Assessing impairment using a configural measure

Jordan S Fuller and Michael A Young

Abstract
Assessing impairment in daily functioning is an important part of a mental health evaluation and of monitoring progress in treatment. The Seasonality Assessment Form includes five yes/no impairment items written to reflect the ways that patients intuitively describe their levels of impairment. However, the items are not mutually exclusive and are not summative so that impairment severity is represented by the configural pattern of responses. This article used configural and graphical methods to examine the nature of response patterns and how to use them to generate an impairment severity score.

Keywords
Assessment, impairment, seasonal affective disorder, psychometrics

Introduction
Efforts to describe the severity of mental illness most often have focused on the severity of symptoms. This approach captures an important aspect of clients' condition and has undergone significant development, as evidenced by more than 280 measures to capture depression symptom severity published between 1918 and 2000 (Santor et al., 2006). However, in recent years, the assessment of adaptive functioning and impairment in functioning has seen increasing attention in the psychopathology literature (e.g. Ro and Clark, 2009). Adaptive functioning is broadly defined as the ability to lead an independent and productive life (Bacon et al., 2002). Impairment in adaptive functioning is important to understand in assessing and treating mental disorders and is vital to understanding psychopathology in a biopsychosocial model. Impairment in depression alone leads to $10 billion in lost productivity, with other important costs from lost time from work and lost opportunity (Jones and Cockrum, 2000). Functional impairment has received major attention in the field of rehabilitation (World Health Organization, 2010), although not necessarily focusing specifically on the link between symptoms and impairment.

Although impairment is correlated with symptom severity, there is not a 1:1 relation between functional impairment and symptom severity (McKnight and Kashdan, 2009), making impairment important to assess on its own. Although, measures like the Global Assessment of Functioning (American Psychiatric Association (APA), 1980) are commonly used to assess functional impairment, these measures often conflate impairment with symptom severity, reducing the specificity of the construct being assessed and potentially allowing for people with very disparate levels of functioning to be assigned the same score. Other common measures (e.g. Sheehan Disability Scale, Sheehan, 1983) assess functional impairment independent of symptoms, but do not use specific behavioral descriptions of functioning. Instead, these measures typically describe impairment using numbers (e.g. 1–5 or 1–100), or poorly operationalized anchors, such as “moderately” or “markedly” impaired. Although, these descriptors are concise and familiar, they may not reflect the ways in which people experience and describe their impairment. In addition, these indicators may be conceptualized differently by respondents, clinicians, and researchers, lowering the validity of the measures and diminishing the clarity of the assessment.

As part of a study of light treatment for seasonal affective disorder (SAD; Eastman et al., 1998), study coordinator Lucie Watel observed the ways in which participants spontaneously talked about their impairments and noted that how participants described their impairment differed from the...
rating options given by formal measures of impairment. In response to these observations, a new impairment scale was developed using questionnaire items modeled after the descriptions used by study participants. Participants described the following types of impairment, which appeared to be ordered by the degree of impairment:

1. I did my normal activities as easily as and as well as usual.
2. I did my normal activities as well as usual, but it was more difficult to do them.
3. I did not do my normal activities as well as usual.
4. I avoided, delayed, or chose not to do some of my normal activities because of how I felt.
5. I was not able to do my normal activities.

These statements cover a range of aspects of functional impairment. The first item indicates no impairment and last item indicates complete impairment. The second item indicates no impairment in performance but a need for greater effort to achieve normal functioning. Items 3 and 4 describe two types of reduced performance in the execution of daily tasks, with item 3 indicating reduced performance on tasks attempted, and item 4 reflecting avoided or delayed engagement in activities of daily living.

Over a defined period of time (e.g. 1 week), the different kinds of impairment a respondent experiences are not mutually exclusive, so that the presence or absence of these experiences can co-occur in any combination. In this way, respondents can endorse as many items as describe their experience, allowing them flexibility in describing their functional impairment during this period of time as they see fit. Although, these types of impairment are theorized to be ordered on a dimension of functional impairment severity, because they can be endorsed in any combination, these items do not follow the format of a summative scale in which item scores are summed to obtain a total scale score. Instead, these items form a configural scale, in which patterns of yes/no endorsements represent types or severities of impairment. Because of the configural nature of this scale, typical test theory and psychometric methods such as factor analysis and item response theory do not apply. Consequently, this study employed other methods to evaluate this scale to assess functional impairment.

In the years, since the initial establishment of these impairment items, their use has seen further development. Although, the report of the original clinical trial (Eastman et al., 1998) did not report results for this impairment scale, later investigators have made use of it in several ways. Enggasser and Young (2007) included the scale as part of the Comprehensive Seasonality Assessment Form (CSAF; later called the Seasonality Assessment Form (Young et al., 2015)) in their study of cognitive vulnerability to SAD. Fliss and Young (2005) then used the Enggasser CSAF data in a study of the relation between distress, impairment and symptom severity in SAD, in which she found that, in a multiple regression, vegetative symptoms, but not psychological symptoms, predicted impairment in a sample of community members suffering from seasonal vegetative symptoms.

Later, Getch (2009) used these impairment items in a separate study in which participants with various mental health diagnoses rated their impairments in five functional domains: Normal Activities, Interacting with Others, Doing Work, Caring for Self, and Physically Moving Around. Results supported the application of these items to various functional domains and with a non-seasonal population. Getch (2009) also developed a scoring system for these impairment items (described below) and examined the linearity of relations between these impairment scores and several important external variables.

