Considine and Paivio, J Trauma Treat 2013, 2.1
DOI: 10.4172/2167-1222.1000148

Journal of Trauma & Treatment

Research Article Open Access

From Trauma Exposure to Depression: An Evaluation of Alexithymia Assessed via Auditory-Affective Perception and Interpersonal Problems as Potential Mediators

Ciaran Michael Considine* and Sandra Paivio

University of Windsor, Ontario, Canada

Abstract

Objectives: Alexithymia involves difficulty identifying and describing emotions and has been linked to a variety of psychological problems, particularly exposure to trauma, interpersonal difficulties, and depression. Currently, alexithymia is most commonly assessed through self- report questionnaires. A neuropsychological test may be a more valid assessment of alexithymia because it uses a performance-based design and focuses on the underlying cognitive process in question: affective-processing. This impaired processing may be useful in testing an explanatory model for the relationship between trauma exposure and the subsequent development of alexithymia, interpersonal problems, and depression.

Participants and methods: Fifty-three undergraduate students pre-screened for trauma exposure, were given questionnaires measuring alexithymia, interpersonal problems, and depression, and then administered a neuropsychological test of Auditory-Affective Perception (AAP). Correlational analyses compared the neuropsychological measure with the alexithymia questionnaire. A hierarchical regression tested a meditational model.

Results: Performance on the neuropsychological measure of AAP did not significantly correlate with the alexithymia questionnaire ($p>0.05$). Alexithymia was found to partially mediate between trauma exposure and depression ($p=0.03$). The over-all model was significant,

$F(2.50)=25.17$, $p<0.001$, adjusted-$R^2=0.48$.

Conclusions: Regression analyses supported self-reported alexithymia as a partial mediator of the relationship between trauma exposure and depression, suggesting that depressive symptoms developed following trauma exposure are partially related to the development of alexithymic symptoms. AAP performance was not significantly correlated with the measure of alexithymia suggesting self-reported alexithymic symptoms are independent of the ability to recognize auditorially-presented emotions; possible explanations and theoretical implications are discussed.

Keywords: Auditory-affective perception (AAP); Alexithymia; Trauma

Introduction

Currently, the assessment of alexithymia is largely dependent on self-report measures, which may be in a format less suitable for measuring this construct. Additionally, there is an absence of published research describing the relationship between alexithymia and related constructs, such as exposure to trauma or depression. This study had two goals: [1] to test a mediational model of the relationship between exposure to trauma and development of depression using self-report measures of alexithymia and interpersonal problems, and an auditory-affective perception task, and [2] to test whether an auditory-affective perception task is a valid measure of alexithymia.

Models and Correlates of Alexithymia

The concept of alexithymia developed from the clinical observation that some patients demonstrated difficulties with symbolic and verbal labeling and expression of emotion [1]. Current research characterizes alexithymia as a deficiency in the ability to understand, process, or describe feelings, and an externally orientated cognitive style with limited attention to inner thoughts and fantasies [2]. The extant research consistently has linked trauma with alexithymia [3,4], alexithymia with interpersonal problems, and interpersonal problems with depression [5,6]. The connection between trauma exposure and development of depression, in particular, is well-documented [3,4]. However, to date, no studies have tested a comprehensive model of the relationships among all these variables.

Alexithymia is associated with many psychological disturbances; specifically, exposure to trauma is documented as a strong contributing factor to development of alexithymia. Clinical understanding currently posits that those exposed to trauma cannot make sense of, and lack the vocabulary to articulate and make sense of, the experiences, including the powerful and sometimes overwhelming feelings involved – thus unresolved trauma at any age can be associated with alexithymia (no words for feelings) [7]. The link between repeated exposure to trauma in childhood (i.e. physical, sexual, and emotional abuse) and alexithymia is also well documented. This association has been attributed to a combination of factors including the vulnerable developmental stage of

***Corresponding author:** Ciaran Michael Considine, University of Windsor, 401 Sunset Avenue 173-2 Chrysler Hall South Windsor, Ontario N9B 3P4, Canada, Tel: 519-253-3000; Fax: 519- 973-7021; E-mail: considic@uwindsor.ca

Received January 22, 2013; **Accepted** February 26, 2013; **Published** February 28, 2013

Citation: Considine CM, Paivio S (2013) From Trauma Exposure to Depression: An Evaluation of Alexithymia Assessed via Auditory-Affective Perception and Interpersonal Problems as Potential Mediators. J Trauma Treat 2: 148. doi:10.4172/2167-1222.1000148

the victim combined with excessive stimulation of the central nervous system [8], lack of adequate support and "emotion coaching" to manage, articulate, and make sense of these experiences [9], and impaired self-reference and dissociation observed in post-trauma personality styles that correlate with difficulties identifying and communicating feelings, that is, with alexithymia [10].

Alexithymia is linked to difficulties in interpersonal functioning, which reflects impairments in emotional communication. There is increasing recognition that "emotional intelligence" is crucial to healthy psychological functioning, particularly to healthy interpersonal functioning through appropriate management of emotions [11]. Efficient decoding of emotions is a crucial ability required to develop and maintain satisfactory interpersonal relations [12]. Deficits in emotional perception are thought to make it difficult to negotiate the socio-emotional world, potentially leading to stress and conflict [13]. Expressive and receptive communication is mediated by affective prosody and tone, which impacts individuals' interpersonal relationships with friends and family, and influences their self-appraisals of social support [14]. Some researchers have suggested that the cold and socially avoidant behaviours characteristic of individuals with alexithymia reflect their difficulties interacting with others on an emotional level which, in turn, perpetuates difficulties in social interactions [15].

Alexithymia also has been linked to depression. Depression has exceedingly high point and lifetime prevalence rates [16]. One study found a significant correlation between alexithymia and depression when measured at baseline and 6 months follow-up [17]. Another study found that psychiatric patients diagnosed with alexithymia suffered more often from depression than other patients and the features of alexithymia among these patients changed as a function of changes in depression [18]. The authors suggest that rather than a direct causal relationship existing between childhood abuse and alexithymia, alexithymia could mediate the associations between a history of childhood abuse and psychiatric symptoms, such as depression, in adulthood. Difficulties with emotional intimacy that are associated with alexithymia could generate a positive feedback cycle whereby the individual is deprived of social support, which leads to and/or exacerbation of depression [19].

