Published in final edited form as:

Psych J. 2015 March ; 4(1): 11–19. doi:10.1002/pchj.84.

Aging and the effects of emotion on cognition: Implications for psychological interventions for depression and anxiety

Bob G. Knight and **Kelly Durbin**

Davis School of Gerontology, University of Southern California, Los Angeles, CA, USA

Abstract

We review findings from laboratory research on age differences in the effects of emotion on cognition. Particular attention is given to sadness leading to mood congruent memory and to anxiety leading to selective attention bias to threat. While older adults in normal moods show the positivity effect as expected from socio-emotional selectivity theory, older adults whose mood has changed from baseline to sad or anxious show these mood-related cognitive biases. These mood-related biases are a foundational part of the theory underlying cognitive behavior therapy (CBT) and so these laboratory findings suggest ways that CBT may work differently with older adults. Pilot work suggests that the presence or absence of these effects may also predict responsiveness to treatment using CBT.

Keywords

anxiety; cognitive behavior therapy with older adults; depression; mood-related cognitive biases

Depression and anxiety are characterized by biases in cognition and emotional processing which impair functioning and reduce the overall quality of life. Both depression and anxiety can lead to significant health burdens. Using information such as the impact of premature death and disability, the World Health Organization (2001) ranked depression as the fourth leading cause contributing to disability-adjusted life years, each of which represents 1 year of “healthy” life lost. Depression is associated with an increased risk of developing coronary heart disease (Frasure-Smith & Lespérance, 2010), a reduction in survival time after a cancer diagnosis (Brown, Levy, Rosberger, & Edgar, 2003), and is a risk factor for mortality (Schulz et al., 2000). Anxiety disorders are also associated with health-related risks, such as coronary artery disease (Gellis, 2006), disability (de Beurs et al., 1999), and sleep disturbances (Potvin, Lorrain, Belleville, Grenier, & Prévile, 2014).

Depression and anxiety in older adults

Depression is a common cause of disability among older adults, although prevalence rates for depression are lower compared with younger adults (Hasin, Goodwin, Stinson, & Grant, 2005). However, Djernes (2006) suggests that depression may be under-recognized and undertreated in older adult populations. In regards to anxiety, studies have found relatively

high rates of comorbidity with depression (Lenze et al., 2000) and evidence suggests that anxiety disorders are perhaps even more prevalent than depression in older adults (Regier et al., 1988). It is possible that current diagnostic criteria and age stereotypes under-represent the true prevalence rates for depression and anxiety in older populations. For example, older adults are less likely to endorse sadness or affective symptoms than their younger counterparts (Fiske, Wetherell, & Gatz, 2009; Gallo, Rabins, & Anthony, 1999). Research has also found that the content of worry among older adults (e.g., health-related concerns) may be different than younger adults (Lindesay et al., 2006). Symptoms associated with depression and anxiety may be misinterpreted as representative of typical feelings coinciding with difficulties in later life, such as declining physical health, bereavement, and reductions in social support. Depression and anxiety among older adults are important public health concerns because older adults have additional health-related consequences. For example, older adults suffering from depression have an increased risk of vascular dementia and Alzheimer's disease (Steffens et al., 2006), nursing home admission (Harris, 2007), and recurrent falling (Gostynski et al., 2001). Anxiety comorbid with depression is associated with a greater decline in memory among older adults (DeLuca et al., 2005) and anxiety disorders have been linked to dementia (Gellis, 2006). These detrimental health consequences underscore the importance of establishing effective treatments for depression and anxiety in older populations.

Cognitive behavior therapy for depression and anxiety

A highly effective treatment for depression and anxiety disorders, such as generalized anxiety disorder and panic disorder, is cognitive behavior therapy (CBT; Butler, Chapman, Forman, & Beck, 2006). CBT has been shown to be equally effective in younger and older adults for treating depression (Cuijpers, van Straten, Smit, & Andersson, 2009). Additionally, CBT has shown large effect sizes in treating anxiety among older adults (Wetherell, Gatz, & Craske, 2003). Yet not all individuals will benefit from treatment interventions, including CBT. Determining the factors that can predict treatment response can help identify individuals who would be most likely to benefit from certain types of treatment interventions. Research on treatment predictors for depression and anxiety has predominantly focused on demographic characteristics, duration of a depressive episode, and pretreatment severity (e.g., Hamilton & Dobson, 2002; Van, Schoevers, & Dekker, 2008); however, other factors should be considered. For example, CBT relies heavily on cognitive processing and executive functioning, so certain aspects of cognition may be particularly helpful in predicting an individual's response to treatment. Research has found that older adults with deficits in executive functioning (e.g., selective attention, control, and regulatory strategies) exhibit a poorer response to CBT (Mohlman & Gorman, 2005). Thus, in addition to investigating whether certain components of cognition are predictive of treatment response, age-related differences in cognitive processing should also be examined.

