

Depression and Anxiety during Acute, Inpatient Rehabilitation as Possible Predictors of Eventual
Return to Work, Post-Spinal-Cord-Injury (SCI)

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Abstract

Spinal cord injury (SCI) is a major medical event that often yields diminished workforce participation. Many psychosocial factors have been linked with differential rates of employment after an SCI; however, the relationship between psychosocial functioning during the earliest stages of recovery, including acute, inpatient rehabilitation and post-discharge employment remain understudied. Accordingly, in this mixed-method study, we examined the measurement properties of two common psychosocial measures (PHQ-9 and GAD-7) and the association between the data derived from these measures and eventual, post-discharge employment after SCI. Results of confirmatory factor analysis indicated that a three-factor model (i.e., somatic, affective, cognitive distress) best fit the data derived from the PHQ-9 and GAD-7. We hypothesized that higher levels of distress captured by these measures would predict significantly reduced workforce participation; however, results indicated null effects of somatic and affective distress on employment but did indicate a significant, positive effect of cognitive distress on increased workforce participation. Neither PHQ-9 nor GAD-7 summary scores were significantly associated with employment outcomes. Findings from this study must be interpreted cautiously but do underscore the potential value of a transdiagnostic conceptualization of distress experienced during acute recovery from SCI, particularly when predicting distal employment outcomes.

Keywords: spinal cord injury, return to work, acute rehabilitation, psychosocial functioning, depression, anxiety

Depression and Anxiety during Acute Rehabilitation as Possible Predictors of Employment, Post-Spinal-Cord-Injury

Spinal cord injury (SCI) is a major medical event that is often accompanied by a number of long-term sequelae, including higher rates of depression and anxiety (Lim et al., 2017), lower rates of employment (Ottomanelli & Lind, 2009; Yasuda, Wehman, Targett, Cifu, & West, 2002), and increased reliance on federal financial assistance and other federal benefits for disabled people (Ma, Chan, & Carruthers, 2014). In the community, psychosocial factors, like depression and anxiety, have been linked with lower rates of employment after SCI; however, data on the relationship between psychosocial functioning during the earliest stages of recovery and long-term functional outcomes (e.g., employment) are scarce.

One setting where this is particularly apparent is within the context of acute, interdisciplinary, inpatient rehabilitation (“acute rehabilitation”). Often participation in acute rehabilitation is one of the first steps in the process of regaining function and compensatory skills following an SCI. The trajectory of one’s stay in an inpatient rehabilitation facility often sets the tone for their prognosis and life course, post-discharge (e.g., Kortte, Stevenson, Hosey, Castillo, & Wegener, 2012); therefore, it is important to quickly identify and intervene upon risk factors for adverse outcomes present during acute rehabilitation. Across medical diagnoses, there are many well-documented outcome-modifying factors that can impede or enhance treatment gains made during participation in acute rehabilitation, including psychosocial functioning (e.g., depression, anxiety; Gillen, Tennen, McKee, Gernert-Dott, & Affleck, 2001); however, these factors are less well understood in the specific context of SCI.

Psychological assessment within acute rehabilitation settings often focuses on assessment and measurement of symptoms associated with various psychiatric conditions, like anxiety and depression. For example, the Patient Health Questionnaire-9 (PHQ-9; Kroenke, Spitzer, & Williams, 2001) is a nine-item self-report measure that provides an efficient means of assessing symptoms of depression, including affective (e.g., low mood), cognitive (e.g., low self-esteem), and somatic (e.g., sleep disturbance) symptoms. Similarly the Generalized Anxiety Disorder-7 (GAD-7; Spitzer, Kroenke, Williams, & Löwe, 2006) is a seven-item self-report measure that provides clinicians with a brief instrument by which to measure experiences of anxiety. Symptoms assessed on the GAD-7 also include affective (e.g., feeling nervous), cognitive (e.g., uncontrollable worry), and somatic (e.g., tension) symptoms. These instruments are commonly used by clinicians working within the context of acute rehabilitation, post-SCI.