Research exploring factors that contribute to alexithymia is crucial, as emotional competency and awareness plays a critical role in healthy functioning and during psychotherapeutic intervention. Understanding the factors that contribute to the relationship between trauma and depression informs prevention and treatment programs and benefits large numbers of individuals. Research indicates that prevalence rates for trauma exposure and subsequent development of psychological and functional disturbance in the general population are high [20]. Moreover, depression is considered the "common cold" of psychological disorders, with some estimates of lifetime incidence of a depressive condition being as high as 20%, as well as imparting high costs both to the individual and society [16]. This pervasiveness highlights the disorder as an important target for research that elucidates contributing factors, as this study does, thereby providing direction for prevention and treatment.

A comprehensive analysis of these constructs via mediational modeling offers more insight than previously published research on single correlations or single variable mediation models. Related constructs may account for overlapping variance, and thus, individually all look significant, though the reality is more complex. Mediational analysis also offers more direction for intervention, as identified mediators can be monitored as warning signs, as well as targeted by clinicians attempting to identify at-risk patients. The present study tested such a model in a sample of undergraduates with a self-reported history of exposure to trauma (Figure 1). The present study therefore was a first step in understanding one pathway to depression and results potentially could generate hypotheses for testing in future research.

Assessment of Alexithymia

With regard to the second objective of the present study, since the mid 1970's, when the alexithymia construct first appeared in the literature, there has been debate about the development of alexithymic measures [21]. Clinician rating scales, such as the Beth Israel Hospital Psychosomatic Questionnaire's [22], consist of an unstructured interview and/or forced- choice format. These methods have limitations in terms of stability in factor analysis [23], time to use, lack of inter-rater reliability [24], and observer-bias [25]. Other measures of alexithymia such as the Levels of Emotional Awareness Scale [26] and the Perception of Affect Task [27] are limited because they require individuals to use visual and lexical systems to assess the stimuli, and then access their semantic knowledge to make a decision on what emotion should be elicited. Additionally, individuals are conscious of these processes during testing, making it less clear what the results are truly measuring. The most commonly used means of assessing alexithymia is the self-report Toronto Alexithymia Scale-20 (TAS-20; [28]). However, a critical literature review of the TAS-20 [29] offered mixed results concerning its psychometric properties. For example, one dimension (externally oriented thinking) appeared not to have adequate reliability.

For these reasons, a performance-based neuropsychological measure of alexithymia may be more valid. For example, individuals diagnosed with alexithymia demonstrate impairments in rating negative facial expressions, and differentiating between nine visually-presented emotions [30,31]. Furthermore, individuals who met criteria for alexithymia on the TAS-20 demonstrated poor ability to identify and correctly label the extent of sadness, anger, and fear in facial expressions [13]. This suggests that alexithymia involves decrements in ability to judge others' emotional visual-cues. While visual perception and processing of affective stimuli in alexithymia has been studied, auditory perception and processing of emotion has been largely ignored. Of note, Xiong-Zhao [32] found delayed event-related P300's (electroencephalogram signals indicative of response to a stimulus)

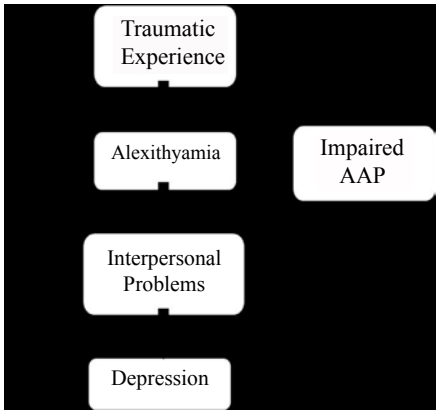

Figure 1: Model for the link between Alexithymia and Depression in a Traumatized Sample.

after affective auditory stimuli for those scoring high on the TAS-20 (Chinese version), suggesting slowed processing of this information.

Although there are self-report and rater-scored measures for alexithymia, and there is research implicating impaired affective processing at some level in this disorder, no performance based test of auditory-affective processing has previously been validated for measuring alexithymia. The present study therefore addressed this issue by investigating whether the auditory-pathway and auditory-affect recognition contribute to the global affective impairments characteristic of alexithymia. This is a first step towards a more comprehensive understanding of the alexithymia construct, with the hope that accurate assessment of difficulties in affective processing can contribute to effective intervention and amelioration of associated functional and psychological difficulties.

In sum, the above review of the literature suggests a chain of associations between trauma, alexithymia, interpersonal problems, and depression. Traumatic experiences are emotionally overwhelming and painful, and difficult to make sense of and articulate. Without adequate support and emotion coaching, individuals learn to rely on avoidance of internal experience as a coping strategy. Although effective as an emotion regulation strategy in the short-term, chronic avoidance of internal experience interferes with emotional awareness and communication capacities. Deficits in emotional awareness and communication (alexithymia) interfere with the capacity for intimacy and interpersonal relatedness and the resulting loneliness and social isolation, in turn, contribute to depression. Although research supports associations among these individual factors, to date, no study has tested such a comprehensive theory of the relationship between trauma and depression. Moreover, no study has examined the contributions of alexithymia to this relationship using a neuropsychological performance-based measure of the alexithymia construct (Figure 1).

Methodology

Participants

Fifty-three undergraduate students from the University of Windsor registered in first-year psychology courses participated in this study. Participants were eligible only if they screened positively for exposure to trauma, and were offered bonus points toward their final mark in the course in exchange for participation. The Institutional Research Ethics Board approved this study.

Measures

Demographic questionnaire: A questionnaire inquired about participant age, education, ethnicity, sexual orientation, veteran status, disability status, and dominant hand. These variables have been found to influence depression and alexithymia rates, as well as reaction to exposure to trauma [33,34].

