (Manos et al., 2010). Higher scores on the EROS are associated with greater access to environmental reinforcers.

Japanese Version of Behavioral Activation for Depression Scale (BADS; Takagaki et al., 2013b)

The original BADS developed by Kanter et al. (2007) consists of 25 items scored on a 7-point scale (0, Not at all to 6, Completely). The four subscales include Activation (BADS-activation, BADS-AC), avoidance/Rumination (BADS-avoidance/rumination, BADS-AR), Work/School Impairment (BADS-work/school impairment, BADS-WS), and Social Impairment (BADS-social impairment, BADS-SI). The BADS-AC measures goal-directed activation and the completion of scheduled activities. The BADS-AR measures avoidance of a negative aversive state, and engaging in rumination, rather than active problem solving. The BADS-WS measures the consequences of inactivity and passivity on work and school responsibilities. The BADS-SI measures similar social consequences and social isolation. Takagaki et al. (2013b) developed the Japanese version of BADS and reported its reliability and validity. This study used BADS-AC. Higher scores on BADS-AC indicate greater goal-directed activation and the completion of scheduled activities.

Japanese Version of the Beck Depression Inventory, Second Version (Kojima & Furukawa, 2003)

The original BDI-II developed by Beck et al. (1996) consists of 21 self-report items scored on a 4-point scale. It is used to measure depressive symptoms. Kojima and Furukawa (2003) developed the Japanese version of the BDI-II and demonstrated its reliability and validity.

Statistical Analysis

First, this report presents descriptive data subjected to correlation analysis. Next, we used residual change scores to assess changes in BDI-II, BADS-AC, and EROS scores from post-treatment to 1-year follow-up. Using software (SPSS ver. 22.0; IBM Inc.), the residuals were calculated as differences between the observed values and those predicted by the model. Residual changes scores reflect either greater increases or lesser decreases in the measure than would be predicted according to their baseline levels. We examined relations among the BDI-II residual change scores from post-treatment to 1-year follow-up, the BADS-AC residual change scores from post-treatment to 1-year follow-up, and the EROS residual change scores from post-treatment to 1-year follow-up using structural equation modeling (SEM) based on maximum likelihood estimation using bootstrapping. An earlier report described that the bias-corrected (BC) interval provides the most accurate confidence and the highest statistical power: it is expected to be the method of choice if it is feasible to conduct resampling (MacKinnon et al.,

2004). Therefore, we used BC to examine the confidence intervals. When using the bootstrapping method, if the 95% bias-corrected confidence intervals (BC 95% CI) did not include 0, they are inferred as significant at the 5% level. Therefore, we used BC 95% CI to test for significance at the 5% level. The BC 95% CI was calculated based on 5000 bootstrap samples. We subsequently conducted an examination of the models including all variables. Several fit indices show how well the tested model accounts for the observed correlation structure of the data. The following indices were used for this study: comparative fit index (CFI), standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA). The range of fit index values is 0–1 (Hooper et al., 2008). Reasonable fit is indicated by CFI values of 0.9 or more (Hooper et al., 2008). The RMSEA and SRMR lower limits are approximately equal to 0. Although the upper limit is expected to be less than 0.08, an RMSEA of 0.05–0.10 is regarded as an indication of fair fit (Hooper et al., 2008). The SRMR lower limit is close to 0, whereas the upper limit is expected to be less than 0.08 (Hooper et al., 2008).

For statistical analyses, we used the package described above and other software (SPSS ver. 22.0; IBM Inc. M-plus ver. 7. 4; Muthen and Muthen, Los Angeles, USA).

Ethical Approval and Informed Consent

Approval for the study was obtained from the ethics committee of Hiroshima University. All participants gave written informed consent before the study began.

Results

Characteristics and Correlation Analysis

Table 1 presents relevant data of all participants. We conducted correlation analysis to examine relations among BDI-II scores at post-treatment and at 1-year follow-up, BDI-II residual change scores from post-treatment to 1-year follow-up, BADS scores at post-treatment and at 1-year follow-up, BADS residual change scores from post-treatment to 1-year follow-up, EROS scores at post-treatment and at 1-year follow-up, and EROS residual change scores from post-treatment to 1-year follow-up. We conducted correlation analysis to explore associations among all factors (Table 1).