One major limitation associated with using these measures within this specific medical context is the lack of psychometric data regarding the measurement properties of these two measures. Lack of psychometric data limits the ability of psychologists and other healthcare providers to firmly operationalize the constructs of depression and anxiety during acute rehabilitation, post-SCI. This is particularly important for this population because many symptoms of depression (e.g., fatigue) and anxiety (e.g., sweating, tachycardia) can be similar in quality to common physiological sequelae of SCI (e.g., autonomic dysreflexia). Accordingly, while it is important to examine the relationship between depression and anxiety during acute rehabilitation and salient outcomes, like employment, it is similarly crucial that the psychometric properties of instruments used to screen for these constructs also be examined.

Additionally, the traditional interpretation of data derived from the PHQ-9 and GAD-7, respectively, as indicators of overall depression and anxiety severity may be inappropriate within the context of acute rehabilitation, post-SCI. In the context of traumatic injury, like SCI, there

may be greater utility in interpreting the distress captured by these measures in terms of their quality (e.g., affective, cognitive, somatic) as opposed to the more traditional framework of depression and anxiety. Appropriate interpretation of the data captured by these measures is important because certain psychosocial interventions may be ineffective in impacting depression (i.e., PHQ-9 total score) and anxiety (i.e., GAD-7 total score) but effective in impacting experiences of affective, cognitive, and somatic distress. For example, and as noted above, perhaps endorsement of somatic distress more accurately reflects the physiological impact of SCI and more general impact of inpatient hospitalization (e.g., being woken up in the middle of the night, participating in hours of physical- and occupational therapy) than somatic experiences of either depression or anxiety. Importantly, intervention for physiological residuals of SCI would likely be different than treatment for somatic symptoms of depression or anxiety, and inaccurate diagnosis can yield increased risk of serious adverse outcomes.

Similarly, unique associations with salient outcomes (e.g., employment) may emerge between scores on these more nuanced factors derived from the PHQ-9 and GAD-7 that do not exist between PHQ-9 and GAD-7 total scores and these same outcomes. This transdiagnostic conceptualization of psychological distress is generally consistent with recommendations from the National Institutes of Health for scientists to distance their research from the *Diagnostic and Statistical Manual for Mental Health Disorders (DSM; American Psychiatric Association, 2013)* and instead utilize the Research Domain Criteria (RDoC; Insel et al., 2010).

Therefore, in this study, we used confirmatory factor analysis (CFA) to test a number of competing models to yield an enhanced understanding of the data derived from the PHQ-9 (Kroenke et al., 2001) and GAD-7 (Spitzer et al., 2006) within the context of acute rehabilitation. While the PHQ-9 and GAD-7 are purported, respectively, to provide a means of measuring depression and anxiety, it remains somewhat unclear if these psychiatric labels are the most appropriate (or useful) descriptors of the data derived from these measures. Using the most parsimonious model derived from CFA, we then explored the linear associations between factor scores on these factors and post-discharge employment status. We hypothesized that a model comprised of affective, cognitive, and somatic factors would best fit the data derived from these measures and that higher levels of distress captured by each of these factors would be associated with lower rates of employment post-discharge.

Method

Participants and Procedures

All participants in this study had previously sustained an SCI and had participated in acute rehabilitation at the Rehabilitation Institute of Michigan in Detroit. The aims of this project were two-fold. Data used to address the study's first aim were extracted from individuals' ($n = 241$) electronic medical records from when they were participating in acute rehabilitation. Alternatively, data used to address the study's second aim were collected prospectively from a subset of individuals ($n = 36$) for whom data had previously been extracted from the electronic medical record and who had previously provided permission via formal informed consent for future research contact. In all, attempts were made to collect prospective data from 70 individuals, indicating a completion of rate of 51.42% for aim two data collection. Prospective data collection occurred via web-survey following individuals' discharge from acute rehabilitation, and individuals who completed this web survey were compensated \$40 for their

time. On average, participants completed the web survey 2.5 years after having sustained their SCI ($SD = 3.29$) and also 2.5 years after having been discharged from acute rehabilitation ($SD = 3.15$). This similarity indicates that most individuals who participated in aim two data collection had completed acute rehabilitation shortly after having sustained their SCI.