Childhood Trauma Questionnaire (CTQ; [35]): The CTQ is a 28-item self-report inventory, designed to measure a broad range of childhood/adolescent neglect and abuse that qualify as traumatic. Questions are answered using a 5-point Likert scale (Never True to Very Often True). Good internal reliability has been demonstrated for the sub-scales of the CTQ: Emotional Abuse (alphas=0.84 to 0.94), Physical Abuse (alphas=0.78 to .92), Sexual Abuse (alphas=0.72 to 0.96), Emotional Neglect (alphas=0.81 to 0.93), Physical Neglect (alphas=0.60 to 0.83). A Minimization/Denial of Abuse scale is also included, to check for response bias. Retest validity alpha's ranged from 0.79 to 0.86, after a mean test interval of 3.6 months (*SD*=1.0). The authors also found the five factor structure has been demonstrated to fit across clinical and non- clinical populations. Finally, it has demonstrated good convergent validity with other measures of childhood trauma [36,37].

Trauma Questionnaire (TQ, [38]): The TQ lists 20 traumatic events that are based on a review of commonly used trauma-assessment questionnaires (e.g., Traumatic Stress Schedule, [39]; PERI Life Events Scale, [40]; Initial Trauma Review-3, [41]). Participants are asked to indicate whether (Yes/No) they have experienced each of the events. After endorsing an event, participants rate the degree of distress associated with it on a 6-point Likert scale (0=not distressing at all, 5=extremely distressing). They are also asked whether they experienced fear, horror or helplessness during the event. The TQ successfully screened a similar undergraduate student sample for the presence of a traumatic history in a previous study [38]. It screened participants for appropriate minimum levels of trauma (at least one) and also provided an index of trauma exposure, with more events and distress considered to indicate more trauma.

Exposure to Trauma (ET): The ET is a composite developed for the present study and is a combination of the Trauma Questionnaire (TQ) and Childhood Trauma Questionnaire (CTQ), described above. This was justified because the TQ and CTQ are conceptually related, have significant overlap in the material and construct they measure, and were found to have a Pearson correlation of 0.502 ($p<0.001$). Thus in order to provide a more robust measure of Exposure to Trauma (ET), unit-weighed z-scores were summed to form a composite and used in subsequent analyses.

Twenty-item Toronto Alexithymia Scale (TAS-20): The TAS-20 is a self-report measure that consists of 20 items that assess the severity of alexithymia using a 5-point scale (1= strongly disagree, 5=strongly agree). The authors empirically constructed the measure such that items reflect the domains of the alexithymia construct. It yields three factors (difficulty describing feelings, difficulty identifying feelings, and externally oriented thinking). The TAS-20 total score has a reported internal consistency of 0.81 and a test-retest reliability of 0.77, using an undergraduate student sample [28].

Sixty-four-Item Inventory of Interpersonal Problems (IIP-64): It is a self-report questionnaire designed to assess the type and severity of various maladaptive interpersonal behavior. The scales consist of two orthogonal axes, a vertical one (status, dominance, power, or control) and a horizontal one (solidarity, friendliness, warmth, or love). It is based on a circumplex [42] model that organizes interpersonal behaviors according to the dimensions of affiliation and control [43]. Items reflect common interpersonal problems reported by individuals seeking psychotherapy. The present study used the overall average score in analyses. Horowitz et al. [42] reported good convergent validity with the Brief Symptom Inventory's [44] Global Severity Index (r=0.78) and with the Behavior and Symptom Identification Scale [45] (r=0.66), as well as good internal consistency (alpha=0.96) and test-retest reliability (r=0.78).

The Beck Depression Inventory – Second Edition (BDI-II): It is a 21-item self-report questionnaire which asks individuals to endorse statements (mood-related or somatic-related) on a scale from 0-3, with item descriptions being unique to each item (e.g. 0=I do not feel sad, 3=I am so sad or unhappy that I can't stand it). The present study used the total score in analyses. Researchers have reported high internal consistency (alpha=0.91) and test-retest reliability (r=0.93)

for the BDI-II total score, as well as concurrent validity (0.71) with the Hamilton Depression Rating Scale [46,47].

Emotional Perception Task (EPT): The EPT is a measure of auditory-affective processing. It consists of 45 items, covering five separate emotions (happy, angry, frightened, sad, and neutral). A tape recorded professional actress reads three different content-neutral sentences (e.g., "Why didn't you tell me you were going to the store") in each of these emotions, three times, and participants are required to listen to each sentence, and then in a short time frame (4 seconds) pick the emotional label they feel best describes the tone of voice in the previous sentence. The test is administered via computer, and completely automated. After each sentence is played aloud, the five emotion options appear on the screen and the individual must select their answer. No corrective feedback is given, and the number of errors made is recorded for each emotion category. Green reported good internal reliability for the EPT (alpha=0.80), as well test-retest reliability (r=0.78). Healthy participants achieved a mean of 75% accuracy compared to chance (i.e. 20%), while a psychiatric patient group achieved 43% accuracy [48].

Procedure

Before data collection, power analysis using online modeling software (and suggested conservative values from the author due to an absence of pilot data) suggested a sample size of 52 individuals [49]. This parallels the rule of thumb used when working with linear regressions of 10 participants per a predictor (i.e. 50). Fifty-three individuals participated.

Mass-screening of the participant pool identified potential participants. Screening consisted of affirmative responses to two questions based on the TQ and DSM-IV-TR, (1) an experience of one or more traumatic experiences listed in the TQ and (2) the experience consisted of extreme distress, fear and/or helplessness related to the endorsed event(s). These two questions correspond to the DSM-IV-TR's criteria for trauma, that is, (A1) the event involved actual or threatened serious injury, death, or a threat to the physical integrity of the self or others, and (A2) the individual experienced fear, helplessness, or horror [50]. Those who responded affirmatively to both questions concerning a single event (minimum criteria for a trauma) were eligible to participate in the study in exchange for bonus points on their final grade.

Prior to participation, all participants read information about the study methodology and their ability to discontinue at any time, and signed a consent form.

In a group setting, participants completed all self-report measures (Demographic Questionnaire, CTQ, TQ, TAS-20, IIP, BDI-II) in random order. Because recalling traumatic experiences could evoke distress, all participants received information about psychological services (i.e. Student Counseling Centre). During the second phase, the EPT neuropsychological test of auditory-affective perception was administered.