Structural Equation Modeling

Using SEM based on maximum likelihood estimation method with bootstrapping, we examined relations among residual change BDI-II after behavioral activation to 1-year follow-up, residual change BADS-AC after behavioral activation to 1-year follow-up, and residual change EROS after behavioral activation to 1-year follow-up. Fitted index values suggest that the proposed model is valid (CFI = 1.00, RMSEA = 0.00, SRMR = 0.00; Fig. 2). The BADS-AC residual change scores from post-treatment to 1-year follow-up (standardized direct effect, 0.30; 95% confidence intervals, 0.15 to 0.41) were found to have direct effects on EROS residual change scores from post-treatment to 1-year follow-up. However, BADS-AC residual change scores from post-treatment

Table 1 Results of descriptive data and correlation analysis

Measures	1	2	3	4	5	6	7	8	Mean (SD)
1. BDI-II scores at post-treatment (5.14)									6.45
2. BDI-II scores at 1-year follow-up (6.46)	.30*								10.77
3.BDI-II scores residual change scores from post-treatment to 1-year follow-up (6.96)	−.46**	.71**							0.00
4. BADS-AC scores at post-treatment (7.32)	−.30*	−.13	.10						19.43
5. BADS-AC scores at 1-year follow--up (8.00)	.05	−.34*	−.35**	.45**					14.86
6. BADS-AC residual change scores from post-treatment to 1-year follow-up (8.05)	.32*	−.22	−.44**	−.46**	.58**				0.00
7. EROS scores at post-treatment (4.20)	−.49**	−.30*	.08	.56**	.32**	−.19			25.88
8. EROS scores at 1-year follow-up (4.67)	−.23	−.60**	−.39**	.31**	.63**	.35*	.53**		23.67
9. EROS residual change scores from post-treatment to 1-year follow-up (4.32)	.23	−.36*	−.50**	−.21**	.37**	.56**	−.40**	.57**	0.00

Note. Values in parentheses represent standard deviations

BDI-II, Beck Depression Inventory-II; *BADS-AC*, Behavioral Activation for Depression Scale-Activation; *EROS*, Environmental Reward Observation Scale. * $p < .05$. ** $p < .01$

to 1-year follow-up (standardized direct effect, −0.20; 95% confidence intervals, −0.47 to 0.02) had no direct effect on BDI-II residual change scores from post-treatment to 1-year follow-up. EROS residual change scores from post-treatment to 1-year follow-up (standardized direct effect, −0.60; 95% confidence intervals, −1.01 to −0.08) had direct effects on BDI-II residual change scores from post-treatment to 1-year follow-up.

Discussion

This study investigated relations among clinical factors after behavioral activation for subthreshold depression. When judging from three fitness indexes (CFI, RMSEA, and SRMR), reasonable fit is inferred for CFI values of 0.9 or more (Hooper et al., 2008). Furthermore, the upper limits of RMSEA and SRMR are expected to be less than 0.08 (Hooper et al., 2008). Therefore, fitted index values suggest that the proposed model is valid. Results indicate that greater increase in BADS-AC residual change scores from post-treatment to 1-year follow-up was associated with increased EROS residual change scores from post-treatment to 1-year follow-up. Furthermore, a greater increase