Other recent work has used similar behavioral descriptors of impairment. The European Study of the Epidemiology of Mental Disorders (ESEMeD; see Buist-Bouwman et al., 2008: 453) used a 3-item behavioral measure of “role functioning” that may be compared to our own measure. ESEMeD respondents rated how many of the past 30 days they had been

(i) totally unable to work or carry out your normal activities; (ii) able to work, but had to cut down on what you did or not get as much done as usual; and (iii) able to work, but had to cut back on the quality of your work or how carefully you worked.

Whereas, both measures assess inability to work, the ESEMeD items described the remaining aspects of impairment in terms of reduced quantity and quality of work. This nonomothetic approach allows epidemiologists to describe the extent to which impairment associated with mental illness relates to real losses in productivity at an international scale. Like the ESEMeD, our items measured reduced work quality, but also included difficulty performing activities and avoidance/delay of activities. These phenomena represent the experience of impairment for the individual, which may be of value in clinical research and practice.

Other work has sought to use behavioral data for illness staging and assessment during the therapy process. Bilsbury and Richman (2002) developed the Discan Method to structure clinically significant behaviors reflecting symptoms and impairment into unique measures at an individualized level. Using this method, patients describe their individual experiences and behaviors then work with the clinician to organize them into four hierarchical illness stages. Next, for each focus of clinical attention patients compare these stages in a pairwise fashion, resulting in a 14-point scale that integrates subjective experience with interval-level measurement. This approach improves upon traditional nomothetic approaches by reducing the need for interpretation and eliminating the need for patients to make absolute judgments regarding their level of symptoms or impairment.

Most recently, Young et al. (2015) included our impairment items in the SAF (Appendix A) and examined the relation between seasonal symptom severity and impairment as
part of a psychometric evaluation of the symptom severity portion of the SAF. Although, the configural impairment scale embedded in the SAF has been used to investigate impairment in various settings, questions remain regarding its structure and psychometric functioning.

**Seasonal affective disorder**

SAD is a subtype of recurrent major depressive disorder characterized by recurrent depressive episodes that occur at the same time each year (Rosenthal et al., 1984), with most people with SAD experiencing episodes in the fall and winter. Based on their patterns of onset (Young et al., 1991), symptoms have been divided into vegetative symptoms (typically including hypersomnia, increased appetite and weight, and fatigue) and psychological symptoms (e.g. depressed mood, anhedonia, difficulty concentrating, thoughts of guilt or worthlessness, suicidal ideation, etc.). During an episode of SAD, vegetative symptoms begin first, in the fall or early winter, followed by psychological symptoms that manifest across the duration of the episode (McCarthy et al., 2002; Whitcomb-Smith et al., 2014; Young et al., 1991). In their 1991 paper, Young et al. proposed the dual vulnerability model to explain this pattern. The dual vulnerability hypothesis proposes that SAD is the product of a vulnerability to seasonal vegetative symptoms in response to environmental changes during the winter along with a vulnerability to psychological symptoms in response to those seasonal vegetative symptoms. Since its initial proposal, the dual vulnerability hypothesis has been well supported in the literature (Enggasser and Young, 2007; Grimaldi et al., 2009; Whitcomb-Smith and Sigmon, 2014; Young et al., 2008).

To date, little research has investigated impairment in SAD. Using cartoon-illustrated ratings, Schlager et al. (1995) found that SAD, even at subsyndromal levels, was associated with functional impairment in various domains. In a large and varied sample, Young et al. (2015) observed a full range of severities of seasonal impairment scores using the configural impairment items of the SAF. Among the subsample diagnosed with SAD and coming for their first treatment with light, 87.8% reported impairment greater than simply having difficulty with daily activities. This pattern suggests that impairment is a significant problem, and merits of further study in this group.

**The present study**

This study contributes to the literature by further examining the psychometric characteristics of the proposed configural impairment scale based on patients’ descriptions of the nature of their impairments. Doing so, employed some novel methods specific to configural measures. In addition, we examined the nature of impairment associated with SAD and seasonal depressive symptoms. In particular, this investigation highlights the role of avoiding, delaying, or choosing not to do activities. Although, this type of impairment would appear potentially fairly severe, Young et al. (2015) found that the majority of their largely non-clinical participants endorsed this item. Finally, we examined the impairments associated with vegetative and psychological symptoms, an important distinction in theories of the etiology of SAD (Young et al., 2008).

**Methods**

**Participants**

Information on participants and data collection procedures has been presented previously (Young et al., 2015). Seven-hundred and forty-one participants came from three separate samples—university students, community members reporting winter vegetative symptoms, and patients seeking light treatment for SAD. Each participant completed the SAF (Young et al., 2015), which includes measures of symptom severity and functional impairment. Across samples, participants reported the full range of symptom severity, from no symptoms to meeting full criteria for SAD and endorsing all symptom items as severe. All participants came from studies complying with the Code of Ethics of the World Medical Association and all procedures were approved by the IRBs of the various institutions before data collection.

The university student sample consisted of 180 new students at a technological university in Chicago, 66% graduate students and 34% undergraduates. Age ranged from 18 to 38 years old (M = 22.3, SD = 3.9). The sample was 63% male, with 42% East Asian and 38% Caucasian participants. Participants were recruited by email for a study of college adjustment and were not pre-screened for psychopathology. Participants were entered in a raffle for a $200 gift card, which was given to one participant after data collection was completed.

The community sample consisted of 288 adults recruited from the Chicago area. Recruitment ads were placed on posters around the area and in local newspapers. The ads targeted people reporting low energy and increased sleep and appetite in the winter. Participants were 18–75 years old (M = 30.6, SD = 10.2), 69% female, 63% Caucasian, and 21% African-American. Participants received $20 for their participation in the study.