Statistical Analyses

Analyses of the data were conducted using IBM SPSS Statistics Version 19. There were three overarching objectives for the analyses: (1) to investigate whether auditory-affective perception was significantly related to exposure to trauma, alexithymia, interpersonal problems, and depression; (2) to investigate whether auditory-affective perception, alexithymia, and interpersonal problems mediated the relationship between exposure to trauma and depression; and (3) to investigate whether grouping together of the significant individual mediators improved the explanatory model. Due to sample size and resultant limitations on power, primary analyses used only each scale's total score. A regression analysis, rather than path analysis or SEM, is appropriate due to the previously mentioned limitations; the present study was a preliminary investigation designed to generate hypotheses for future testing using more powerful analyses with a larger sample.

Preacher and Hayes [51] developed a macro for SPSS that is useful for analyzing the path coefficients in multiple mediator models. It utilizes a bootstrapping method to produce confidence intervals for the total and specific indirect effects of an IV on a DV via one or multiple mediators. This method is considered superior to the more common alternative method of using individual mediation analysis followed by a SOBEL test. For all analyses, a 95% confidence interval was used, along with 1000 iterations for the bootstrapping.

Results

Q-Q plot inspection, skewness and kurtosis cut-offs (-2/2 and -3/3, respectively), and Shapiro-Wilk tests all indicated normality of the data. Results indicated that the questionnaires and performance measure all demonstrated normality for each of the three tests. Additionally, inspection of scatterplots of the residuals did not appear to violate assumed normality; bivariate scatterplot visual inspection indicated appropriate linearity between the variables. Investigating these scatterplots also suggested the data generally fell around lines of best fit, suggesting the data did not violate assumed homoscedastic distribution. As previously described, the normal distribution of the TQ and CTQ, along with the conceptual/statistical relationship (Pearson correlation=0.502, $p<0.001$) between the TQ and CTQ allowed for consolidation of the two measures of exposure to trauma into a single measure for analyses, dubbed Exposure to Trauma (ET).

Both the inspection of a correlation matrix for scales that correlated too strongly (>0.80), and the use of a VIF cut-off of <3 indicated multicollinearity was not an issue. Boxplots identified a limited number of potential univariate outliers. Results indicated that 3 EPT scores and 1 TAS score were outliers, though none were extreme (i.e. >3 times the interquartile range from a quartile). After checking Mahalanobis' distances using df=5, $p=0.01$, with a chi-squared table cut-off of 15.086, no multivariate outliers were identified. Since the planned analysis is multivariate in nature and the size of the sample is small to moderate, all cases were retained for analysis.

Since the correlation analysis revealed that controlling for demographic variables did not affect the relationships between primary variables, they were not included as covariates for the analysis.

Demographic and descriptive data

The sample demographics consisted of 45 (85%) females, 38 (71.7%) caucasians, 50 (94.3%) heterosexuals, and 4 (7.5%) veterans. On average, females were 23.36 years old (SD=6.92) and had 14.89 years of education (SD=0.96). The average age of males was 27.38 (SD=8.85), and they on average had 14.75 years of education (SD=0.89).

Table 1 summarizes descriptive information for all primary variables. On average, participants endorsed Minimal-Low levels (score of 36-41) of exposure to traumatic events and maltreatment during childhood (CTQ; [35]) and a similar amount of distress from exposure to traumatic experiences as the previous study using the Trauma Questionnaire (TQ; [38]); this is still significantly above average scores

Measure	CTQ	TQ	ET	TAS	EPT	IIP	BDI
Mean	380.19	120.57	0	450.35	110.8	800.5	110.79
S.D.	130.7	90.71	10.73	120.77	40.3	340.64	40.28
Cronbach's α	00.8	NA	NA	00.84	00.58	00.94	00.91

Note: CTQ: Childhood Trauma Questionnaire; TQ: Trauma Questionnaire, ET: Exposure to Trauma consolidated measure; TAS: Toronto Alexithymia Scale – 20; EPT: Emotional Perception Task; IIP: Inventory of Interpersonal Problems – 64; BDI: Beck Depression Inventory – II

Table 1: Descriptive Statistics for all Primary Variables.

for populations without exposure to trauma. Though the sample endorsed elevated levels of alexithymia, they fell below a validated cut-off for clinical levels of alexithymia (score of 56+) (TAS-20; [52]). With regard to interpersonal problems, the sample scored near the cut-off for above-average in a non-clinical population (score of 81-85) (IIP-64; [42]). They endorsed a mild amount of depressive symptoms (score of 0-13) on average (BDI-II; [46]). On the measure of auditory-affective perception, the sample made a similar number of errors to a healthy control group (12 or less errors) (EPT; [48]). Internal reliability was good for all measures except the EPT (Cronbach's alpha=0.58) (Table 1).

Inter-correlations among variables

Since it was possible that some of the demographic data would significantly correlate with the primary variables, a bivariate correlation matrix was conducted to investigate which variables should be controlled for in subsequent analyses. Gender, age, sexual orientation, and disability all correlated with at least one primary variable (>0.30), thus they were used as covariates in partial correlations among primary variables. Results indicated that partial correlation coefficients (controlling for demographic variables) were not meaningfully different from bivariate correlations. Thus, for ease of interpretation, only the bivariate correlational matrix is presented.

Table 2 indicates that the CTQ, TQ, ET constructed measure, TAS, IIP, and BDI are all significantly and positively related to each other, with the exception of the TAS and TQ. This provides partial support for the proposed hypotheses, and offers justification for the subsequent analyses conducted. However, table 2 also indicates that the Emotional Processing Task (EPT) was not significantly related to any of the other primary variables. This is inconsistent with study expectations (Table 2).

Regression analysis

Table 3 and figure 2 show the pathways for the full mediation model and indicates that the exposure to trauma (ET) significantly predicts Depression, but that only one of the potential moderators appears to be significantly predicted by ET and also predict for Depression. The IIP was only significantly predicted by ET. After controlling for the effect of all three potential mediators, ET remains a significant predictor of Depression. Finally, the indirect effect of ET on Depression via the TAS is significant. Thus this model was found to be significant $F(4,48)=12.17$, $p<0.001$, with an adjusted R-squared value of 0.46. Though the total indirect effect of the group of mediators is significant, Preacher and Hayes [51] state that this statistic should only be interpreted if all contributing mediators are individually significant. As recommended, follow-up analysis found that when only the TAS is included as a mediator there is no change in significance of the model, and only negligible shift in the adjusted R-squared value (+0.02), so the original results were kept. Taken together, results indicated that the TAS was a partial mediator between ET and Depression.