Measures

PHQ-9. The PHQ-9 is a depression screener commonly used in medical settings (Kroenke et al., 2001). There exist some data to support its use in the context of acute rehabilitation, post-SCI (Bombardier et al., 2012; Krause, Saunders, Bombardier, & Kalpakjian, 2011). On this measure, respondents are asked to use a four-point Likert scale to rate how often they have experienced nine symptoms of depression over the preceding two weeks. Response options include: not at all (0), several days (1), more than half the days (2), and nearly every day (3). Scores on the PHQ-9 range from 0 to 27, and threshold values of 5 (i.e., mild), 10 (i.e., moderate), and 15 (i.e., severe) have been previously recommended for clinical interpretation of depression severity. Using these criteria, participants in this study reported mild levels of depression ($M = 6.80$; $n = 211$) characterized by considerable variability ($SD = 5.26$).

GAD-7. The GAD-7 is an anxiety screener commonly used in medical settings (Spitzer et al., 2006). To our knowledge, the GAD-7 has not yet been empirically examined in the specific context of acute rehabilitation, post-SCI. Like the PHQ-9, on this measure, respondents are asked to use a four-point Likert scale to rate how often they have experienced seven symptoms of anxiety over the preceding two weeks. Response options include: not at all (0), several days (1), more than half the days (2), nearly every day (3). Scores on the GAD-7 range from 0 to 21, and, also like the PHQ-9, threshold values of 5 (i.e., mild), 10 (i.e., moderate), and 15 (i.e., severe) have been previously recommended for clinical interpretation of anxiety severity. Using these criteria, participants in this study reported mild levels of anxiety ($M = 5.79$; $n = 207$) also characterized by considerable variability ($SD = 5.31$).

Employment Status. Individuals were asked to indicate whether they were or were not currently employed at the time of completing the web survey. Of the 36 individuals who completed the web survey this study, five participants (13.89%) reported being employed, 28 reported not being employed (77.78%) and three individuals (8.33%) refused to answer. Moderate-to-high rates of missingness across other items associated with employment (e.g., likelihood of ever returning to the workforce; 50.00% missing) limited our ability to perform more detailed analyses of the associations between psychosocial functioning and employment outcomes.

Injury Characteristics and Demographics. Demographics (e.g., age, race, sex) and injury-related information (e.g., severity) were extracted from the electronic medical record. Information pertaining to individuals' inpatient hospitalization (e.g., length of stay [LOS] within acute rehabilitation) were extracted as well. Frequency counts and descriptive statistics for these data can be found in Table 1.

Review of the data summarized in Table 1 reveals that, consistent with other epidemiological data on SCI, the majority of participants in this study were male. These data also indicate that the majority of participants in this study were Non-White, had sustained an

incomplete SCI. With regard to NLI, most participants had sustained either cervical or thoracic injury. These data indicate considerable variability with respect to both age and LOS during participation in acute rehabilitation.

Table 1. Frequency counts and descriptive statistics for demographic, injury-, and hospitalization-related data

	Aim 1 (n = 241)		Aim 2 (n = 36)		
	<i>n</i>	%	<i>n</i>	%	
Sex					
	<i>Male</i>	170	70.0	27	75.0
	<i>Female</i>	73	30.0	9	25.0
Race					
	<i>White</i>	71	29.2	8	22.2
	<i>Not-White</i>	172	70.8	28	77.8
Neurologic level of injury					
	<i>Cervical</i>	149	61.3	16	44.4
	<i>Thoracic</i>	90	37.0	19	52.8
	<i>Lumbar</i>	4	1.6	1	2.8
	<i>Sacral</i>	0	0.0	0	0.0
Completeness					
	<i>Complete</i>	54	22.2	10	27.8
	<i>Incomplete</i>	189	77.8	26	72.2
Continuous variables					
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
	<i>Age</i>	52.41	16.55	40.88	16.31
	<i>Length of stay (days)</i>	34.26	31.96	46.25	26.38

Results

Factor Structure

We used confirmatory factor analysis (CFA) to compare the fit and parsimony of four unique statistical models comprised of item-level data from the PHQ-9 and GAD-7. The first factor analytic model included all 16 items from both the PHQ-9 and GAD-7, with all 16 items loading onto a unitary *distress* factor. Fit indices for this model reflected borderline-to-poor model fit ($\chi^2 = 305.16$, $df = 104$, $p < .001$; $RMSEA = .089$, $BIC = 408.41$); that is, RMSEA values below .08 are generally interpreted as indicative of acceptable model fit.