According to the CBT framework, negative cognitive biases in how individuals view themselves, their world, and their future contribute to the onset and maintenance of depression and anxiety (Beck, Emery, & Greenberg, 1985; Beck, Rush, Shaw, & Emery, 1979). In particular, depressed and anxious individuals are biased towards attending to and remembering negative and threatening information and are also inclined to interpret

ambiguous information as negative (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Mathews & MacLeod, 2005). In addition to negative cognitive biases, individuals with depression have increased difficulty implementing cognitive control and emotion regulation strategies when confronted with negative information (Gotlib & Joormann, 2010).

Age-related differences in emotion and cognition

Older adults with depression and anxiety may have differences in cognition and emotional processing. For example, depressed older adults are more likely to endorse cognitive changes than younger adults (Fiske et al., 2009). There is also reason to believe that the general interaction between emotion and cognition may operate differently in older adults. For example, in healthy, nondepressed older adults, there is an age-related shift in cognitive and emotional processing. Compared with younger adults, older adults attend to and remember more positive than negative information, a phenomenon referred to as the positivity effect (Carstensen & Mikels, 2005). This shift towards positive information can be explained within the context of socio-emotional selectivity theory, which suggests that older adults prioritize emotional goals while younger adults pursue knowledge and information as they develop careers and become acquainted with the world (Carstensen, Isaacowitz, & Charles, 1999). In order to maintain emotional well-being, older adults implement cognitive control and emotion regulation strategies during encoding to prioritize the processing of positive stimuli (Mather & Knight, 2005). Evidence suggests that when older adults' attention is distracted and the ability to engage in control and regulatory strategies is limited, the positivity effect in memory is eliminated (Mather & Knight, 2005). The strength and vulnerability integration model (SAVI; Charles, 2010) suggests that negative life events and chronic stressors can greatly decrease the use of these adaptive emotion regulation strategies, which can reduce the positivity bias. Serrano, Latorre, and Gatz (2007) found that the positivity effect in autobiographical memory retrieval was reduced in older adults with depressive symptoms compared with nondepressed older adults. Understanding the mechanisms that underlie the transition away from a positivity bias, either from chronic stressors or negative cognitive biases associated with anxiety and depression, can provide important insight into the age-related differences in cognition.

Attending to and remembering information that is similar in valence to an individual's internal mood state, such as a negative attentional bias among depressed individuals, is often referred to as mood congruence. While mood congruency has been studied extensively in younger adults, less is known about mood congruence effects in older adults. As suggested by the socio-emotional selectivity theory, the saliency of emotional goals may cause older adults to process emotional information differently. Correspondingly, there may be an age-related difference in mood congruence effects as well.

Mood congruence effects and sad mood in older adults

In order to investigate mood congruence effects in older adults, studies have used mood induction methodologies. Sad mood inductions using music and Velten statements (i.e., self-referential statements that are depressing in context; Velten, 1968) have been shown to be

effective in inducing a sad mood in older adults (Fox, Knight, & Zelinski, 1998). One study, using music to induce sad and happy moods, found that both younger and older adults displayed mood congruency effects (Ferraro, King, Ronning, Pekarski, & Risan, 2003). Specifically, Ferraro et al. (2003) found that younger and older adults were significantly faster at identifying whether sad words were real words, compared with happy words, when induced into a sad mood. The reverse pattern was true when younger and older adults were induced into a happy mood.

Knight, Maines, and Robinson (2002) administered numerous cognitive tasks after inducing nondepressed younger and older adults into either a sad or neutral mood using Velten statements and classical music. These tasks included a lexical ambiguity task, which involved spelling homophones with potentially sad or neutral meanings, and multiple memory tasks that asked participants to recall word lists, prose passages, and autobiographical events. For the lexical ambiguity and word recall tasks, older adults recalled and spelled fewer negative words compared with younger adults, consistent with the general age-related shift for remembering more positive than negative information. When induced into a sad mood, both younger and older adults exhibited biases towards information congruent with their moods. Specifically, when prompted into a sad internal mood state, younger and older adults recalled a greater number of negative words and were more likely to recall a negative autobiographical event than younger and older participants who were induced into a neutral mood. Furthermore, older adults who were induced into a sad mood recalled fewer positive words than older adults in the neutral mood condition, demonstrating that not only is recall for negative words enhanced during a sad mood state, but positive word recall is reduced.