Additionally, exploratory analyses found no impact on the significance of the previous findings after eliminating Neutral Errors on the EPT (suggested by principle component analysis), discarding the Externally-Oriented Thinking subscale of the TAS-20 (due to reliability issues and conceptual relatedness), or using quadrants of the IIP-64 subscales (Table 3) (Figure 2).

Discussion

This study investigated the relationships between exposure to trauma, auditory-affective perception, alexithymia, interpersonal problems, and depression in a sample of undergraduate students pre-selected for exposure to trauma. The sample was homogenous (predominately young, well-educated, Caucasian females), and the sample size was limited, thus the conclusions should be viewed within the appropriate context and not over-generalized. Additionally, the study investigated whether auditory-affective processing, alexithymia, or interpersonal problems mediated the relationship between trauma exposure and depression. Investigation of participant demographics as potential covariates indicated that gender, age, sexual orientation, and disability all were correlated with at least one of the primary variables;

Measure	CTQ	TQ	ET	TAS	EPT	IIP	BDI
CTQ	1	0.50**	0.87**	0.31*	-0.17	0.40**	0.44**
TQ		1	0.87**	0.25	0.00	0.29*	0.40**
ET			1	0.32*	-0.10	0.40**	0.49**
TAS				1	0.06	0.56**	0.64**
EPT					1	0.11	-0.03
IIP						1	0.41**
BDI							1

Note: *significant at $p = 0.01$, ** significant at $p = 0.0010$. CTQ: Childhood Trauma Questionnaire; TQ: Trauma Questionnaire; ET: Exposure to Trauma consolidated measure; TAS: Toronto Alexithymia Scale – 20; EPT: Emotional Perception Task; IIP = Inventory of Interpersonal Problems – 64; BDI: Beck Depression Inventory – II

Table 2: Bivariate Correlation Matrix with Significant Demographic Variables not Controlled.

Path	Coeff0.	*S.E.*	*t*	*p*
IV to Mediators (A) EPT	-0.24	0.34	-0.70	0.49
TAS	20.37	0.98	20.43	0.02
IIP	70.92	20.57	30.08	0.003
Direct Effects of Mediators on DV (B)				
EPT	-0.08	0.24	-0.32	0.74
TAS	43	0.10	40.52	<0.001
IIP	-0.001	0.04	-0.20	0.84
	20.79	0.70	20.80	<0.001
Total Effect of IV on DV (C)				
ET				
Direct Effect of IV on DV (C')				
ET	10.80	0.65	20.80	0.007
Effect		***S.E.***	***Z***	***p***
Indirect Effects of IV on DV via Mediators (AB)				
TOTAL	0.98	0.49	20.01	0.04
EPT	0.02	0.06	0.31	0.76
TAS	10.02	0.47	20.17	0.03
IIP	-0.06	0.28	-0.21	0.83

Note: ET: Exposure to Trauma consolidated measure; TAS: Toronto Alexithymia Scale – 20; EPT : Emotional Perception Task; IIP: Inventory of Interpersonal Problems – 64

Table 3: Regression Statistics for All Mediators.

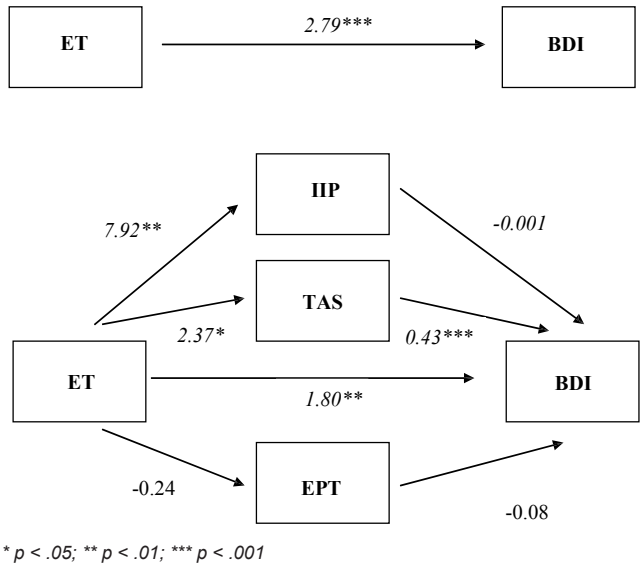

Figure 2: Actual Path Model with Coefficients.

however, none had a significant impact on inter-correlation among the variables, or on the meditational model. Measured levels of trauma exposure, alexithymia, interpersonal problems, and depression were significantly inter-correlated with each other. However, correlations between the AAP task and other variables were trivial suggesting that this was independent of the other constructs.

With regards to trauma exposure, on average, participants met criteria for mild childhood maltreatment on the Childhood Trauma Questionnaire (CTQ) [52], comparable to levels reported for other undergraduate samples [35,53]. Participants also endorsed similar types and numbers of traumatic experiences on the Trauma Questionnaire (TQ) to those reported for a similar group of undergraduate students at the University of Windsor [38]. The present study indicated that, on average, participants had elevated scores for alexithymia that did not meet a clinical severity threshold [52], met cut-offs for above-average levels of interpersonal problems [42], and for mild levels of depression [46]. Thus, participants in the present study reported sub-clinical levels of psychological disturbances typically associated with trauma exposure.

The data support a partial mediational model with self-reported alexithymia mediating the relationship between exposure to trauma and depression in this sample. This finding supported one study hypothesis. While degree of interpersonal problems was associated with trauma exposure, the data do not support it as a mediator between trauma exposure and depression. The data also do not support the hypothesis that the Emotional Perception Test (EPT) measure of auditory-affective processing was related to, or an effective measure of, alexithymia in this sample. The latter findings were inconsistent with study hypotheses.