The clinical sample consisted of 273 patients seeking outpatient psychiatric treatment for winter SAD at the Psychiatry Department at the University of Groningen in the Netherlands. Inclusion required a DSM-IV-TR (APA, 2000) diagnosis of recurrent major depressive disorder with seasonal pattern. This was assessed by a licensed clinical psychologist using the MINI International Neuropsychiatric Interview (Sheehan et al., 1998). At the time data were collected, 122 patients were presenting for their first winter of light treatment. The other 151 had received light treatment in previous winters (range 1–16 years, median 2) and were presenting for the
current winter’s treatment. Patients were excluded if they met criteria for other DSM-IV-TR Axis I disorders, currently used psychotropic or light-sensitizing medication, or had diabetes or eye disease, both of which have been shown to negatively impact the clinic’s light and medication treatment regimen (Meesters and Letsch, 1998). Participants were 15–82 years old (M = 39.9, SD = 12.9), mostly female (75.5%), and almost all Caucasian (> 99%). All participants completed a Dutch translation of the SAF during intake. Two Dutch clinical psychologists translated the SAF independently, discussed discrepancies, and agreed on the final translation.

Measures

Impairment was measured using the impairment items from SAF (Appendix A; Young et al., 2015). This scale asked respondents to select whether when winter symptoms were at their worst, they (a) did their normal activities as easily and as well as usual, (b) did their normal activities as well as usual, but with more difficulty, (c) did their normal activities less well than usual, (d) avoided, delayed, or chose not to do some of their normal activities because of how they felt, or (e) were unable to do their normal activities. Respondents were instructed to check as many items as are descriptive of their behavior, and responses were recorded with a 1 if the item is endorsed and a 0 if the item was not endorsed. The intention of this method was to allow participants to report in categories that are similar to how a person might naturally describe their impairment. Respondents could endorse as many items as apply. These ascending-ordered, yes-no format items taken together comprise a configural scale, in which information is contained in the pattern of responses rather than the number of items endorsed. Thus, it would not be appropriate to simply add together the item endorsements to form a total score.

Each respondent’s endorsements were formatted into a single 5-digit code with zeros and ones arranged right to left, from the least impaired, “I did my normal activities as easily and as well as usual,” to the most impaired, “I was not able to do my normal activities.” Each of the resulting five-digit codes of 1s and 0s represents a different pattern of impairment. For example, 01011 represents endorsement of items 4, 2, and 1. However, at this stage the quantitative degree of impairment represented by these codes was not clear and the codes themselves were simply qualitative labels. Establishing quantitative impairment values for the configural codes was a purpose of the study.

The 31 codes can be logically ranked based on the presumed order of degree of impairment of the five items (Getch, 2009). The order of the codes was based on two principles. First, the individual items are ordered from least to greatest impairment, as noted earlier. Second, although the highest item that the participant endorses signifies the maximum degree of impairment experienced, additional endorsements of less impaired functioning signifies that impairment was not at that maximum level in all domains or at all times and thus represents less impairment than if only the maximum level code was endorsed. The full ranking system, as well as frequency and percentages found for each pattern in the sample are presented in Table 1.

The SAF (Young et al., 2015) also was used to assess severity of seasonal symptoms associated with SAD. Respondents rate the severity of each of 14 symptoms on a five-point Likert-type scale. Six items cover psychological symptoms and eight items concerns vegetative symptoms. Scores can be used as a total SAF score or as psychological symptom severity (PSS) and vegetative symptom severity (VSS) factor scores. The SAF is evenly divided between scored psychological and vegetative items, yielding scale scores ranging from 0 to 24 for both scales. Young et al. (2015) employed confirmatory factor analysis to establish that the SAF fits a bifactor model, with three orthogonal factors—a general factor loading on all items (α = 0.95), as well as psychological factor (α = 0.90), and a vegetative factor (α = 0.93). Impairment items are not included in these symptoms severity scores.

Data analytic approach

As previously stated, the types of impairment represented are believed to represent points along a spectrum. However, they are not summative and therefore cannot be evaluated with models such as item response theory. Instead, various methods were employed to demonstrate the degree to which items related to each other in an orderly and systematic manner. First, frequencies and co-occurrences of the five types of functional impairment were examined. Next, the relations between the probability of endorsing each type of impairment and depression symptom severity (SAF total score) were examined by generating LOESS-smoothed non-linear regression curves (Cleveland and Devlin, 1988) using SigmaPlot (Systat Software, San Jose, CA, n.d.). Third, the relations between types of impairment and psychological and vegetative symptoms specifically were examined using correlations various linear and non-linear regression methods.

Results

What types and degrees of impairment did participants report?

Of the 741 participants, 95 (12.8%) reported that “I do my normal activities as easily and as well as usual” (not impaired), either alone or in combination with other items. One hundred ninety-eight (26.7%) endorsed “I do my normal activities as well as usual, but it is more difficult to do them” (more difficult). One hundred ninety-two (25.9%) indicated “I do my normal activities as easily and as well as usual, but it is more difficult to do them” (less well). “I avoid, delay, or choose not to do some activities because of how I feel” (avoid or delay) was the most common response,
with 392 endorsements (52.9%). Ninety-four (12.7%) indicated, “I am not capable of doing some of my normal activities” (not able). All together only 87 participants (11.7%) endorsed a complete lack of impairment (i.e. endorsed yes for item 1 and no for all other items) during the winter, leaving 88.3% of the sample with some level of impairment. A total of 80% of impaired respondents endorsed impairment greater than simply having difficulty with their normal activities, meaning that they endorsed doing activities less well, avoiding activities, or being unable to complete some of their normal activities alone or in combination with other forms of impairment.

