Published by:

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The National Center for Post-Traumatic Stress Disorder

PTSD Research Quarterly

VOLUME 8, NUMBER 4 ISSN 1050-1835 FALL 1997

A BRIEF INTRODUCTION TO STRUCTURAL EQUATION MODELING

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Overview of the Methodology. Structural equation modeling (SEM) is a collection of statistical procedures that elucidate the bases or foundations underlying relationships among observed variables. The methodology—as we know it today—derives primarily from the work of psychometrician Karl Jöreskog and his associates. In the late 1960s and early 1970s, Jöreskog developed a representation for analyzing the structures governing matrices of covariances among observed variables, the "analysis of covariance structures" (Jöreskog, 1970), commonly referred to as the "LISREL [Linear Structural Relations] Model." This representation has two components: a measurement component and a structural component. The measurement component reflects relationships between latent variables, constructs, or factors and their manifest indicators or observed variables. It has been dubbed "confirmatory factor analysis" since it allows for an evaluation of a hypothesized factor solution. The structural component reflects relationships among the latent variables, constructs, or factors themselves.

Typically, the structure postulated to underlie observed relationships in a SEM analysis is portrayed as a path diagram such as that in Figure 1. This is a fairly simple model illustrating possible mechanisms whereby characteristics of a traumatic experience (degree of exposure and perceived threat) lead to PTSD symptomatology, both directly and indirectly via the mediators of negative affectivity and social support. There are five latent variables of interest (the circles): degree of exposure, perceived threat, negative affectivity, social support, and PTSD. Each has its set of manifest indicators (the boxes), scores computed from responses to test items or interview questions. For example, the manifest indicators for PTSD might be scores on Criterion B (reexperiencing), C1 (effortful avoidance), C2 (emotional numbing), and D (hyperarousal) summed over item subsets from Weathers, Litz, Herman, Huska, and Keane's (1993) PTSD Checklist. The single-headed large arrows illustrate directional relationships between the five latent variables and their manifest indicators (measurement component) and among the five latent variables (structural component), and the double-headed curved arrow symbolizes a covariance or nondirectional relationship. The model also recognizes error, both error in the prediction of manifest indicators in the measurement component (e_1 to e_{14}) and error in the prediction of the latent variables in the structural component (E_1 to E_3).

A SEM analysis involves the solving of a series of simultaneous regression equations. For the measurement component, the usual strategy is for a manifest indicator to be regressed on its latent variable and error. To offer just one example from Figure 1 (page 3),

$$\text{ESS} = B_1(\text{Social Support}) + e_9,$$

where ESS is the score on a measure of emotional social support, e_9 is the error term, and B_1 is an unstandardized regression weight. B_1 is thus a factor loading as reported in a confirmatory factor analysis, indicating the strength of the relationship between the latent variable of social support and one of its three manifest indicators. Analogous equations are developed for other paths between each latent variable and its manifest indicators. One exception in this sample model is the link from the Stressor Exposure Index (SEI) to its latent variable, degree of exposure. The direction of influence indicates that the SEI is a causal indicator, which may be appropriate in the modeling of stressful life events (see Cohen, Cohen, Teresi, Marchi, & Velez, 1990, for a discussion of causal indicators).

Similarly, for the structural component, a latent variable outcome is regressed on one or more other latent variable predictors and error. Again, from Figure 1,

$$\text{Social Support} = B_2(\text{Degree of Exposure}) + B_3(\text{Perceived Threat}) + B_4(\text{Negative Affectivity}) + E_2.$$

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B_2 through B_4 are unstandardized regression weights, denoting the unique contributions of degree of exposure, perceived threat, and negative affectivity, respectively, to the prediction of social support. E_2 is error in prediction. In like manner, we could express an equation for the prediction of negative affectivity from degree of exposure, perceived threat, and error, and another for the prediction of PTSD from degree of exposure, perceived threat, social support, and error. Since there is no direct path from negative affectivity to PTSD, the equation for PTSD would not contain this predictor. In summary, using the available data to solve the system of regression equations for both measurement and structural components yields estimates of the strength of relationships and other information on the quality of the hypothesized model.