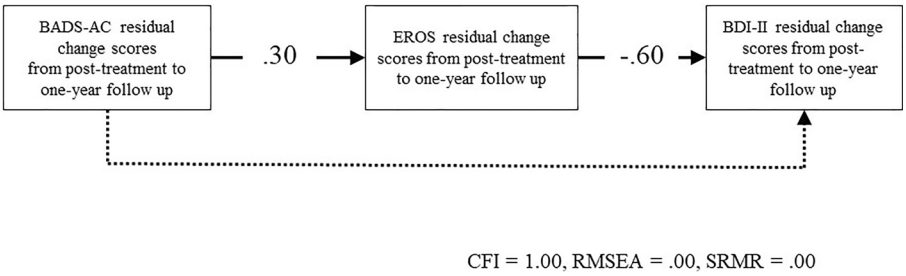

Fig. 2 Result of hypothetical SEM model. The solid line represented statistically significant. Abbreviation: BDI-II, Beck Depression Inventory-II; BADS-AC, Behavioral Activation for Depression Scale-Activation; EROS, Environmental Reward Observation Scale; CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; SEM, structural equation modeling

in EROS residual change scores from post-treatment to 1-year follow-up was associated with decreased BDI-II residual change scores from post-treatment to 1-year follow-up.

Some people with depressive symptoms are less likely to engage in activities that the person once enjoyed. They will think it difficult to engage in activities without improvement in their depressed symptoms. Behavioral activation highlights the nature of negative moods and then asks clients to consider the possibility of acting from the outside-in rather than from the inside-out (Martell et al., 2001; Martell et al., 2010). For behavioral activation, instead of acting in accordance with the mood, we first explain that the mood changes by acting. In our behavioral activation (Takagaki et al., 2016a, 2016b; Takagaki et al., 2018), rather than acting in accordance with a depressed mood, we helped participants to activate their behavior toward their individual goals, even in the presence of depression symptoms. Consequently, after behavioral activation, the study results might indicate that behavior habits are being formed. Moreover, those initially in stages of activation during our five-session behavioral activation might have tended to be more active after the intervention. Regarding positive reinforcement, reports of earlier studies have described that an increase of positive reinforcement decreases depressive symptoms (Manos et al., 2010; Takagaki et al., 2013a). Results indicate that greater increases in positive reinforcement are associated with decreased depressive symptoms, as demonstrated also in earlier studies. Gearing et al. (2013) reported from a meta-analysis that CBT intervention with a booster session is effective and more sustainable than CBT intervention without booster sessions. Although booster sessions are regarded as effective for behavioral activation (Martell et al., 2010), few studies have examined maintenance factors of depressive symptoms from post-treatment to 1-year follow-up. Although these results must be interpreted carefully, because we did not conduct a booster session from after behavioral activation to 1-year follow-up, more attention might be devoted to changes in activation and positive reinforcement to prevent worsening of depressive symptoms after behavioral activation. Behavioral activation treatment modifies a person's environment through behavior changes that increase access to positively reinforcing events and activities (Manos et al., 2010). Even after behavioral activation, it might be necessary to verify the frequency of activities and to ascertain whether the repertoire of activities has diminished.

This study has some limitations. All study participants were undergraduate students with subthreshold depression at a single institution. Therefore, further studies must be

conducted with a more diverse sample to generalize the results obtained through this study. Secondly, BDI-II, BADS-AC, and EROS scores are all assessed at the same two time points. Because no causal or longitudinal relation exists between the outcomes, this point represents a limitation of this study. For future studies, it might be necessary to examine relations between outcomes using variables of different time points. Thirdly, because this study did not demonstrate any effect of a booster session, causal relations must be interpreted carefully. Future studies should specifically investigate booster session effects.

Although some limitations might have affected this study, the study results suggest that, to prevent worsening of depressive symptoms after behavioral activation, one must ascertain whether the frequency of activities and positive reinforcement has diminished.

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Declarations

Ethical Approval and Informed Consent Approval for the study was obtained from the ethics committee of Hiroshima University. All participants gave written informed consent before participation.

Conflict of Interest The authors declare no competing interests.

Disclaimer No funding entity influenced the results or presentation of the study results.

References

Armento, M. E., & Hopko, D. R. (2007). The Environmental Reward Observation Scale (EROS): Development, validity, and reliability. *Behavior Therapy, 38*, 107–119. https://doi.org/10.1016/j.beth.2006.05.003.