Frequencies of each pattern of five impairments are presented in Table 1. The most common patterns of impairments were endorsement of only one item, that is, 00001, 00011, 00010, 01001, or 01000. Endorsement of 01000 (only avoid or delay) was by far the most common response (n=233, 31.4%), with the next most common pattern (17.3% of the sample) being 00010 (only more difficult). Single-item endorsement was followed in frequency by endorsement of groups of contiguous items, for example, 00110 and 01100. This suggests that the items are in fact arranged in order of increasing impairment, with participants experiencing a range of impairments. Endorsement of non-contiguous items, for example, 10010 (n=0) or 01001 (n=2), was very uncommon. The exception was endorsement of non-contiguous items that included avoid or delay, for example, 01010 (n=23, 3.1%). This exception, coupled with the high overall rate of endorsement for this item, suggested that avoid or delay may not fit into the pattern of increasing impairment represented by the other items in the scale.

### Table 1. Rank and frequency of impairment patterns.

| Rank | Pattern | Frequency | Percentage |
|------|---------|-----------|------------|
| 1    | 00001   | 87        | 11.7       |
| 2    | 00011   | 6         | 0.8        |
| 3    | 00010   | 128       | 17.3       |
| 4    | 00101   | 0         | 0          |
| 5    | 00111   | 0         | 0          |
| 6    | 00110   | 7         | 0.9        |
| 7    | 00100   | 85        | 11.5       |
| 8    | 01001   | 2         | 0.3        |
| 9    | 01011   | 0         | 0          |
| 10   | 01010   | 23        | 3.1        |
| 11   | 01101   | 0         | 0          |
| 12   | 01111   | 0         | 0          |
| 13   | 01110   | 19        | 2.6        |
| 14   | 01100   | 51        | 6.9        |
| 15   | 01000   | 233       | 31.4       |
| 16   | 10001   | 0         | 0          |
| 17   | 10011   | 0         | 0          |
| 18   | 10010   | 1         | 0.1        |
| 19   | 10101   | 0         | 0          |
| 20   | 10111   | 0         | 0          |
| 21   | 10110   | 0         | 0          |
| 22   | 10100   | 0         | 0          |
| 23   | 11001   | 0         | 0          |
| 24   | 11011   | 0         | 0          |
| 25   | 11010   | 6         | 0.8        |
| 26   | 11101   | 0         | 0          |
| 27   | 11111   | 0         | 0          |
| 28   | 11110   | 8         | 1.1        |
| 29   | 11100   | 22        | 3          |
| 30   | 11000   | 28        | 3.8        |
| 31   | 10000   | 29        | 3.9        |

*Items within each pattern are ordered left to right from most to least impaired (i.e. items 5, 4, 3, 2, and 1).

What degrees of impairment do the items represent?

At the outset of this study, items were expected to represent points along a single dimension of impairment. To test this hypothesis, we examined the probability of each type of impairment being endorsed across the range of depression symptom severity using LOESS-smoothed plots. This approach is conceptually similar to an item characteristic curve in item response theory, but using an important correlate of impairment, symptom severity, instead of an inferred latent construct score or an item total score, both of which require the items to be summative. If the items reflect points along a single dimension, then the peak probabilities of item endorsements should form an ordered sequence across the range of symptom severity. Figure 1 presents these plots for items 1, 2, 3, and 5; item 4 will be discussed separately. The expected pattern was exhibited, with the peak probabilities occurring in the expected sequence across the magnitude of symptom severity: 1, 2, 3, and 5.

The probability of endorsing not impaired was highest at the lowest symptom severity, decreased as symptom severity increased, and was essentially zero once the SAF symptom severity score was in the mid-20s. Thus, being able to do activities as easily and well as usual was less likely to occur as symptom severity increased and was no longer possible...
once symptom severity reached a SAF score of about 23. The probability of endorsing more difficult peaked around a SAF score of 11, with endorsement gradually tapering off until the maximum SAF score. This suggests that, as symptoms become more severe, activities quickly become difficult, but that this less severe impairment is then supplanted by more severe types of impairment. The probability of endorsing less well peaked near a SAF score of 29, with steady decreases toward minimum and maximum severity. Notably, endorsement remained around 20% at maximum SAF score. So, while doing activities less well is not the most severe type of impairment, some respondents did endorse it, even at the highest symptom severity. The probability of endorsing not able remained close to 0 until symptom severity scores approach their maximum, where endorsement probability increases steeply, reaching its peak at the maximum severity. Thus, although impaired participants experienced difficulty and decreased performance, they were able to do their daily activities until symptoms became severe.

Avoid or delay did not fit the pattern exhibited by the other types of impairment (Figure 2). Probability of endorsement did not peak between less well and not able, or anywhere else for that matter. Instead, the probability of avoiding or delaying remained low until a SAF symptom severity score of about 10. It then increased steadily until a SAF score of about 35, at which point the probability of avoiding or delaying remained steady at about .8, regardless of increasing symptom severity. This pattern resembles a probabilistic threshold model, as in an IRT psychometric model (Thissen and Steinberg, 1988), in which there is a relatively narrow range of the latent trait in which the probability of an item response rapidly increases. Applied to this case, this finding suggests that avoidance or delay generally occurs when a threshold of symptom severity is crossed. This pattern contrasts with those for the other types of impairment (Items 1, 2, 3, and 5) in which the probability of endorsement rose and fell across different ranges of symptom severity. This difference in the relation between impairment endorsement and symptom severity between avoid or delay and more difficult, less well, and not able lends further support to the notion that avoiding or delaying activities represents a construct separate from difficulty/ability to function.

As a consequence of the abovementioned results, avoid or delay was separated from the other impairment items and reconceptualized. For the remainder of this article, performance impairment refers to impairment based on not impaired, more difficult, less well, and not able (Items 1, 2, 3, and 5 from the original impairment scale). Impairment related to avoidance or delay of activities will be referred to as coping impairment, that is, that avoidance and delaying are behaviors invoked to cope with symptoms and potential performance impairment. These constructs and the implications of this separation will be further discussed later in the article (“Discussion” section).