First, the relationships among trauma exposure, alexithymia, interpersonal problems, and depression were consistent with previously reported findings [17,54-56]. However, previous research did not collect data on each of these variables from the same sample at the same time, and thus were unable to examine the intercorrelations of all primary variables. This study supported the hypothesis that an interrelationship between these variables exists. The finding that greater extent of exposure to trauma is related to increased severity of alexithymia, more severe interpersonal problems, and more severe depressive symptoms support the conclusion that there is an important relationship between these psychological constructs in those who have been exposed to trauma, even if they do not endorse clinical-levels of symptoms.

The associations among study variables (with the exception of the EPT) support current theory and research on the etiology of depression and alexithymia. Findings are consistent with research demonstrating an increase in depressive symptoms later in life following a traumatic event, and that more exposure is related to more severe depressive symptoms, regardless of age at the time of the experience [57]. The relationship between interpersonal problems and depression in the present study also is consistent with the current interpersonal-cognitive model of depression, whereby perceived rejection, isolation, and loss all are thought to contribute to depressive symptoms [6]. Finally, the relationship between trauma exposure and interpersonal difficulties found in the present study is consistent with other research reporting a link between trauma exposure and interpersonal problems, such as aggression and apathy towards others, and social withdrawal [58]. Experts theorize that this link is attributed to a variety of causes, such as psychophysiological changes in cortisol levels when exposed to stress-related stimuli, an increase in mood disorders such as depression and posttraumatic stress disorder, and development of antisocial personality-like behaviours [54,58,59].

This study explored the theory that increased exposure to trauma leads to more severe depression, and that this relationship may develop partly through alexithymia and difficulties with interpersonal relationships. Other studies support the mediating effects of alexithymia and interpersonal problems when these variables were examined individually [19,60], however none of these studies assessed the unique contribution of each of these variables controlling for other possible mediating variables.

In the present study, when considering interpersonal problems and alexithymia together, only self-reported alexithymia was a partial mediator. This finding is consistent with the research that exposure to trauma can lead to feeling emotionally overwhelmed, resulting in an impaired ability to articulate and make sense of one's own emotional experiences. If this impairment is not resolved, it can lead to decreased emotional competence. Difficulties identifying and communicating feelings can in turn contribute to depression. The impaired ability to recognize and convey one's emotions can result in a decrease in emotional intimacy with others, which deprives the individual of social support, thereby sustaining or exacerbating the depressive symptoms [2,61].

However, even when considering interpersonal problems independently, it was not found to significantly mediate the relationship between exposure to trauma and depression. This finding is inconsistent with theory and previous research [58,62,63]. Research suggests that certain types of interpersonal problems are related to the other constructs in this model, specifically, cold and socially avoidant behaviors [6,15,54]. As this study initially measured a broad range of interpersonal problems, and breaking the IIP into subscales limited power during the exploratory analyses, future research should investigate the role withdrawn and avoidant interpersonal problem behaviors play within the context of exposure to trauma and depression.

With regard to auditory-affective processing, the authors

hypothesized that participants who reported above average psychological disturbance related to trauma (i.e., alexithymia, interpersonal problems, and depression) would demonstrate some impairment on the Emotion Perception Task. Even though the measure was designed to assess clinically significant levels of neurologic, neuropsychological, and psychiatric dysfunction, the authors hypothesized that the EPT would be sensitive enough to detect some degree of impairment. On average, participants made a similar number of errors in identifying auditorially-presented emotions on the EPT as the normative sample provided by the test publisher [48]. Though contrary to expectations, this does support the EPT's ability to effectively discriminate between non-clinical and clinical populations based on auditory-affective perception.

The present endeavor is perhaps the only study to assess whether self-reported alexithymia is related to impaired ability to correctly perceive and label different affective tones of voice. From a neuropsychological perspective, symptoms associated with alexithymia are thought to be a function of some type of impaired cognitive processing of internal and/or external emotional stimuli. Impairments may be at the level of perception of and attending to affective cues, or labeling of these cues, or higher-order integration and associational processing of affective cues. The EPT was designed to assess emotional-perceptual neurological impairments. Given the conceptual overlap in these two methods of assessment, it was surprising to find that AAP, as measured by the EPT, was not significantly related to self-reported alexithymia on the TAS. Possible explanations include the EPT not being sensitive enough to detect impairment in the non-clinical sample, the low test reliability (compared to published EPT psychometrics) in this sample, TAS symptoms not being a result of cognitive impairment but rather a deficit in attending to internal processes, or the possibility that alexithymia is not associated with impaired labeling of affective stimuli, but instead a dysfunction in the generation of an appropriate neurophysiologic response to affective stimuli [64,65].

The present study has several limitations that should be noted. For instance, the authors relied on theory and prior research to suggest a temporal order for the relationship model. However, one cannot assume causality. Green [48] noted that females make fewer mistakes on the EPT than males; the present sample's gender ratio may have contributed to the null results. Research described earlier [66] suggests that different types of trauma and interpersonal problems may contribute to depression, however, the sample size limited analysis to IIP quadrants rather than individual subscales. The failure to find statistically significant hypothesized relationships may also be due to the non-clinical nature of the sample. Finally, results are inconsistent with previous research demonstrating impaired visual-affective perception in those reporting alexithymia [13], which warrants the question of whether a mode-dependent difference in affective perception exists or if the sample characteristics were responsible for null findings. In summary, future testing of the proposed and related models should consider utilizing longitudinal methodology, more sensitive affective perception measures (e.g. measure reaction times), and samples that are larger, more heterogeneous, and who endorse more severe clinical symptoms.

Conclusions and Implications

Research on auditory-affective processing in alexithymia is limited. Results of the present study indicate that one neuropsychological measure of auditory-affective perception may not be an appropriate test for symptoms of alexithymia in non-clinical samples similar to the present study. It also suggests that when given a generous exposure time and decision-making time (compared to aforementioned facial-affect recognition studies), those with alexithymia may have adequate affective perception and recognition. Their symptoms may therefore be better described as a deficit in sustained inward-attention or self-monitoring, rather than an affective-perception deficit. The partial mediation effect found for alexithymia in the present study is consistent with expectations based on theory and research. Greater exposure to trauma contributes to greater difficulties identifying and labeling emotional experience (alexithymia), which, in turn, contributes to increase depressive symptoms. Present findings also have implications for treatment of depression in individuals with a history of trauma exposure, specifically, those individuals who are similar to the present study's sample. The range of scores in this study's sample suggests that even in non-clinical and relatively well-off populations, some individuals have clinical levels of psychological distress or impairment related to trauma exposure. Results suggest that University psychological services should 1) probe for history of exposure to trauma during all assessments, 2) emphasize identification and articulation of emotional experience in those presenting with depressive symptoms and a history of exposure to trauma, and 3) use a similar therapeutic focus for those suffering from acute exposure to trauma, as this emphasis may act in a prophylactic manner, helping to ameliorate the risk of eventual depressive symptom development.