Balazs, J., Miklosi, M., Kereszteny, A., Hoven, C. W., Carli, V., Wasserman, C., et al. (2013). Adolescent subthreshold-depression and anxiety: Psychopathology, functional impairment and increased suicide risk. *Journal of Child Psychology and Psychiatry, 54*, 670–677.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Beck Depression Inventory: Manual* (2nd ed.). The Psychological Corp.

Benton, S. A., Robertson, J. M., Tseng, W., Newton, F. B., & Benton, S. L. (2003). Changes in counseling center client problems across 13 years. *Professional Psychology: Research and Practice, 34*, 66–72. https://doi.org/10.1037/0735-7028.34.1.66.

Bertha, E. A., & Balazs, J. (2013). Subthreshold depression in adolescence: a systematic Review. *European Child & Adolescent Psychiatry, 22*, 589–603. https://doi.org/10.1007/s00787-013-0411-0.

Cuijpers, P., van Straten, A., & Warmerdam, L. (2007). Behavioral activation treatments of depression: A meta-analysis. *Clinical Psychology Review, 27*, 318–326. https://doi.org/10.1016/j.cpr.2006.11.001.

Cuijpers, P., Koole, S. L., van Dijke, A., Roca, M., Li, J., & Reynolds, C. F. (2014). Psychotherapy for subclinical depression: meta-analysis. *The British Journal of Psychiatry, 205*, 268–274. https://doi.org/10.1192/bjp.bp.113.138784.

Dimidjian, S., Barrera Jr., M., Martell, C., Munoz, R. F., & Lewinsohn, P. M. (2011). The origins and current status of behavioral activation treatment for depression. *Annual Review of Clinical Psychology, 7*, 1–38. https://doi.org/10.1146/annurev-clinpsy-032210-104535.

Gearing, R. E., Schwalbe, C. S., Lee, R., & Hoagwood, K. E. (2013). The effectiveness of booster sessions in CBT treatment for child and adolescent mood and anxiety disorders. *Depression and Anxiety, 30*, 800–808. https://doi.org/10.1002/da.22118.

Georgiades, K., Lewinsohn, P. M., Monroe, S. M., & Seeley, J. R. (2006). Major depressive disorder in adolescence: The role of subthreshold symptoms. *Journal of the American Academy of Child & Adolescent Psychiatry, 45*, 936–944.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural equation modeling: Guidelines for determining model fit. *The Electronic Journal of Business Research Methods, 6*, 53–60.

Johnson, J. G., Cohen, P., & Kasen, S. (2009). Minor depression during adolescence and mental health outcomes during adulthood. *The British Journal of Psychiatry, 195*, 264–265.

Kanter, J.W., Mulick, P.S., Busch, A. M., Berlin, K.S., & Martell, C. R. (2007). The Behavioral Activation for Depression Scale (BADS): psychometric properties and factor structure. *Journal of Psychopathology and Behavioral Assessment, 29*, 191–202. https://doi.org/10.1007/s10862-006-9038-5.

Kawakami, N., Takeshima, T., Ono, Y., Uda, H., Hata, Y., Nakane, Y., et al. (2005). Twelve-month prevalence, severity, and treatment of common mental disorders in communities in Japan: Preliminary finding from the World Mental Health Japan Survey 2002–2003. *Psychiatry and Clinical Neurosciences, 59*, 441–452. https://doi.org/10.1111/j.1440-1819.2005.01397.x.

Kessler, R. G., & Ustun, T. B. (2004). The World Mental Health (WMH) survey initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *International Journal of Methods in Psychiatric Research, 13*, 93–121. https://doi.org/10.1002/mpr.168.

Kojima, M., & Furukawa, T. (2003). *Japanese Version of the Beck Depression Inventory* (2nd ed.). Nippon-Hyoron-sha Co..

Kunisato, Y., Takagaki, K., Okajima, I., Nakajima, S., Ishikawa, S., Kanai, Y., et al. (2011). Development of Japanese version of Environmental Reward Observation Scale (EROS). *Japan Journal of Behavior. Therapy, 37*, 21–31.