When comparing younger and older adults to examine age-related differences, Knight et al. (2002) found that older adults displayed mood congruency across a greater number of cognitive tasks. While both younger and older adults displayed mood congruency effects when recalling word lists and autobiographical events, only older adults demonstrated mood congruence during the lexical ambiguity task. Specifically, older adults in the sad mood condition generated a greater number of negative than neutral homophones compared with older adults in the neutral mood condition. Yet, the difference between negative homophones generated among young adults in the sad and neutral mood induction was not significant. Findings across all of the cognitive tasks in this study provided strong support that older adults do, in fact, demonstrate mood congruency effects for both implicit (e.g., lexical ambiguity task) and explicit (e.g., word recall) memory.

Another study also used sad and neutral mood induction to investigate the effects of internal mood states on the retrieval of recent (e.g., past week) and distant (e.g., high school) autobiographical memories (Knight, Kellough, & Poon, 2011). A main effect of age among distant memories revealed that overall, older adults recalled fewer sad autobiographical events than their younger counterparts, illustrating a positivity bias. Replicating and extending the findings of Knight et al. (2002), this study also found that when older adults were induced into a sad mood, they retrieved a greater number of negative autobiographical memories for events in the past week compared with older adults in the neutral mood induction. Surprisingly, the opposite pattern emerged among younger adults. Compared with

young participants in the neutral mood condition, young adults induced into a sad mood were actually less likely to recall a sad event from the past week. This mood incongruence in memory may be reflective of young adults' engagement in mood repair. Taken together, the previous two studies provide evidence that older adults may actually be more likely than younger adults to show mood congruent biases in both implicit and explicit memory.

In addition to cognitive biases in memory, mood congruence effects in older adults may also extend to bias the saliency of physical symptoms. A recent study investigated how a sad mood and age stereotyping would impact attention to physical symptoms (Poon & Knight, 2009). Older adults were randomly assigned to one of four conditions, with mood (sad, neutral) and old age schema (activated, not activated) manipulations as between-subjects factors. Mood was manipulated by asking participants to write a brief narrative about a sad or neutral personal event and this mood manipulation was maintained by playing music throughout the study. Participants in the activated old age schema were asked a series of questions on the topic of aging, while individuals in the control schema condition were asked questions about population density. After mood inductions, a modified Stroop task was administered in which older adults were asked to identify the font color of symptom-related (e.g., fatigue, dizziness), aging-related (e.g., elderly, seniors), and neutral words. Based on response times for identifying font color, older adults in the control conditions displayed an attentional bias away from physical symptoms. Reduced attention to negative words, such as negative physical symptoms, is consistent with prior literature on the positivity effect. However, sad mood and an old age schema minimized avoidance of physical symptoms. Older adults' increased attention to negative physical symptoms when induced into a sad mood state provides further demonstration of mood congruency. The overall pattern of results from these three studies on mood congruency and a sad mood provides evidence that, similar to younger adults, older adults have biases towards attending to and remembering negative information when induced into a sad mood state and perhaps even to a greater extent than younger adults. Thus, the effects of emotion on cognitive processing may be more influential among older adults and negative cognitive biases may be a critical component for the development and maintenance of late life depression.

Mood congruence effects and anxiety in older adults

As discussed earlier, anxiety in young adults is associated with an attentional bias towards threatening information. In order to investigate the association between mood congruency effects and anxiety in older adults, studies have used anxious mood inductions. A study conducted by Fox and Knight (2005) examined the effects of state and trait anxiety on selective attention to threat among healthy older adults using Stroop and dot-probe tasks. To assess state anxiety, an anxious mood was induced by telling older adults that they would be videotaped and scored on their memory and ability to deliver a speech after reading an advanced passage on the topic of terrorism threat. Participants in the neutral mood condition were told that they would be asked some questions after reading a passage on renewable energy sources. Trait anxiety was measured using the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983).

Fox and Knight (2005) found that older adults who were induced into an anxious mood state exhibited an attentional bias towards threat during the dot-probe task, whereas older adults in the neutral mood condition tended to avoid threatening information. An attentional bias for threatening words was also found in older adults with low levels of trait anxiety during the Stroop task. However, this bias during the Stroop task was not present for older adults with high levels of trait anxiety. This lack of an attentional bias to threat among older adults with high trait anxiety is somewhat surprising considering evidence that highly anxious individuals can be more distracted by physically threatening words than individuals with lower levels of anxiety (Eysenck & Byrne, 1992). One possible explanation for the lack of an attentional bias to threat among older adults with high trait anxiety is the effect of experience. Considering that this was a nonclinical sample, older adults with high trait anxiety may have developed adaptive mood regulation strategies to assist with completing more complex tasks. There is also evidence that anxious individuals initially attend to threat, but then disengage from threatening stimuli that are presented for long periods of time as a form of cognitive and attentional avoidance (Derryberry & Reed, 2002). Therefore, it is plausible that in order to minimize the disruption of emotional goals, older adults may be more likely to utilize a vigilant-avoidant response strategy when presented with threatening information.