References

1. Ruesch J (1948) The infantile personality. The core problem of psychosomatic medicine. Psychosom Med 10: 134-144.
2. Taylor G, Bagby R, Parker J (1997) Disorders of affect regulation: Alexithymia in medical and psychiatric illness. Cambridge University Press, New York, NY.
3. Kooiman CG, van Rees Vellinga S, Spinhoven P, Draijer N, Trijsburg RW, et al. (2004) Childhood adversities as risk factors for alexithymia and other aspects of affect dysregulation in adulthood. Psychother Psychosom 73: 107-116.
4. Wiersma JE, Hovens JG, van Oppen P, Giltay EJ, van Schaik DJ, et al. (2009) The importance of childhood trauma and childhood life events for chronicity of depression in adults. J Clin Psychiatry 70: 983-989.
5. Bermond B, Vorst HC, Vingerhoets AJ, Gerritsen W (1999) The Amsterdam Alexithymia Scale: its psychometric values and correlations with other personality traits. Psychother Psychosom 68: 241-251.
6. Dobkin R, Panzarella C, Alloy L, Cascardi M, Truesdell K, et al. (2007) Assessing an interpersonal-cognitive risk factor for depression: Preliminary validation of the Social Feedback Questionnaire. Journal of Social and Personal Relationships 24: 765-780.
7. Paivio S, Pascual-Leone A (2010) Emotion-focused therapy for complex trauma: An integrative approach. American Psychological Association, Washington, DC.
8. Krystal H, Krystal J (1988) Integration and self-healing: Affect, trauma, alexithymia.Analytic Press, Inc., Hillsdale, NJ England.
9. Gottman J, Katz L, Hooven C (1997) Meta-emotion: How families communicate emotionally. Lawrence Erlbaum Associates, Inc., Hillsdale, NJ England.
10. Clark-Knauft A (2001) An analysis of posttrauma personality symptoms in alexithymia.Dissertation Abstracts International 62.
11. Tarasuik J, Ciorciari J, Stough C (2009) Understanding the neurobiology of emotional intelligence: A review. Assessing emotional intelligence: Theory, research, and applications: 307-320.
12. Feldman R, Rimé B (1991) Fundamentals of nonverbal behavior. Cambridge University Press. New York, NY, Paris, France.
13. Prkachin G, Casey C, Prkachin K (2009) Alexithymia and perception of facial expressions of emotion. Personality and Individual Differences 46: 412-417.
14. Cummings A (2007) The effect of affective prosody and empathy on interpersonal functioning and social support among inpatients with mood disorder. Dissertation Abstracts International 67.

15. Spitzer C, Siebel-Jurges U, Barnow S, Grabe HJ, Freyberger HJ (2005) Alexithymia and interpersonal problems. Psychother Psychosom 74: 240-246.

16. Oldehinkel AJ, Wittchen HU, Schuster P (1999) Prevalence, 20-month incidence and outcome of unipolar depressive disorders in a community sample of adolescents. Psychol Med 29: 655-668.

17. Honkalampi K, Hintikka J, Tanskanen A, Lehtonen J, Viinamäki H (2000) Depression is strongly associated with alexithymia in the general population. J Psychosom Res 48: 99-104.

18. Honkalampi K, Hintikka J, Antikainen R, Lehtonen J, Viinamäki H (2001) Alexithymia in patients with major depressive disorder and comorbid cluster C personality disorders: a 6-month follow-up study. J Pers Disord 15: 245-254.

19. Mazzeo S, Espelage D (2002) Association between childhood physical and emotional abuse and disordered eating behaviors in female undergraduates: An investigation of the mediating role of alexithymia and depression. Journal of Counseling Psychology 49: 86-100.

20. Foa E, Keane T, Friedman M, Cohen J (2009) Effective treatments for PTSD: Practice guidelines from the International Society for Traumatic Stress Studies. (2ndedn), Guilford Press, New York, NY.

21. Nemiah JC (1977) Alexithymia. Theoretical considerations. Psychother Psychosom 28: 199-206.

22. Sifneos PE (1973) The prevalence of 'alexithymic' characteristics in psychosomatic patients. Psychother Psychosom 22: 255-262.

23. Taylor GJ, Bagby RM (1988) Measurement of alexithymia. Recommendations for clinical practice and future research. Psychiatr Clin North Am 11: 351-366.

24. Taylor G, Bagby R, Luminet O (2000) Assessment of alexithymia: Self-report and observer- rated measures. In: The handbook of emotional intelligence: Theory, development, assessment, and application at home, school, and in the workplace (pp. 301-319). Jossey- Bass, San Francisco, CA.

25. Kleiger JH, Kinsman RA (1980) The development of an MMPI alexithymia scale. Psychother Psychosom 34: 17-24.

26. Lane RD, Quinlan DM, Schwartz GE, Walker PA, Zeitlin SB (1990) The Levels of Emotional Awareness Scale: a cognitive-developmental measure of emotion. J Pers Assess 55: 124-134.

27. Lane RD, Sechrest L, Reidel R, Weldon V, Kaszniak A, et al. (1996) Impaired verbal and nonverbal emotion recognition in alexithymia. Psychosom Med 58: 203-210.

28. Bagby RM, Taylor GJ, Parker JD (1994) The Twenty-item Toronto Alexithymia Scale--II. Convergent, discriminant, and concurrent validity. J Psychosom Res 38: 33-40.

29. Kooiman CG, Spinhoven P, Trijsburg RW (2002) The assessment of alexithymia: a critical review of the literature and a psychometric study of the Toronto Alexithymia Scale-20. J Psychosom Res 53: 1083-1090.

30. Parker PD, Prkachin KM, Prkachin GC (2005) Processing of facial expressions of negative emotion in alexithymia: the influence of temporal constraint. J Pers 73: 1087-1107.