The relations between coping impairment and types of performance impairment were further studied by examining their co-occurrence. Coping impairment increasingly co-occurred with other impairment until plateauing at the level of performing activities less well than usual. A total of 2% of respondents whose performance was not impaired (Yes on item 1) still avoided or delayed some activities. A total of 60% of respondents who reported some kind of impairment (No on item 1) also avoided or delayed activities. A total of 28% of respondents who found activities to be more difficult (Yes on item 2) also avoided or delayed activities. A total of 52% of respondents who did activities less well (Yes on item 3) also avoided or delayed activities. Finally, 53% of participants who were not able to do some of their normal activities (Yes on item 5) also avoided or delayed activities.

Following separating coping impairment, endorsement patterns for performance impairment items only were reexamined. In doing so, participants who endorsed only avoid or delay were removed because without it they effectively had missing data (i.e. their code was 0000). Patterns, ranks, and frequencies from the revised, performance impairment scale are presented in Table 2. Endorsement of single impairment types remained the most common pattern. More difficult alone became most common, endorsed by 29.7% of participants. Following in frequency were less able, not impaired, and not able alone (26.8%, 17.5%, and 11.2%, respectively). Contiguous item endorsement remained the next most frequent pattern, and, with avoid or delay now removed, non-contiguous item endorsement occurred even more rarely; only 7 participants (1.4%) endorsed non-contiguous items (all the 7 participants endorsed more difficult and not able). Thus, the separation of performance impairment maintained the patterns of endorsement hypothesized in the original scale development, and largely eliminated uncommon patterns.

How is impairment related to the severities of vegetative and cognitive symptoms in SAD?

Vegetative (VSS; M=14.07, SD=6.37), psychological (PSS; M=11.66, SD=6.78), and overall (M=25.73, SD=12.56)
Symptom severity scores were distributed across the range measured by the SAF. In order to evaluate the relation between impairment and symptom severities, impairment scores were regressed onto vegetative and psychological symptoms. Both symptom types were significant predictors of performance impairment (vegetative: $\beta = .235$, $p < .001$; psychological: $\beta = .483$, $p < .001$), with acceptable multicollinearity diagnostics (tolerance = .312). Psychological symptoms were stronger predictors of this type of impairment. A logistic regression examined the relations of coping impairment with vegetative and psychological symptoms. As with performance impairment, vegetative symptoms (OR = 1.17) and psychological symptoms (OR = 1.09) were both significant predictors ($p < .001$), with vegetative symptoms associated with coping impairment more strongly.

In order to examine the various types of performance impairment as they relate separately to psychological and vegetative symptom severities in particular, item endorsement probabilities were plotted separately as a function of psychological symptoms and as a function of vegetative symptoms, in general, the probabilities of endorsing the items peaked in order by degree of impairment, as when plotted as a function of overall symptom severity (Figure 1). To facilitate comparison of vegetative and psychological symptoms, Figures 3 to 7 show the plots of the symptom curves for each type of impairment separately. For all performance impairment items, the probability of endorsement rose more rapidly and peaked earlier for PSS than for VSS. Thus, participants were more likely to endorse severe forms of impairment, and less likely to endorse mild or not impaired, as a function of psychological symptoms compared to vegetative symptoms. Lack of impairment (Item 1; Figure 3) was more likely with mild to moderate vegetative symptoms compared to psychological

### Table 2. Rank and frequency of performance impairment patterns (i.e. without “Avoid or Delay”).

| Rank | Pattern | Frequency | Percentage |
|------|---------|-----------|------------|
| 1    | 0001    | 89        | 17.5       |
| 2    | 0011    | 6         | 1.2        |
| 3    | 0010    | 151       | 29.7       |
| 4    | 0101    | 0         | 0          |
| 5    | 0111    | 0         | 0          |
| 6    | 0110    | 26        | 5.1        |
| 7    | 0100    | 136       | 26.8       |
| 8    | 1001    | 0         | 0          |
| 9    | 1011    | 0         | 0          |
| 10   | 1010    | 7         | 1.4        |
| 11   | 1101    | 0         | 0          |
| 12   | 1111    | 0         | 0          |
| 13   | 1110    | 8         | 1.6        |
| 14   | 1100    | 22        | 4.3        |
| 15   | 1000    | 57        | 11.2       |

*Items within each pattern are ordered left to right from most to least impaired (i.e. items 5, 3, 2, and 1).*
symptoms, but unlikely with severe symptoms of either type. Difficulty in doing activities (Item 2; Figure 4) was more likely at low levels of psychological symptoms compared to vegetative symptoms but was more likely at higher levels of vegetative symptoms. Doing activities less well (Item 3; Figure 5) also was more likely at low levels of psychological symptoms compared to vegetative symptoms and more likely at higher levels of vegetative symptoms. Item 5 (Figure 6) was most likely with mild symptoms of either type but became more likely as a function of psychological symptoms at moderate to severe scores. Coping impairment, or avoiding/delaying activities (Item 4; Figure 7), was more likely as a function of psychological symptoms at all levels of severity.

Discussion

This study examined five types of functional impairment (including none) and the use of a 5-item configural impairment scale in a mixed sample of college students, community adults with seasonal depressive symptoms, and seasonal affective disorder patients seeking light treatment. Although, participants rated impairment associated with seasonal depressive symptoms, these impairment items were designed to be for use with any condition, and to assess impairment independent of its source. The descriptions of these types of impairment were intended to be more intuitive and meaningful for respondents, allowing also a more specific understanding of the nature of changes in functioning compared to typical mild-moderate-severe rating scales.