Another recent study also investigated whether anxiety would moderate the attentional bias for emotional information in older adults. Using the STAI (Spielberger et al., 1983) to measure trait anxiety, Lee and Knight (2009) stratified nonclinical samples of younger and older adults into low, moderate, and high trait anxiety levels. Participants were presented with negative-neutral pairs of faces, pictures, and words displayed either subliminally (20 ms and 50 ms for younger and older adults, respectively) or supraliminally (1,500 ms for both age groups). Subliminal and supraliminal stimuli presentations allowed for investigation of whether a possible vigilant-avoidant response strategy is present among older adults. For example, reduced attention to supraliminal, compared with subliminal, stimuli would indicate a vigilant-avoidant response, while the reverse pattern would reflect an avoidant-vigilant response pattern. Distinguishing between these two attentional bias response patterns is critical for understanding the circumstances in which older adults attend to and disengage from negative information.

Across all anxiety levels, older adults displayed a vigilant-avoidant pattern for angry faces (Lee & Knight, 2009). Additionally, older adults with moderate levels of anxiety also exhibited a vigilant-avoidant response for sad faces. However, anxiety levels influenced attention for negative words in the opposite direction. Older adults with high levels of trait anxiety had greater attention for negative words presented supraliminally than for those presented subliminally, demonstrating an avoidant-vigilant response pattern. Surprisingly, younger adults did not display an attentional bias for threat when faces, words, or pictures were used as stimuli. The attentional biases to threat observed in older, but not younger, adults in this study provides further support for the notion that older adults may be more susceptible to mood congruency and negative cognitive biases than younger adults.

The display of both vigilant-avoidant and avoidant-vigilant response patterns suggests that, under certain conditions, older adults have an attentional bias to threat at both early and late

stages of threat detection. These findings from Lee and Knight (2009) illustrate the importance of considering varying anxiety levels and stimulus modalities when investigating cognitive and emotional processing in older adults. For example, detecting threat among angry faces may be an adaptive and automatic process that remains intact across the lifespan (Mather & Knight, 2006). Yet detecting threat among other types of stimuli may be more prone to age-related differences. Future research is needed in this area to disentangle these influences and to determine the precise circumstances under which older adults are vigilant and avoidant of threatening information.

Overall, these studies on sad and anxious mood inductions provide indirect evidence for the presence of mood congruency effects, such as negative cognitive biases among depressed and anxious older adults. Additionally, these findings suggest that older adults may be more susceptible to mood congruency effects than younger adults, possibly due to the prioritization of emotional goals in later life. However, not all research has found evidence for mood congruency in older adults. One study used eye-tracking techniques to investigate younger and older adults' gaze preference for emotional faces when induced into positive and negative moods (Isaacowitz, Toner, Goren, & Wilson, 2008). Isaacowitz et al. (2008) found that young adults displayed gaze preferences for angry and afraid faces when induced into a negative mood, demonstrating mood congruency. However, older adults attended away from angry and sad faces and preferred to gaze towards happy faces when induced into a negative mood. Isaacowitz et al. explained the mood incongruency displayed in older adults in the context of socio-emotional selectivity theory and the prioritization of emotional well-being. Future research is needed to determine the precise circumstances under which older adults display mood congruence and mood incongruence when induced into a negative mood. Additionally, future studies should compare mood congruent biases during sad and anxious mood inductions to the cognitive biases associated with depression and anxiety in older adults.

Implications for CBT

Age-related differences in negative cognitive biases have important implications for treating depression and anxiety. As discussed earlier, predictors of treatment response for interventions, such as CBT, typically focus primarily on demographic variables, severity and duration of symptoms. Yet, there are numerous inconsistencies in the literature regarding treatment predictors, and aggregated effect sizes are generally small, possibly due to the selection process for identifying predicting variables. For depression in older adults, lower ratings of self-reported health were a moderate predictor of worse treatment outcomes (Kiosses, Leon, & Areán, 2011). Lower self-reported health ratings as a predictor of treatment response may reflect medical conditions that constrain the efficacy of treatments for depression or signify the presence of a strong negative bias towards physical symptoms.

Theoretically, a potential predictor of treatment response is the presence of cognitive biases. For example, a key component of CBT for depression is altering maladaptive thoughts and beliefs, so a reasonable hypothesis is that individuals with a more negative cognitive schema should benefit more from a cognitive-based therapy. However, research has indicated that individuals with high levels of dysfunctional attitudes and cognitive beliefs have a poorer

response to CBT compared with individuals with lower levels (e.g., Hamilton & Dobson, 2002; Jarrett, Eaves, Grannemann, & Rush, 1991). Both Hamilton and Dobson (2002) and Jarrett et al. (1991) used self-report measures, such as the Dysfunctional Attitude Scale (DAS; Weissman, 1979), to assess negative thoughts. Critically, self-report measures rely on introspective ability and willingness to report, which may be less reflective of cognitive biases, such as increased attention towards threatening information. Furthermore, in general, the methodological variance among studies using self-report measures to assess predictor and treatment response variables may contribute to the counterintuitive association between highly dysfunctional thoughts and poorer outcomes to CBT. Mood congruency effects, or mood-coupled cognitive biases, may be more accurate in assessing cognitive components as a predictor of treatment response.