The second model reflected the traditional *depression* and *anxiety* conceptualization of the data derived from the PHQ-9 and GAD-7. In this model, all nine items from the PHQ-9 loaded onto a *depression* factor and all seven items from the GAD-7 loaded onto an oblique *anxiety* factor. Fit indices for this model demonstrated superior fit relative to the one-factor model ($\chi^2 = 288.29$, $df = 103$, $p < .001$; $RMSEA = .086$, $BIC = 393.70$). The size of the BIC change between this model and its predecessor reflected a large improvement in model fit relative to the initial, one-factor model. That is, while BIC absolute values cannot be meaningfully interpreted in isolation, BIC-change scores can, with lower BIC values reflecting superior model fit. With regard to interpretation of BIC-change values, a BIC-change of 10 or greater is generally viewed as a large improvement in model parsimony.

The third model reflected a *non-somatic and somatic* conceptualization of the distress captured by the PHQ-9 and GAD-7. That is, items from these two measures thought to reflect somatic experiences of distress were constrained to a *somatic* factor, while items that tapped more cognitive or affective experiences were constrained to a *non-somatic* factor. In this iteration, 10 items loaded onto the *non-somatic* factor and six items loaded onto the *somatic* factor. Although the RMSEA value continued to demonstrate marginal model fit, this two-factor model did demonstrate relatively better fit compared to the two previously computed models ($\chi^2 = 266.69$, $df = 103$, $p < .001$; $RMSEA = .081$, $BIC = 372.10$), with the magnitude change in BIC reflecting a large improvement in model fit.

The last model computed expanded upon the one preceding it by splitting the non-somatic factor into two factors comprised of items with mostly *affective* qualities and those with mostly *cognitive* qualities. In this three-factor model, five items loaded onto the *affective* factor, five items loaded onto the *cognitive* factor, and the same six items as before continued to load onto the *somatic* factor. Of the models tested, this model best fit the data derived from the PHQ-9 and GAD-7 as evident by its absolute RMSEA value and relative BIC value ($\chi^2 = 239.85$, $df = 101$, $p < .001$; $RMSEA = .075$, $BIC = 349.56$). Whereas the preceding models had all demonstrated marginal fit indices (i.e., $RMSEA \geq .08$) this model possessed an RMSEA value within acceptable limits (i.e., $RMSEA < .08$). Again, the magnitude change in BIC (i.e., $BIC\text{-change} \geq 22.54$) indicated a large improvement in fit relative to all preceding models.

Factor Associations with Employment

After completing confirmatory factor analysis of the data derived from the PHQ-9 and GAD-7, we next examined the association between scores on each of these factors with post-discharge employment status. Table 2 includes descriptive data for participants' scores on the *affective*, *cognitive*, and *somatic* factors extracted from the PHQ-9 and GAD-7, plus item-level data as well.

Table 2. Descriptive statistics for the affective, cognitive, and somatic factors extracted from the PHQ-9 and GAD-7 and their corresponding items

	<i>N</i>	<i>M</i>	<i>SD</i>	Min.	Max
affective	208	3.18	3.10	0	14
<i>suicidality</i>	214	0.16	0.53	0	3
<i>dread/fear</i>	208	0.58	0.93	0	3
<i>anhedonia</i>	214	0.61	0.97	0	3
<i>low mood</i>	214	0.86	0.99	0	3
<i>feeling nervous</i>	210	1.02	1.08	0	3
cognitive	207	3.46	3.79	0	15
<i>uncontrollable worry</i>	210	0.73	1.07	0	3
<i>excess worry</i>	210	0.79	1.11	0	3
<i>irritability</i>	209	0.90	1.09	0	3
<i>concentration problems</i>	214	0.51	0.93	0	3
<i>low self esteem</i>	212	0.56	0.95	0	3
somatic	208	5.84	4.32	0	18

<i>fatigue/lethargy</i>	214	1.21	1.09	0	3
<i>appetite change</i>	213	0.94	1.15	0	3
<i>tension</i>	209	1.11	1.13	0	3
<i>restlessness</i>	210	0.68	1.02	0	3
<i>psychomotor change</i>	214	0.45	0.86	0	3
<i>sleep problems</i>	214	1.47	1.17	0	3

As noted previously, 28 of the 36 individuals (77.78%) who completed prospective data collection reported not being employed, while only (13.89%) reported being employed. While we had initially intended to use logistic regression to analyze the association between psychosocial functioning during acute rehabilitation and post-discharge employment, this uneven distribution raised concerns regarding the use of this type of analysis in this study (King & Zeng, 2001).