Participants endorsed a wide array of impairment configurations, associated with a wide range of symptom severity. Most participants (88%) reported having some impairment in functioning during the winter. Thus, even for individuals undiagnosed with seasonal affective disorder, some functional impairment in the winter was common. Of these impaired respondents, 80% reported impairment more severe than simply difficulty performing normal activities. These impairments may have serious implications for the individual and for the economy through losses in productivity, missed work time, and lost opportunities, similar to what is reported with depression generally (Jones and Cockrum, 2000).

The configural nature of the impairment assessment instrument allows respondents to indicate as many types of impairment as they feel apply to them. Endorsements of more than one type of impairment were common, suggesting that respondents may have experienced different levels of impairment at different times or in different functional domains. Typically, these kinds of endorsements were of adjoining levels of impairment, indicating that although the severity of impairment is not monolithic, it is unlikely to vary widely across circumstances.

Results indicated that the items contained in this scale represent two separate components, which we labeled performance impairment and coping impairment. This conclusion was based on several findings. Not impaired, more difficult, less well, and unable exhibited a regular and progressive pattern of association with increasing symptom severity. Also, as noted earlier, contiguous endorsement of those items was common, offering further evidence that these impairment types are generally organized in a sequence from least to most severe. This pattern reflects the content of these four items, which all relate to one’s ability to perform activities of daily living, proceeding from a normal ability to perform (not impaired), to difficulty performing, to reduced quality of performance, to inability to perform. The resulting performance impairment scale is comprised 15 possible patterns of response to the four items.

The item “I avoid, delay, or choose not to do some of my normal activities because of how I feel” did not conform to the patterns observed for the other items. Instead, it exhibited an association with symptom severity typical of a threshold process (Thissen and Steinberg, 1988). In addition, the presence of avoid or delay interrupted the patterns of contiguous endorsements seen in other items.
In retrospect, the content of avoid or delay also differs from the other types of impairment, which directly reflect one’s ability to perform activities. In contrast, avoiding or delaying suggests an element of intention: one decides to avoid, delay, or choose not to do certain activities, regardless of one’s ability to perform them. However, it still represents impairment because activities are not getting done. For this reason, impairment consisting of avoiding or delaying activities was termed coping impairment, since it reflects a strategy of dealing with symptoms or reduced performance. The construct of coping impairment and its measurement are in need of further development.

In addition to the relations between impairment and overall symptom severity, results suggested differential associations between impairment and vegetative and psychological symptoms. Maximum endorsement of each type of impairment occurred at lower symptom severity for psychological symptoms than for vegetative symptoms. Thus, at equal levels of severity, psychological symptoms were more impairing than vegetative symptoms. This distinction is consistent with previous findings that cognitive/affective symptoms were more impairing than vegetative symptoms (Hanson and Young, in press) and that the impairments associated with psychological symptoms were often mediated by the meanings and interpretations given by the individual to the symptoms, whereas impairments associated with vegetative symptoms were commonly a direct consequence of the symptoms.

**Use of the performance and coping impairment scales**

The performance impairment scale can serve as a valuable metric for researchers and clinicians as a rapid tool to assess impairment in functional ability. It is simple for respondents to use and short enough to be administered alongside other measures. In addition, the scale can be adapted to meet various needs. The prompt can be written for different time references (e.g. “the past week,” “after your injury,” “when seasonal symptoms are at their worst”) and for different domains of functioning (e.g. work or social functioning or even dressing oneself; Getch, 2009).

The performance impairment scale can be scored as done here, with a ranking of response patterns (Table 2). This method maintains the full richness of information of a configural scale. The 15 patterns allow for wide variation in magnitude of performance impairment. Although, technically this is an ordinal scale, as with other similar ordinal scales it can be treated as interval-level. In this study, the scale exhibited a linear relation with symptom severity, providing evidence of criterion-related validity. Although, one could simply use the most severe type of impairment endorsed (Items ordered 0–4), this method would provide much less information about ranges of impairment across domains and times. In a clinical context, this detailed information about different types of impairment in different contexts could be useful in helping a client manage their difficulties. For example, whether to alter thoughts or behaviors, or to use acceptance could vary depending on the types of diminished performance that an individual experiences in different contexts.

Whereas performance impairment reflects the respondent’s ability to function, coping impairment reflects one way that people may choose to respond to their symptoms and performance impairments—by avoiding, delaying, or postponing activities. This response does represent an impairment because activities are not being accomplished. However, whether it represents maladaptive coping depends on whether the alternatives are better. For example, delaying an activity may serve as an adaptive alternative to poor or failed performance on important tasks. Stated another way, avoiding, delaying, or postponing activities may function as protection against the negative consequences of performance impairment. In this sample, although these strategies were used more often when performance impairment was greater, they also were not uncommonly used with less severe performance impairments. The adaptiveness of a client’s choices to use these strategies at various levels of performance impairment could be a useful focus of attention in treatment.

In order to fully understand the function and adaptability of coping impairment, its structure must be further delineated. Individuals may avoid (keep away from reminders of), delay (put off indefinitely), postpone (reschedule), or choose not to do activities in response to impairment, symptomatology, or situation. Although, individuals may engage in avoidance to prevent objective decrements in performance, they also might do so to avoid the aversive experience that comes with attempting or failing the activity. Thus, avoidance coping impairment could represent experiential avoidance (Hayes et al., 1996), that is, actions taken to reduce exposure to unwanted thoughts or emotions. Consistent with this idea, Hanson and Young (in press) found that impairment was often the consequence of how depressed patients interpret their symptoms as opposed to the presence of the symptom itself. In this case, interventions appropriate to behavioral avoidance could be useful, in contrast to the case of avoidance being an attempt to obtain the best objective outcome.