To assess pretreatment mood-coupled cognitive biases as a predictor for response to CBT, a pilot study used autobiographical memory and emotional word recall tasks among six older adult clients receiving CBT for depressive disorders (Knight, 2011). Four older adult clients improved over the course of therapy, as assessed using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), and no longer met the diagnostic criteria for depressive disorders, as assessed using the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR; American Psychiatric Association, 2000). These four clients exhibited mood-coupled cognitive biases pretreatment; however, these biases were no longer present during post-therapy measures (e.g., amount of negative words recalled dropped from 80 to 42%, pre- to post-treatment, respectively). The two clients who did not improve from CBT did not display mood-coupled cognitive biases pretreatment. Specifically, at pretreatment, CBT responders had an 80% negative word recall and 78% recall of negative autobiographical events, while CBT nonresponders had a 50 and 33% recall, respectively. Another study administered 4 weeks of positive autobiographical retrieval training to depressed older adults and found that after training, older adults exhibited fewer depressive symptoms and improved life satisfaction (Serrano, Latorre, Gatz, & Montanes, 2004).

Findings from these two studies provide an exciting foundation for future research to assess the role of mood-coupled cognitive biases as a treatment predictor, particularly among older adult clients who may be more susceptible to mood congruency effects. Future research should also investigate pretreatment cognitive biases as a treatment predictor among older adults with anxiety and comorbid anxiety and depression. Research assessing negative cognitive biases as a response predictor for depression and anxiety could aid in treatment selection for both younger and older adults. Individuals with negative cognitive biases could be selected to receive cognitive-based treatments, such as CBT or cognitive bias modification (for a meta-analysis, see Hallion & Ruscio, 2011). Individuals who exhibit fewer cognitive biases and would be less likely to benefit from treatments aimed at changing maladaptive cognitions may respond better to different forms of treatment. For example, these clients may benefit more from medication or other psychotherapies, such as acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 1999), which encourages acceptance and mindfulness along with strategies to change behavior. Older adults who have mild cognitive deficits, which could be a barrier to cognitive-based treatments, might benefit more from problem-solving treatments (Kiosses et al., 2011).

Determining whether certain components of cognition are predictive of response to CBT has broad impacts when considering CBT is the most widely taught therapy among training programs in psychiatry, psychology, and social work (Weissman et al., 2006). CBT is a highly effective treatment that reduces relapse rates and is ultimately less expensive than medication-only interventions (Dobson et al., 2008; Hollon et al., 2005). Specifically, evidence suggests that while cognitive therapy may be twice as expensive than medication during the acute treatment phase, cumulative costs intersect around the ninth month of treatment, with ongoing medication becoming more expensive than psychotherapy (Dobson et al., 2008). Determining which individuals would be most likely to benefit from certain types of psychotherapies, such as CBT, would be even more cost-effective.

In conclusion, identifying factors that predict response to treatments such as CBT is important to determine which individuals would be most likely to benefit from treatment. As a core component of cognitive therapy is changing automatic maladaptive thoughts and negative cognitive biases, evaluating cognitive processes as response predictors is essential. A further consideration is age-related differences in cognition. Research has suggested that older adults may differentially attend to and disengage from negative information and may be more susceptible to mood congruency effects than younger adults. Understanding the differences in cognitive and emotional processing in older adults can provide invaluable insight into how these processes contribute to the onset and maintenance of late life depression and anxiety. Considering the serious health consequences associated with late life depression and anxiety, accurate diagnoses and effective treatments are critical.