Unable to examine the logistic association between these variables, we opted to use point biserial correlation to examine the linear association between scores on each of these factors and post-discharge employment status. Results of this analysis indicated that scores on the affective and somatic factor were not significantly ($p > .05$) associated with employment status; however, there did exist a significant, positive correlation between scores on the cognitive factor and employment status ($r = .32, p < .05, n = 31$). Neither injury characteristics (i.e., neurologic level of injury, completeness), demographic factors (i.e., age, race, sex), were significantly associated with employment status. Greater time elapsed since discharge was significantly associated with higher rates of employment ($r = .60, p < .001, n = 33$). Total scores on neither the PHQ-9 nor GAD-7 were significantly associated with post-discharge employment.

With this information in mind, we performed a post hoc partial correlation to examine the association between the *affective*, *cognitive*, and *somatic* factors with employment, while holding, time elapsed since discharge constant. Results of this analysis were generally consistent with zero order correlations; that is, scores on neither the affective nor somatic factor correlated with employment; however, higher scores on the cognitive factor remained significantly correlated with higher incidence of post-discharge employment ($r = .41, p < .05, n = 28$).

Discussion

The goals of this study were two-fold. First, we were interested in clarifying the psychometric structure of a commonly used depression (PHQ-9) and anxiety (GAD-7) measure within the context of acute rehabilitation, post-SCI. We then sought to examine the association between scores on these factors with employment following discharge from acute rehabilitation. This study was unique in its approach – Psychometric examination of the data derived from multiple measures remains rare, even between highly similar measures, like the PHQ-9 and GAD-7, where differences in scaling and other measurement properties are not of particular concern. As greater emphasis continues to be placed on research that steps away from the *DSM* and instead towards transdiagnostic topologies, like the RDoC, psychometric examination of data derived from multiple measures may become increasingly useful and necessary in understanding experiences of psychological distress.

Results of factor analysis lent support for our initial hypothesis; that is, a three-factor solution, comprised of an *affective*, *cognitive*, and *somatic* factor best fit the data derived from the PHQ-9 and GAD-7. This lends support for the hypothesis that distress experienced by

individuals with SCI during participation in acute rehabilitation may be better conceptualized in terms of quality as opposed to *DSM*-defined psychiatric labels. As noted previously, this type of work may have implications for measuring the efficacy of psychosocial interventions within this specific medical setting. For example, an intervention that does not demonstrate an effect on PHQ-9 and GAD-7 total scores may actually be effective in impacting scores on these new PHQ-9 and GAD-7 factors. To further verify this finding, it will be important for other researchers to perform analyses similar to this one in other samples of individuals participating in acute rehabilitation, post-SCI.

This study was also unique because it examined the association between scores on these transdiagnostic factors with an ecologically valid functional outcome (i.e., employment). While results of CFA were generally consistent with a priori hypotheses, the correlational analyses performed in this study were unfortunately limited in their scope and did not lend support for initial hypotheses. For example, we hypothesized that higher scores on the factors derived from the PHQ-9 and GAD-7 would predict lower levels of post-discharge employment; however, findings from this study indicated that, in this sample, the opposite tended to occur. Specifically, while higher scores on the affective and somatic factors were non-significantly associated with post-discharge employment, higher scores on the cognitive factor were surprisingly associated with higher rates of employment.

This latter finding is interesting and warrants continued investigation. Hypotheses for why this study produced this counterintuitive finding, include the possibility that higher scores on this factor activated more intense psychosocial intervention services, during participation in acute rehabilitation, which then ultimately facilitated greater workforce participation. Alternatively, perhaps the nature of distress captured by this factor (e.g., worry) functioned as a motivator for increased workforce participation. Alongside the null effects of PHQ-9 and GAD-7 total scores on employment, this significant association between cognitive distress and employment underscores the potential value of the data analytic approach used in this study. Because this finding is in direct opposition to a priori hypotheses and because of the novelty of the factors derived from the PHQ-9 and GAD-7 in this study and because of this study's relatively small and unevenly distributed sample, it is important to interpret this incidental finding with a considerable degree of tenuousness. It is entirely possible that this finding is unique to the sample of individuals recruited for participation in this study and would therefore not generalize to the larger SCI population.