At the outset of this study, avoiding/delaying/postponing was conceptualized as being on a continuum of impairment severity with other types of impairment, which proved not to be the case. This new conceptualization requires development of the construct of coping impairment and improvements in measurement of avoiding/delaying/postponing over the single yes/no item used in this study. This might include expanding the yes/no response format to a configural scale similar to performance impairment, or to a series of frequency Likert-type scales reflecting the components of coping impairment found through research.

**Study limitations**

The findings of this study should be understood in the context of several methodological limitations. Although the
conceptualization and measurement was transdiagnostic, all
the data came from assessments relating to typical winter
depressive symptoms. This provided information on the
nature of impairment that typically accompanies seasonal
depression, but also makes the generalization to other condi-
tions unknown. It also is not certain how results for this re-
trospective, summative report would compare to those if
questions had asked about a particular winter, the current
winter, the past week, or today. Although the sample being
diverse, with participants coming from a range of clinical
and non-clinical sources, could be an advantage, it also is
neither specific nor representative. Furthermore, the sea-
sonal sample was recruited for winter vegetative symptoms,
but was not formally diagnosed or assessed for history of
treatment or other psychopathology. In addition, the treat-
ment seeking sample was located in the Netherlands (all
others being in the United States), introducing potential cul-
tural differences in the experience or expression of impair-
ment that were not investigated. Regarding the impairment
scales, performance impairment and coping impairment
items were presented to participants mixed together. It is
unknown how respondents might have responded differen-
tly if the items were presented differently—in particular
separating avoid or delay, the most frequently endorsed
item. Also, coping impairment was measured with a single,
Yes/No item. As noted earlier, this was consistent with the
original formulation of the study, but, in retrospect given the
results, a more detailed assessment coping impairment
would have been advantageous.

Despite these limitations, the impairment items exam-
inied captured a wide variety of patient experiences in a
simple scale that can be rapidly administered. A large het-
ergeneous sample provided a broad range of symptom
severity and an array of impairment patterns. Participants
were recruited from populations of college students, com-
nunity-dwelling adults with vegetative symptoms, and peo-
lies with SAD presenting for light treatment, supporting the
use of these items in multiple settings and with all levels of
seasonal symptomatology.

**Future directions**

This study took the novel approach of examining specific
behavioral descriptors of the nature of impairment, in con-
tact to abstract labels for the severity of impairment (e.g.
mild, moderate, severe). Although the descriptors of types
of impairment were derived originally from patients’ spon-
tenous descriptions, this was an informal process and
more research, qualitative and quantitative, could be done
to describe the nature of impairment, both generically and
for specific conditions. Consistent with the configural
nature of the patterns of types of impairment, we employed
a variety of methods to examine the patterns and to develop
a system to score severity of impairment. There are no
standard procedures for this work and future research
should continue to develop these methods as well as evalu-
ate the scoring method that was derived. Avoiding or delay-
ing activities proved to be a very common expression of
impairment in our sample. Although this was the only type
of impairment that reflected intent, it is not the only inten-
tional behavior that may be performed in response to symp-
toms. Other types of coping (i.e. discussing problems with
a friend, or drinking alcohol) may vary in how adaptiveness
they are. Regardless, these strategies may still lead to fur-
ther impairment, for example, alienating oneself from oth-
ers due to excessive reassurance seeking (Potthoff et al.,
1995) or poor work performance due to a hangover. Thus,
coping impairment in particular warrants further definition
and development as a construct.

This study was the first to investigate behavioral manifes-
tations of impairment in seasonal affective disorder. Although
it is clear that impairment is strongly related to seasonal
symptoms when symptoms are at their worst for an individual
(as described in the prompt), it is unclear how impairment and
symptoms arise and co-vary across the course of the winter. It
was notable that winter impairments were reported even
when “worst” was not very severe. The brief and repeatable
nature of the impairment items used here make them practical
to use in longitudinal investigations that may elucidate causal
relations, feedback loops, or other mechanisms of association
between symptoms and impairments.

**Declaration of conflicting interests**

The author(s) declared no potential conflicts of interest with respect
to the research, authorship, and/or publication of this article.

**Funding**

The author(s) received no financial support for the research, author-
ship, and/or publication of this article.

**Notes**

1. There are only 31 rather than 32 response patterns because
00000 is an invalid response, failing to endorse any statement
about impairment, including no impairment.

2. To assign ranks to patterns, consider the five sets of patterns
grouped by the highest item endorsed. First, it is clear that
00001 ("I did my normal activities as easily and as well as
usual") it is the least impaired pattern and so is assigned the
rank of one. If item 2 is the highest item endorsed, then 00011
and 00010 are the possible patterns. Given that a one on item
1 (far right) is less severe than a zero, these two patterns can
be assigned ranks 2 and 3, respectively. If item 3 is the highest
item endorsed, the possibilities are 00110, 00111, and
00101. Using the severity order just established for the 2-item
patterns process, these response patterns can be ordered 7, 6,
5, and 4. Patterns with item 4 or 5 endorsement can be ranked
in the same fashion.

3. Note that the SAF has separate items for increases and
decreases in sleep and appetite symptoms. For each symptom,
the higher of the increased and decreased items is included in
the score.
References

American Psychiatric Association (1980) *Diagnostic and statistical manual of mental disorders* (3rd ed.). Washington, DC: American Psychiatric Association.

American Psychiatric Association (2000) *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: American Psychiatric Association.

Bacon SF, Collins MJ and Plake EV (2002) Does the global assessment of functioning assess functioning? *Journal of Mental Health Counseling* 24(3): 202–212.