References

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th. Washington, DC: Author; 2000. text rev.
- Bar-Haim Y, Lamy D, Pergamin L, Bakermans-Kranenburg MJ, van IJzendoorn MH. Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin*. 2007; 133(1):1–24. DOI: 10.1037/0033-2909.133.1.1 [PubMed: 17201568]
- Beck, AT., Emery, G., Greenberg, RL. Anxiety disorders and phobias: A cognitive perspective. New York, NY: Basic Books; 1985.
- Beck, AT., Rush, AJ., Shaw, BF., Emery, G. Cognitive theory of depression. New York, NY: The Guilford Press; 1979.
- Brown KW, Levy AR, Rosberger Z, Edgar L. Psychological distress and cancer survival: A follow-up 10 years after diagnosis. *Psychosomatic Medicine*. 2003; 65:636–643. DOI: 10.1097/01.PSY.0000077503.96903.A6 [PubMed: 12883115]
- Butler AC, Chapman JE, Forman EM, Beck AT. The empirical status of cognitive-behavioral therapy: A review of meta-analyses. *Clinical Psychology Review*. 2006; 26:17–31. DOI: 10.1016/j.cpr.2005.07.003 [PubMed: 16199119]
- Carstensen LL, Isaacowitz DM, Charles ST. Taking time seriously: A theory of socioemotional selectivity. *The American Psychologist*. 1999; 54(3):165–181. DOI: 10.1037/0003-066X.54.3.165 [PubMed: 10199217]
- Carstensen LL, Mikels JA. At the intersection of emotion and cognition: Aging and the positivity effect. *Current Directions in Psychological Science*. 2005; 14(3):117–121. DOI: 10.1111/j.0963-7214.2005.00348.x
- Charles ST. Strength and vulnerability integration: A model of emotional well-being across adulthood. *Psychological Bulletin*. 2010; 136(6):1068–1091. DOI: 10.1037/a0021232 [PubMed: 21038939]

- Cuijpers P, van Straten A, Smit F, Andersson G. Is psychotherapy for depression equally effective in younger and older adults? A meta-regression analysis. *International Psychogeriatrics*. 2009; 21(1): 16–24. DOI: 10.1017/S1041610208008089 [PubMed: 19040783]
- de Beurs E, Beekman ATF, van Balkom AJLM, Deeg DJH, van Dyck R, van Tilburg W. Consequences of anxiety in older persons: Its effect on disability, well-being and use of health services. *Psychological Medicine*. 1999; 29:583–593. DOI: 10.1017/S0033291799008351 [PubMed: 10405079]
- DeLuca AK, Lenze EJ, Mulsant BH, Butters MA, Karp JF, Dew MA, Reynolds CF. Comorbid anxiety disorder in late life depression: Association with memory decline over four years. *International Journal of Geriatric Psychiatry*. 2005; 20:848–854. DOI: 10.1002/gps.1366 [PubMed: 16116585]
- Derryberry D, Reed MA. Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology*. 2002; 111(2):225–236. DOI: 10.1037/0021-843X.111.2.225 [PubMed: 12003445]
- Djernes JK. Prevalence and predictors of depression in populations of elderly: A review. *Acta Psychiatrica Scandinavica*. 2006; 113:372–387. DOI: 10.1111/j.1600-0447.2006.00770.x [PubMed: 16603029]
- Dobson KS, Hollon SD, Dimidjian S, Schmalings KB, Kohlenberg RJ, Gallop RJ, Jacobson NS. Randomized trial of behavioral activation, cognitive therapy, and antidepressant medication in the prevention of relapse and recurrence in major depression. *Journal of Consulting and Clinical Psychology*. 2008; 76(3):468–477. DOI: 10.1037/0022-006X.76.3.468 [PubMed: 18540740]
- Eysenck MW, Byrne A. Anxiety and susceptibility to distraction. *Personality and Individual Differences*. 1992; 13(7):793–798. DOI: 10.1016/0191-8869(92)90052-Q
- Ferraro FR, King B, Ronning B, Pekarski K, Risan J. Effects of induced emotional state on lexical processing in younger and older adults. *The Journal of Psychology*. 2003; 137(3):262–272. DOI: 10.1080/00223980309600613 [PubMed: 12795548]
- Fiske A, Wetherell JL, Gatz M. Depression in older adults. *Annual Review of Clinical Psychology*. 2009; 5:363–389. DOI: 10.1146/annurev.clinpsy.032408.153621
- Fox LS, Knight BG. The effects of anxiety on attentional processes in older adults. *Aging and Mental Health*. 2005; 9(6):585–593. DOI: 10.1080/13607860500294282 [PubMed: 16214707]
- Fox LS, Knight BG, Zelinski EM. Mood induction with older adults: A tool for investigating effects of depressed mood. *Psychology and Aging*. 1998; 13(3):519–523. DOI: 10.1037/0882-7974.13.3.519 [PubMed: 9793125]
- Frasure-Smith N, Lespérance F. Depression and cardiac risk: Present status and future directions. *Heart*. 2010; 96(3):173–176. DOI: 10.1136/hrt.2009.186957 [PubMed: 19861300]
- Gallo JJ, Rabins PV, Anthony JC. Sadness in older persons: 13-year follow-up of a community sample in Baltimore, Maryland. *Psychological Medicine*. 1999; 29:341–350. DOI: 10.1017/S0033291798008083 [PubMed: 10218925]
- Gellis, ZD. Older adults with mental and emotional problems. In: Berkman, B., editor. *Handbook of Social Work in Health and Aging*. New York, NY: Oxford University Press; 2006. p. 129–139.
- Gostynski M, Ajdacic-Gross V, Heusser-Gretler R, Gutzwiller F, Michel JP, Herrmann F. Demenz, Depressionen und Aktivitäten des täglichen Lebens als Risikofaktoren von Stürzen bei Betagten [Dementia, depression and activity of daily living as risk factors for falls in elderly patients]. *Sozial- und Präventivmedizin*. 2001; 46(2):123–130. DOI: 10.1007/BF01299729 [PubMed: 11446307]
- Gotlib IH, Joormann J. Cognition and depression: Current status and future directions. *Annual Review of Clinical Psychology*. 2010; 6:285–312. DOI: 10.1146/annurev.clinpsy.121208.131305
- Hallion LS, Ruscio AM. A meta-analysis of the effect of cognitive bias modification on anxiety and depression. *Psychological Bulletin*. 2011; 137(6):940–958. DOI: 10.1037/a0024355 [PubMed: 21728399]
- Hamilton KE, Dobson KS. Cognitive therapy of depression: Pretreatment patient predictors of outcome. *Clinical Psychology Review*. 2002; 22:875–893. DOI: 10.1016/S0272-7358(02)00106-X [PubMed: 12214329]