This last point underscores several limitations of this study. While data from more than 200 individuals with SCI were included in the CFA performed in this study, prospective data were collected from less than a fifth (18%) of those individuals. While a priori power analysis indicated that a minimum sample size of 34 would be adequate to detect a moderate-to-large effect of PHQ-9 and GAD-7 item endorsement on post-discharge employment, attempts were made to recruit a larger sample. While recruitment efforts were largely successful, a sizable minority of individuals contacted for participation in this study (48.57%) were either disinterested in participation or unreachable due to changes in contact information. Therefore, relatively small size limited the number of covariates that could be included in statistical analyses. Furthermore, and of crucial importance, only five of the 36 participants (13.9%) who completed prospective data collection reported current employment, which further limits the generalizability of this study's findings. Had the sample recruited for this study been stratified in terms of employment, rather than convenience sampled, this limitation would have likely been ameliorated. Moderate rates of missingness across other questions posed to participants during

prospective data collection further limited which variables could be included in statistical analyses and underscores possible discomfort experienced by members of this population regarding questions related to disability benefits and employment.

A strength of this study was its diversity with respect to race; that is, approximately three-quarters of the individuals in our sample were people of color. The intersection of race and disability is important yet often overlooked, and inadequate representation of people of color in empirical research often raises concerns regarding the generalizability of data to Non-White communities. For example, failure to adequately include people of color in empirical research can yield an underappreciation of how systemic factors, like institutionalized racism, may impact the experiences of Non-White people. While this study was not explicitly designed to provide data on the impact of social factors (e.g., racism) on experiences of psychological distress following SCI, the findings from this study are valuable in that they may be more directly generalizable to people of color living with SCI.

While the results of this study must be interpreted with a considerable degree of caution, from a policy perspective, much can still be gleaned from these data. For example, the incidental finding regarding the association between higher levels of cognitive distress during participation in acute rehabilitation and post-discharge employment warrants further examination. However, if findings from future studies lend further evidence to support the presence of this association, then some policy-level interventions may be warranted. For example, if that association exists because individuals who endorse heightened distress are provided with more intense mental health services, which then facilitates greater workforce participation, then it may actually be cost effective to incentivize more prophylactic engagement with mental healthcare providers.

From a methodological perspective, some participants in this study appeared to experience some discomfort discussing their current employment status with our research team, which may reflect anxiety about the perceived risk of losing disability benefits secondary to disclosure of current work status. This occurred even though participants were informed that all information shared as part of this study would be kept private and confidential. Policy-focused interventions geared towards providing education and information about the existing rights and protections for disabled people may help alleviate some of these concerns, which may in turn enhance the quality of data generated from future studies.

Building on this study, future studies should work to recruit larger samples – In this study, recruitment for prospective data collection was limited by the need to include individuals for whom inpatient clinical data were available and who had already provided informed consent for future research contact. Secondary analysis of longitudinal data contained within large, publicly available databases, like the SCI Model Systems database, may provide researchers with adequate statistical power to test more complex models linking item endorsement on measures of psychosocial functioning with salient outcomes, like employment. The three-factor model of data derived from the PHQ-9 and GAD-7 observed in this study is an interesting finding, the validity of which must be explicitly examined in subsequent studies. Similarly, the significant association between higher levels of cognitive experiences of psychological distress with enhanced workforce participation must also be interpreted tenuously and reexamined in future studies.

Conclusion

Findings from this study indicated that data derived from administration of the PHQ-9 and GAD-7 to individuals participating in acute rehabilitation, post-SCI most parsimoniously

loaded onto a three-factor (i.e., affective, cognitive, somatic) model. Relatively small sample size, an unevenly distributed sample in terms of employment, and moderate rates of missingness across study variables limit the conclusions that can be drawn regarding the association between scores on those factors with post-discharge employment. However, in this study there appeared to be a significant association between higher scores on a measure of cognitive experiences of psychological distress (e.g., worry, low self-esteem) and higher rates of employment. This counterintuitive finding warrants further examination to clarify why this association may exist and verify that it is not an artifact of the relatively small and unevenly distributed sample recruited for this study.

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