Advantages and Cautions. One feature of SEM is that error is a part of the measurement component, estimated separately. Consequently, the latent variables are considered devoid of measurement error and, in effect, perfectly reliable. On the other hand, in multiple regression analysis using observed scores, variables cannot be assumed to be perfectly reliable, regression coefficients are biased, and the direction of the bias is not easily determined or corrected (Kenny, 1979). In a SEM analysis employing both measurement and structural components with presumably perfectly reliable latent variables, regression weights are unbiased estimates of their parameters, a necessity for accurate statistical inference. Also, SEM is a full information estimation procedure in that it employs all of the information in the complete data set to derive parameter estimates. Based on statistical theory and the hypothesized model, estimates are computed to most closely reproduce the observed covariance matrix among all variables. Parameter estimates so derived are efficient: Their standard errors are minimized and their estimates are as close to the true values as possible. Moreover, as Hoyle (1994) noted, SEM is well suited to examine complex networks of relationships, and strategies are available to evaluate overall fit of models and select the best among competing models.

There are certainly cautions to observe when evaluating a study employing SEM or undertaking a SEM analysis. First, the methodology is powerful in the ways in which it can capitalize on the unique characteristics of a data set. Thus, as Jöreskog (1993) warned, relationships proposed in a model must be based on substance and theory. This caveat is even more relevant when researchers contemplate model modifications, especially when adding paths to improve model-data fit. Wherever possible, cross-validation or double cross-validation is recommended. Additionally, the statistical theory upon which SEM is based generally requires continuous outcome variables and the analysis of covariance matrices (not simply Pearson correlations). There are special techniques to handle both dichotomous outcomes and the analysis of standard correlational data, but they may not be readily accessible using the more popular SEM software.

Finally, it should be emphasized that the mere application of SEM does not guarantee correct causal inference. There are three requirements for causal inference: covariation, temporal contiguity, and a low likelihood of spurious relationship attributable to a third variable. SEM is one approach to supplying evidence for covariation, but the latter two requirements are clearly dependent upon the design of a study, not the statistical method employed.

SEM in Trauma Research. The articles abstracted below are of two types: those that describe the test of a measurement model alone (confirmatory factor analyses), and those that incorporate a structural component explaining mechanisms by which traumatic events influence PTSD or other forms of distress. We selected only studies with full information estimation (described above). Consequently, many well-executed path analyses employing multiple regression with observed variables are not included.

Inquiries into the structure of measures of PTSD have dominated confirmatory factor analyses in trauma research. The earliest were directed at Keane, Caddell, and Taylor's (1988) Mississippi Scale, first addressing the military version of this instrument (King & King, 1994), and then the civilian version (Vreven, Gudanowski, King, & King, 1995). Both studies benefited from the availability of large community-based samples of participants in the National Vietnam Veterans Readjustment Study (NVVRS; Kulka et al., 1990). More recently, confirmatory factor analyses have been conducted on instruments that mirror the DSM-IV PTSD symptoms. As examples, Sack, Seeley, and Clarke (1997) used data from Khmer refugees to examine the structure of PTSD as assessed by the Diagnostic Interview for Children and Adolescents (Welner, Reich, Herjanic, Jung, & Amado, 1987), and King, Leskin, King, and Weathers (1997) tested competing models to explain the structure of the Clinician-Administered PTSD Scale (Blake et al., 1990; Weathers & Litz, 1994) for a sample of treatment-seeking veterans. These two studies yielded a four-factor solution generally consistent with DSM-IV. All four confirmatory factor analyses, however, endorsed a splitting of the Criterion C symptom category into separate effortful avoidance and emotional numbing factors. Finally, Engdahl, Eberly, and Blake's (1996) study of PTSD in elderly veterans demonstrated the use of confirmatory factor analysis at the instrument level, wherein total scores on the Mississippi Scale, MMPI-PK Scale (Keane, Malloy, & Fairbank, 1984), and Impact of Event Scale (Horowitz, Wilner, & Alvarez, 1979) converged on a common PTSD latent variable.

Many SEM analyses have been conducted on the NVVRS data to chronicle the complexity of variables that may influence PTSD symptom severity. One research team, Fontana and Rosenheck, have tested comprehensive models incorporating prewar, military and war-zone, and postwar variables for both the NVVRS male Vietnam veterans (Fontana & Rosenheck, 1994) and the NVVRS female veterans (Fontana, Schwartz, & Rosenheck, 1997). We and our colleagues also have used this rich resource in a series of studies to examine prewar risk factors (King, King, Foy, & Gudanowski, 1996) and postwar resilience-recovery variables (King, King, Fairbank, Keane, & Adams, in press), in