- Harris Y. Depression as a risk factor for nursing home admission among older individuals. *Journal of the American Medical Directors Association*. 2007; 8(1):14–20. DOI: 10.1016/j.jamda.2006.06.005 [PubMed: 17210498]
- Hasin DS, Goodwin RD, Stinson FS, Grant BF. Epidemiology of major depressive disorder: Results from the National Epidemiologic Survey on alcoholism and related conditions. *Archives of General Psychiatry*. 2005; 62(10):1097–1106. DOI: 10.1001/archpsyc.62.10.1097 [PubMed: 16203955]
- Hayes, SC., Strosahl, KD., Wilson, KG. Acceptance and commitment therapy: An experiential approach to behavior change. New York, NY: Guilford; 1999.
- Hollon SD, DeRubeis RJ, Shelton RC, Amsterdam JD, Salomon RM, O'Reardon JP, Gallop R. Prevention of relapse following cognitive therapy vs medications in moderate to severe depression. *Archives of General Psychiatry*. 2005; 62(4):417–422. DOI: 10.1001/archpsyc.62.4.417 [PubMed: 15809409]
- Isaacowitz DM, Toner K, Goren D, Wilson HR. Looking while unhappy: Mood-congruent gaze in young adults, positive gaze in older adults. *Psychological Science*. 2008; 19(9):848–853. DOI: 10.1111/j.1467-9280.2008.02167.x [PubMed: 18947348]
- Jarrett RB, Eaves GG, Grannemann BD, Rush AJ. Clinical, cognitive, and demographic predictors of response to cognitive therapy for depression: A preliminary report. *Psychiatry Research*. 1991; 37:245–260. DOI: 10.1016/0165-1781(91)90061-S [PubMed: 1891508]
- Kiosses DN, Leon AC, Areán PA. Psychosocial interventions for late-life major depression: Evidence-based treatments, predictors of treatment outcomes, and moderators of treatment effects. *The Psychiatric Clinics of North America*. 2011; 34(2):377–401. DOI: 10.1016/j.psc.2011.03.001 [PubMed: 21536164]
- Knight BG. Pilot data on mood-coupled cognitive bias and cognitive behavior therapy. 2011 Unpublished raw data.
- Knight, BG., Kellough, JL., Poon, CYM. Age differences in mood congruence effect. Unpublished manuscript, Department of Psychology, University of Southern California; Los Angeles, CA: 2011.
- Knight BG, Maines ML, Robinson GS. The effects of sad mood on memory in older adults: A test of the mood congruence effect. *Psychology and Aging*. 2002; 17(4):653–661. DOI: 10.1037/0882-7974.17.4.653 [PubMed: 12507361]
- Lee LO, Knight BG. Attentional bias for threat in older adults: Moderation of the positivity bias by trait anxiety and stimulus modality. *Psychology and Aging*. 2009; 24(3):741–747. DOI: 10.1037/a0016409 [PubMed: 19739931]
- Lenze EJ, Mulsant BH, Shear MK, Schulberg HC, Dew MA, Begley AE, Reynolds CF. Comorbid anxiety disorders in depressed elderly patients. *The American Journal of Psychiatry*. 2000; 157(5): 722–728. DOI: 10.1176/appi.ajp.157.5.722 [PubMed: 10784464]
- Lindesay J, Baillon S, Brugha T, Dennis M, Stewart R, Araya R, Meltzer H. Worry content across the lifespan: An analysis of 16- to 74-year-old participants in the British National Survey of Psychiatric Morbidity 2000. *Psychological Medicine*. 2006; 36:1625–1633. DOI: 10.1017/S0033291706008439 [PubMed: 16863599]
- Mather M, Knight M. Goal-directed memory: The role of cognitive control in older adults' emotional memory. *Psychology and Aging*. 2005; 20(4):554–570. DOI: 10.1037/0882-7974.20.4.554 [PubMed: 16420131]
- Mather M, Knight MR. Angry faces get noticed quickly: Threat detection is not impaired among older adults. *Journal of Gerontology: Psychological Sciences*. 2006; 61B(1):54–57. DOI: 10.1093/geronb/61.1.P54
- Mathews A, MacLeod C. Cognitive vulnerability to emotional disorders. *Annual Review of Clinical Psychology*. 2005; 1:167–195. DOI: 10.1146/annurev.clinpsy.1.102803.143916
- Mohlman J, Gorman JM. The role of executive functioning in CBT: A pilot study with anxious older adults. *Behaviour Research and Therapy*. 2005; 43:447–465. DOI: 10.1016/j.brat.2004.03.007 [PubMed: 15701356]