31. Parker JD, Taylor GJ, Bagby RM (1993) Alexithymia and the recognition of facial expressions of emotion. Psychother Psychosom 59: 197-202.

32. Xiong-Zhao Z, Bin C, Shu-Qiao Y, Xiao-Yan W (2006) The auditory P300 about undergraduate students with different grade alexithymia: An experimental study. Chinese Journal of Clinical Psychology 14: 283-285.

33. Kilpatrick DG, Ruggiero KJ, Acierno R, Saunders BE, Resnick HS, et al. (2003) Violence and risk of PTSD, major depression, substance abuse/dependence, and comorbidity: results from the National Survey of Adolescents. J Consult Clin Psychol 71: 692-700.

34. Taylor GJ, Bagby RM (2004) New trends in alexithymia research. Psychother Psychosom 73: 68-77.

35. Bernstein D, Fink L (1998) Childhood Trauma Questionnaire manual. Psychological Corporation, San Antonio, TX.

36. Briere J (1992) Child abuse trauma: Theory and treatment of the lasting effects. Sage, Newbury Park, CA.

37. Fink L (1995) Development, reliability, and validity of the Childhood Trauma Interview.Doctoral Dissertation, New York University, New York.

38. Wild N, Paivio S (2001) Psychological adjustment, coping, and emotion regulation as predictors of posttraumatic growth. Master's Thesis, University of Windsor, Windsor.

39. Norris F (1990) Screening for traumatic stress: A scale for use in the general population.Journal of Applied Social Psychology 20: 1704-1718.

40. Dohrenwend BS, Krasnoff L, Askenasy AR, Dohrenwend BP (1978) Exemplification of a method for scaling life events: the Peri Life Events Scale. J Health Soc Behav 19: 205-229.

41. Briere J, Scott C (2006) Principles of trauma therapy: A guide to symptoms, evaluation, and treatment. Sage Publications, Inc., Thousand Oaks, CA.

42. Horowitz LM, Alden LE, Wiggins JS, Pincus AL (2000) Inventory of Interpersonal Problems manual. The Psychological Corporation, London.

43. Alden LE, Wiggins JS, Pincus AL (1990) Construction of circumplex scales for the Inventory of Interpersonal Problems. J Pers Assess 55: 521-536.

44. Derogatis LR (1993) BSI Brief Symptom Inventory: Administration, scoring, and procedures manual. (4thedn) National Computer Systems, Minneapolis, MN.

45. Eisen SV, Dill DL, Grob MC (1994) Reliability and validity of a brief patient-report instrument for psychiatric outcome evaluation. Hosp Community Psychiatry 45: 242-247.

46. Beck AT, Steer RA, Brown GK (1996) Manual for the Beck Depression Inventory-II. Psychological Corporation, San Antonio, TX.

47. Beck AT, Steer RA, Ball R, Ranieri W (1996) Comparison of Beck Depression Inventories -IA and -II in psychiatric outpatients. J Pers Assess 67: 588-597.

48. Green P (1986) The Emotional Perception Test. Unpublished manuscript.

49. Lenth RV (2006-9) Java Applets for power and sample size [computer software]. Retrieved May 25, 2010

50. American Psychiatric Association (2000) Diagnostic and statistical manual of mental disorders (4thedn), text revision). Author, Washington, DC.

51. Preacher KJ, Hayes AF (2008) Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behav Res Methods 40: 879-891.

52. Loas G, Otmani O, Fremaux D, Lecercle C, Duflot M, et al. (1996) External validity, reliability and basic score determination of the Toronto Alexithymia Scales (TAS and TAS-20) in a group of alcoholic patients. Encephale 22: 35-40.

53. Paivio SC, Cramer KM (2004) Factor structure and reliability of the Childhood Trauma Questionnaire in a Canadian undergraduate student sample. Child Abuse Negl 28: 889-904.

54. Blumenthal DR, Neemann J, Murphy CM (1998) Lifetime exposure to interparental physical and verbal aggression and symptom expression in college students. Violence Vict 13: 175-196.

55. Riso LP, Miyatake RK, Thase ME (2002) The search for determinants of chronic depression: a review of six factors. J Affect Disord 70: 103-115.

56. Streich J (2008) Trauma in the non-clinical population: 5 Years later exploring the effects of exposure to the 9/11 attacks on NYC corporate employees. Dissertation Abstracts International 68.

57. Gillespie CF, Bradley B, Mercer K, Smith AK, Conneely K, et al. (2009) Trauma exposure and stress-related disorders in inner city primary care patients. Gen Hosp Psychiatry 31: 505-514.

58. Scarpa A (2003) Community violence exposure in young adults. Trauma Violence Abuse 4: 210-227.

59. Schäfer I, Ross C, Read J (2009) Childhood trauma in psychotic and dissociative disorders. In: Psychosis, trauma and dissociation: Emerging perspectives on severe psychopathology (pp. 137-150). Wiley, New York, NY.

60. Lumley MA, Ovies T, Stettner L, Wehmer F, Lakey B (1996) Alexithymia, social support and health problems. J Psychosom Res 41: 519-530.

61. Honkalampi K, Hintikka J, Laukkanen E, Lehtonen J, Viinamäki H (2001) Alexithymia and depression: a prospective study of patients with major depressive disorder. Psychosomatics 42: 229-234.

62. Barrett MS, Barber JP (2007) Interpersonal profiles in major depressive disorder. J Clin Psychol 63: 247-266.

63. Zemore R, Dell L (1983) Interpersonal problem-solving skills and depression-proneness.Personality and Social Psychology Bulletin 9: 231-235.

64. Gilbert A (2009) The physiological response to implicit and explicit fear faces in alexithymia. Dissertation Abstracts International 69.

65. de Timary P, Roy E, Luminet O, Fillée C, Mikolajczak M (2008) Relationship between alexithymia, alexithymia factors and salivary cortisol in men exposed to a social stress test. Psychoneuroendocrinology 33: 1160-1164.

66. Whiffen V, Thompson J, Aube J (2010) Mediators of the link between childhood sexual abuse and adult depressive symptoms. Journal of Interpersonal Violence 15: 1100-1120.