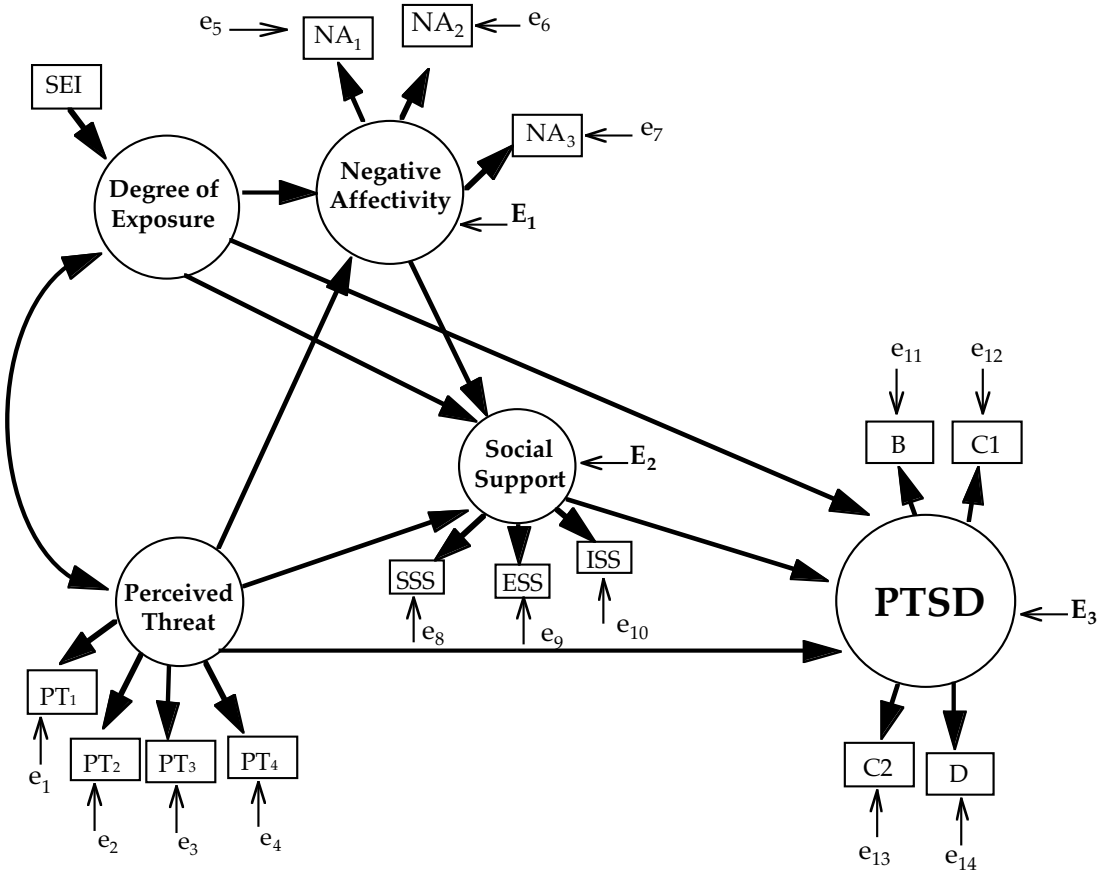

Figure 1. Illustration of a Model Predicting PTSD.

SEI = Stressor Exposure Index; PT_1 - PT_4 = Four "miniscales" measuring perceived threat or subjective fear; NA_1 - NA_3 = Three "miniscales" measuring negative affectivity; SSS = Structural social support; ESS = Emotional social support; ISS = Instrumental social support; B = Criterion B symptoms (reexperiencing); C1 = Criterion C1 symptoms (effortful avoidance); C2 = Criterion C2 symptoms (emotional numbing); D = Criterion D symptoms (hyperarousal).

conjunction with multiple war-zone stressor dimensions, to account for PTSD severity in men and women.

The King et al. (1996, in press) studies also demonstrated the use of multisample SEM to evaluate interaction effects using a median split approach. For example, an interaction was found between early (prewar) trauma history and combat exposure such that the relationship between early trauma history and PTSD was stronger for male veterans exposed to higher levels of combat than for their peers exposed to lower levels of combat. A more elegant treatment of interactions is provided in Norris and Kaniasty's (1992) study of crime prevention strategies. They computed a product of latent variables to represent an interaction—akin to techniques used in moderated multiple regression—and found that fear of crime's effect on psychological distress was buffered by certain crime prevention strategies.

There are numerous examples where SEM was used to assess mediation effects. We offer three here. First, Norris and Kaniasty (1996) demonstrated a direct effect of disaster exposure on distress but also supported differential indirect or mediation effects for two types of social support, received and perceived. In a study by Runtz and Schallow (1997), social support and coping mediated the relationship between retrospective reports of childhood abuse and current adjustment. Similarly, Hershberger and D'Augelli (1995) found that victimization was related to mental health directly, but also indirectly via social support and self-acceptance.