- Poon CYM, Knight BG. Influence of sad mood and old age schema on older adults' attention to physical symptoms. *Journal of Gerontology: Psychological Sciences*. 2009; 64B(1):41–44. DOI: 10.1093/geronb/gbn025
- Potvin O, Lorrain D, Belleville G, Grenier S, Prévaille M. Subjective sleep characteristics associated with anxiety and depression in older adults: A population-based study. *International Journal of Geriatric Psychiatry*. 2014; Advance online publication. doi: 10.1002/gps.4106
- Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*. 1977; 1:385–401. DOI: 10.1177/014662167700100306
- Regier DA, Boyd JH, Burke JD Jr, Rae DS, Myers JK, Kramer M, Locke BZ. One-month prevalence of mental disorders in the United States: Based on five epidemiologic catchment area sites. *Archives of General Psychiatry*. 1988; 45(11):977–986. DOI: 10.1001/archpsyc.1988.01800350011002 [PubMed: 3263101]
- Schulz R, Beach SR, Ives DG, Martire LM, Ariyo AA, Kop WJ. Association between depression and mortality in older adults: The Cardiovascular Health Study. *Archives of Internal Medicine*. 2000; 160(12):1761–1768. DOI: 10.1001/archinte.160.12.1761 [PubMed: 10871968]
- Serrano JP, Latorre JM, Gatz M. Autobiographical memory in older adults with and without depressive symptoms. *International Journal of Clinical and Health Psychology*. 2007; 7(1):41–57.
- Serrano JP, Latorre JM, Gatz M, Montanes J. Life review therapy using autobiographical retrieval practice for older adults with depressive symptomatology. *Psychology and Aging*. 2004; 19(2): 272–277. DOI: 10.1037/0882-7974.19.2.272
- Spielberger, CD., Gorsuch, RL., Lushene, R., Vagg, PR., Jacobs, GA. *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press; 1983.
- Steffens DC, Otey E, Alexopoulos GS, Butters MA, Cuthbert B, Ganguli M, Yesavage J. Perspectives on depression, mild cognitive impairment, and cognitive decline. *Archives of General Psychiatry*. 2006; 63(2):130–138. DOI: 10.1001/archpsyc.63.2.130 [PubMed: 16461855]
- Van HL, Schoevers RA, Dekker J. Predicting the outcome of antidepressants and psychotherapy for depression: A qualitative, systematic review. *Harvard Review of Psychiatry*. 2008; 16(4):225–234. DOI: 10.1080/10673220802277938 [PubMed: 18661365]
- Velten E Jr. A laboratory task for induction of mood states. *Behaviour Research and Therapy*. 1968; 6:473–482. DOI: 10.1016/0005-7967(68)90028-4 [PubMed: 5714990]
- Weissman AN. The Dysfunctional Attitude Scale: A validation study. *Dissertation Abstracts International*. 1979; 40:1389–1390.
- Weissman MM, Verdelli H, Gameroff MJ, Bledsoe SE, Betts K, Mufson L, Wickramaratne P. National survey of psychotherapy training in psychiatry, psychology, and social work. *Archives of General Psychiatry*. 2006; 63(8):925–934. DOI: 10.1001/archpsyc.63.8.925 [PubMed: 16894069]
- Wetherell JL, Gatz M, Craske MG. Treatment of generalized anxiety disorder in older adults. *Journal of Consulting and Clinical Psychology*. 2003; 71(1):31–40. DOI: 10.1037/0022-006X.71.1.31 [PubMed: 12602423]
- World Health Organization. *Mental health: New understanding, new hope*. Albany: NY: Author; 2001. The World Health Report 2001.