Lewinsohn, P. M., Sullivan, L. M., & Grosscup, S. (1980). Changing reinforcing events: an approach to the treatment to depression. *Psychotherapy: Theory, Research & Practice, 17*, 322–334.

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39*, 99–128.

Manos, R. C., Kanter, J. W., & Busch, A. M. (2010). A critical review of assessment strategies to measure the behavioral activation model of depression. *Clinical Psychology Review, 30*, 547–561. https://doi.org/10.1016/j.cpr.2010.03.008.

Martell, C. R., Addis, M. E., & Jacobson, N. S. (2001). *Depression in context: Strategies for guided action*. W. W. Norton & Company.

Martell, C. R., Dimidjian, S., & Herman-Dunn, R. (2010). *Behavioral activation for depression – A clinician's guide*. The Guilford Press.

Mazzucchelli, T., Kane, R., & Rees, C. (2009). Behavioral activation treatments for depression in adults: A meta-analysis and review. *Clinical Psychology: Science and Practice, 16*, 383–411. https://doi.org/10.1111/j.1468-2850.2009.01178.x.

Pincus, H. A., Davis, W. W., & McQueen, L. E. (1999). Subthreshold mental disorders. A review and synthesis of studies on minor depression and other brand names. *British Journal of Psychiatry, 174*, 288–296.

Richards, D. A., Ekers, D., McMillan, D., Taylor, R. S., Byford, S., Warren, F. C., et al. (2016). Cost and Outcome of Behavioural Activation versus Cognitive Behavioural Therapy for Depression (COBRA): A randomised, controlled, non-inferiority trial. *Lancet, 388*, 871–880. https://doi.org/10.1016/S0140-6736(16)31140-0.

Takagaki, K., Okajima, I., Kunisato, Y., Nakajima, S., Kanai, Y., Ishikawa, S., et al. (2013a). Preliminary assessment of the behavioral activation model in Japanese undergraduate students. *Psychological Reports, 112*, 47–59. https://doi.org/10.2466/02.15.21.PR0.112.1.47-59.

Takagaki, K., Okajima, I., Kunisato, Y., Nakajima, S., Kanai, Y., Ishikawa, S., et al. (2013b). Development and validation of the Japanese version of the Behavioral Activation for Depression Scale (BADS). *Archives of Psychiatric Diagnostics and Clinical Evaluation, 6*, 76–85.

Takagaki, K., Okamoto, Y., Jinnin, R., Mori, A., Nishiyama, Y., Yamamura, T., et al. (2014). Behavioral characteristics of subthreshold depression. *Journal of Affective Disorders, 168*, 472–475.

Takagaki, K., Okamoto, Y., Jinnin, R., Mori, A., Nishiyama, Y., Yamamura, T., et al. (2016a). Behavioral activation for late adolescents with subthreshold depression: a randomized controlled trial. *European Child Adolescent Psychiatry, 25*, 1171–1182. https://doi.org/10.1007/s00787-016-0842-5.

Takagaki, K., Okamoto, Y., Jinnin, R., Mori, A., Nishiyama, Y., Yamamura, T., et al. (2016b). Mechanisms of behavioral activation for late adolescents: Positive reinforcement mediates the relationship between activation and depressive symptoms from pre-treatment to post-treatment. *Journal of Affective Disorders, 204*, 70–73. https://doi.org/10.1016/j.jad.2016.06.046.

Takagaki, K., Okamoto, Y., Jinnin, R., Mori, A., Nishiyama, Y., Yamamura, T., et al. (2018). Enduring effects of a 5-week behavioral activation program for subthreshold depression among late adolescents: An exploratory randomized controlled trial. *Neuropsychiatric Disease and Treatment, 14*, 2633–2641. https://doi.org/10.2147/NDT.S172385.

Tomoda, A., Mori, K., Kimura, M., Takahashi, T., & Kitamura, T. (2000). One-year incidence and prevalence of depression among first-year university students in Japan: A preliminary study. *Psychiatry and Clinical Neurosciences, 54*, 583–588. https://doi.org/10.1046/j.1440-1819.2000.00757.x.