SEM Resources. We have referenced some SEM texts and edited volumes that should provide a good understanding of the methodology, as well as several SEM software packages. Lawrence Erlbaum Associates publishes *Structural Equation Modeling: A Multidisciplinary Journal,* which features new developments in SEM, applications of the methodology, and commentaries on software innovations. Finally, one may wish to access Internet resources. A good starting point is the SEMNET web page and its associated electronic mail network: `<www.gsu.edu/~mkteer/semfaq.html>`.

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SEM RESOURCES

Books

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Loehlin, J.C. (1992). *Latent variable models: An introduction to factor, path, and structural analysis.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Marcoulides, G.A. & Schumacker, R.E. (Eds.) (1996). *Advanced structural equation modeling.* Mahwah, NJ: Lawrence Erlbaum Associates.

Schumacker, R.E. & Lomax, R.G. (1996). *A beginner's guide to structural equation modeling.* Mahwah, NJ: Lawrence Erlbaum Associates.

Software

AMOS (Author: James Arbuckle). Smallwaters Corporation, Phone 773-667-8635.

CALIS (Author: Wolfgang Hartmann). SAS Institute, Inc., Phone 919-677-8000.

EQS (Author: Peter Bentler). Multivariate Software, Inc., Phone 800-301-4456.

LISCOMP (Author: Bengt Muthen). Scientific Software International, Inc., Phone 312-684-4920.

LISREL8/PRELIS2/SIMPLIS (Authors: Karl Joreskog & Dag Sorbom). Scientific Software International, Inc., Phone 312-684-4920.

RAMONA (Author: Michael Browne). SYSTAT, SPSS Inc., Phone 312-329-7839.

SEPATH (Author: James Steiger). Statsoft, Inc., Phone 918-749-1119.

SELECTED ABSTRACTS

Engdahl, B.E., Eberly, R.E., & Blake, J.D. (1996). **Assessment of posttraumatic stress disorder in World War II veterans.** *Psychological Assessment, 8,* 445-449. Four PTSD scales were compared in a community sample of 330 American former prisoners of war and combat veterans of World War II. The Mississippi Scale for Combat-Related PTSD (M-PTSD), the MMPI-2 Pk PTSD scale, and the Impact of Event Scale (IES) all demonstrated moderate relationships with PTSD as defined by the Structured Clinical Interview for DSM-III-R. Comparative validities were similar to those observed in Vietnam veteran samples. Confirmatory factor analysis indicated that the 3 scales loaded significantly on 1 factor. The impact of DSM-IV PTSD criteria changes was examined and found to be minimal. Implications for the use of the M-PTSD, Pk, and IES in combat-related PTSD assessment are discussed.

Fontana, A. & Rosenheck, R.A. (1994). **Posttraumatic stress disorder among Vietnam theater veterans: A causal model of etiology in a community sample.** *Journal of Nervous and Mental Disease, 182,* 677-684. Data from the National Vietnam Veterans Readjustment Study, conducted from 1986 to 1988, were used to develop and cross-validate a model of the etiology of PTSD among a community sample of 1198 male Vietnam theater veterans. The initial model specified causal paths among five sets of variables, ordered according to their historical occurrence: a) premilitary risk factors and traumas, b) war-related and non-war-related traumas during the military, c) homecoming reception, d) postmilitary traumas, and e) PTSD. The initial model was refined and then cross-validated, leading to the specification of a final model with highly satisfactory fit and parsimony. In terms of the magnitude of their contribution to the development of PTSD, lack of support from family and friends at the time of the homecoming and exposure to combat were the two most influential contributors. Other contributing factors, in order of importance, were Hispanic ethnicity, societal rejection at the time of homecoming, childhood abuse, participation in abusive violence, and family instability. Exposure to war-related and non-war-related traumas occurred largely independently of each other, with war-related traumas contributing substantially more than non-war-related traumas to the development of PTSD. Limitations to interpretation of the results are noted due to the retrospective nature of the data and the inevitable omission of other etiological factors.

Fontana, A., Schwartz, L.S., & Rosenheck, R.A. (1997). **Posttraumatic stress disorder among female Vietnam veterans: A causal model of etiology.** *American Journal of Public Health, 87,* 169-175. OBJECTIVES: The Vietnam and Persian Gulf wars have awakened people to the realization that military service can be traumatizing for women as well as men. This study investigated the etiological roles of both war and sexual trauma in the development of chronic PTSD among female Vietnam veterans. METHODS: Data from the National Vietnam Veterans Readjustment Study for 396 Vietnam theater women and 250 Vietnam era women were analyzed with structural equation modeling. RESULTS: An etiological model with highly satisfactory fit and parsimony was developed. Exposure to war trauma contributed to the probability of PTSD in theater women, as did sexual trauma in both theater and era women. Lack of social support at the time of homecoming acted as a powerful mediator of trauma for both groups of women. CONCLUSIONS: Within the constraints and assumptions of causal modeling, there is evidence that both war trauma and sexual trauma are powerful contributors to the development of PTSD among female Vietnam veterans.