Bilsbury CD and Richman A (2002) A staging approach to measuring patient-centered subjective outcomes. *Acta Psychiatrica Scandinavica* 106: 5–40.

Buist-Bouwman MA, Ormel J, de Graaf R, et al. (2008) Mediators of the association between depression and role functioning. *Acta Psychiatrica Scandinavica* 118: 451–458.

Cleveland WS and Devlin SJ (1988) Locally weighted regression: An approach to regression analysis by local fitting. *Journal of the American Statistical Association* 83(403): 596–610.

Eastman CI, Young MA, Fogg LF, et al. (1998) A placebo-controlled trial of bright light treatment for winter seasonal affective disorder. *Archives of General Psychiatry* 55: 883–889.

Enggasser JL and Young MA (2007) Cognitive vulnerability to depression in seasonal affective disorder: Predicting mood and cognitive symptoms in people with seasonal vegetative changes. *Cognitive Therapy and Research* 31(1): 3–21.

Fliss M and Young MA (2005) How do seasonal vegetative and cognitive affective symptoms contribute to distress and impairment? Poster presented at the Association for Behavioural and Cognitive Therapies, Washington, DC, November.

Getch SE (2009) Development and validation of the assessment of impairment measure. Unpublished Master’s Thesis, Illinois Institute of Technology, Chicago, IL.

Grimaldi S, Partonen T, Haukka J, et al. (2009) Seasonal vegetative and affective symptoms in the Finnish general population: Testing the dual vulnerability and latitude effect hypotheses. *Nordic Journal of Psychiatry* 63: 397–404.

Hanson B and Young MA (2016) Understanding the Impairment Associated With Depressive Symptoms. *Journal of Nervous and Mental Disease* 205(8): 600–604.

Hayes SC, Wilson KG, Gifford EV, et al. (1996) Experiential avoidance and behavioral disorders: A functional dimensional approach to diagnosis and treatment. *Journal of Consulting and Clinical Psychology* 64: 1152–1168.

Jones MT and Cockrum PC (2000) A critical review of published economic modelling studies in depression. *PharmacoEconomics* 17(6): 555–583.

McKnight PE and Kashdan TB (2009) The importance of functional impairment to mental health outcomes: A case for reassessing our goals in depression research. *Clinical Psychology Review* 29: 243–259.

McKee M and Letts MC (1998) The dark side of light treatment for seasonal affective disorder. *International Journal of Risk & Safety in Medicine* 55(10): 890–896.

Potthoff JG, Holahan CJ, Joiner TE, et al. (1995) Reassurance seeking, stress generation, and depressive symptoms: An integrative model. *Journal of Personality and Social Psychology* 68: 664–670.

Ro E and Clark LA (2009) Psychosocial functioning in the context of diagnosis: Assessment and theoretical issues. *Psychological Assessment* 21(3): 313–324.

Rosenthal NE, Sack DA, Gillin JC, et al. (1984) Seasonal affective disorder. A description of the syndrome and preliminary findings with light therapy. *Archives of General Psychiatry* 41(1): 72–80.

Santor DA, Gregus M and Welch A (2006) Eight decades of measurement in depression. *Measurement* 4: 135–155.

Schlager D, Fromm J and Jaffe A (1995) Winter depression and functional impairment among ambulatory primary care patients. *Comprehensive Psychiatry* 36(1): 18–24.

Sheehan DV (1983) Sheehan Disability Scale (SDS): Overview [Measurement instrument]. Available at: http://www.cqaimh.org/pdf/tool_lof_sds.pdf

Sheehan DV, Lecrubier Y, Sheehan KH, et al. (1998) The mini-international neuropsychiatric interview (M.I.N.I.): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry* 59: 22–33.

Sigmaplot (n.d.) San Jose, CA: Systat Software, Inc. Available at: www.sigmplot.com

Thissen D and Steinberg L (1988) Data analysis using item response theory. *Psychological Bulletin* 104(3): 385–395.

Whitcomb-Smith S and Sigmon ST (2014) The temporal development of mood, cognitive, and vegetative symptoms in recurrent SAD episodes: A test of the dual vulnerability hypothesis. *Cognitive Therapy and Research* 38(1): 43–54.

Whitcomb-Smith S, Sigmon ST, Martinson A, et al. (2014) The temporal development of mood, cognitive, and vegetative symptoms in recurrent SAD episodes: A test of the dual vulnerability hypothesis. *Cognitive Therapy and Research* 38: 43–54.

World Health Organization (2010) Measuring Health and Disability: Manual for WHO Disability Assessment Schedule (WHODAS 2.0). Geneva: World Health Organization.

Young MA, Hutman P, Enggasser JL, et al. (2015) Assessing usual seasonal depression symptoms: The seasonality assessment form. *Journal of Psychopathology and Behavioral Assessment* 37(1): 112–121.

Young MA, Reardon A and Azam O (2008) Rumination and vegetative symptoms with light therapy. *World Health Organization* 34(1): 567–576.

Young MA, Watel LG, Lahrmeier HW, et al. (1991) The temporal onset of individual symptoms in winter depression: Differentiating underlying mechanisms. *Journal of Affective Disorders* 22: 191–197.

Author biographies

Jordan S Fuller, M.S. is a doctoral candidate in clinical psychology at Illinois Institute of Technology. His research interests include statistical analysis, measurement, depression, and neuropsychology.

Michael A Young, Ph.D. is a professor in the Department of Psychology at Illinois Institute of Technology. He has extensive research publications in the areas of the symptoms and diagnosis of depression, seasonal affective disorder, cognitive-behavioral models of mood disorders, and statistical modeling of psychopathology.