Hershberger, S.L. & D'Augelli, A.R. (1995). **The impact of victimization on the mental health and suicidality of lesbian, gay, and bisexual youths.** *Developmental Psychology, 31,* 65-74. Lesbian, gay, and bisexual youths 15 to 21 years old were studied to determine the impact of verbal abuse, threat of attacks, and assault on their mental health, including suicide. Family support and self-acceptance were hypothesized to act as mediators of the victimization and mental health-suicide relation. Structural equation modeling revealed that in addition to a direct effect of victimization on mental health, family support and self-acceptance in concert mediated the victimization and mental health relation. Victimization was not directly related to suicide. Victimization interacted with family support to influence mental health, but only for low levels of victimization.

King, D.W., King, L.A., Foy, D.W., & Gudanowski, D.M. (1996). **Prewar factors in combat-related posttraumatic stress disorder: Structural equation modeling with a national sample of female and male Vietnam veterans.** *Journal of Consulting and Clinical Psychology 64,* 520-531. Structural equation modeling was used to examine relationships among prewar factors, dimensions of war-zone stress, and current PTSD symptomatology using data from 1,632 female and male participants in the National Vietnam Veterans Readjustment Study. For men, previous trauma history (accidents, assaults, and natural disasters) directly predicted PTSD and also interacted with war-zone stressor level to exacerbate PTSD symptoms for high combat-exposed veterans. Male veterans who entered the war at a younger age displayed more symptoms. Family instability, childhood antisocial behavior, and age had indirect effects on PTSD for men. For women, indirect prewar effects emanated from family instability. More attention should be given to critical developmental conditions, especially family instability and earlier trauma exposure, in conceptualizing PTSD in adults.

King, D.W., Leskin, G.A., King, L.A., & Weathers, F.W. (1997). *Confirmatory factor analysis of the Clinican-Administered PTSD Scale.* Paper presented at the American Psychological Society Convention, Washington, DC. The Clinician-Administered PTSD Scale (CAPS) is a structured interview that assesses the 17 key symptoms of PTSD as established in DSM-IV. CAPS data from 524 treatment-seeking male military veterans were submitted to confirmatory factor analysis to test a series of nested models reflecting alternative representations of PTSD dimensionality: (a) a four-factor, first-order solution; (b) a two-factor, higher-order solution; (c) a single-factor, higher-order solution; and (d) a single-factor, first-order solution. The model of best fit was the four-factor, first-order solution, containing moderately to highly correlated yet distinct first-order factors corresponding to the reexperiencing, effortful avoidance, emotional numbing, and hyperarousal aspects of PTSD. Implications for theory, assessment, and future research are presented.

King, L.A. & King, D.W. (1994). **Latent structure of the Mississippi Scale for Combat-Related Post-Traumatic Stress Disorder: Exploratory and higher-order confirmatory factor analyses.** *Assessment, 1,* 275-291. A series of factor analyses evaluated the dimensionality of the Mississippi Scale for Combat-Related Post-Traumatic Stress Disorder. Over 2,200 Vietnam theater and

era veterans were divided into 3 random subsamples, each of which was used in a separate stage of analysis. Initial exploratory factor analyses suggested an underlying single-factor solution. In the second subsample, a second-order solution comprised of a general factor subsuming several first-order factors was supported using chi-square difference testing. This model was successfully replicated with the third subsample. Cumulative evidence suggests that the latent structure of the Mississippi Scale is best represented as an umbrella PTSD factor leading to 4 subsidiary facets or dimensions.

King, L.A., King, D.W., Fairbank, J.A., Keane, T.M., & Adams, G.A. (in press). **Resilience-recovery factors in posttraumatic stress disorder among female and male Vietnam veterans: Hardiness, postwar social support, and additional stressful life events.** *Journal of Personality and Social Psychology.* Structural equation modeling procedures were used to examine relationships among several war zone stressor dimensions, resilience-recovery factors, and PTSD symptoms in a national sample of 1,632 Vietnam veterans (26 % women and 74 % men). A 9-factor measurement model was specified on a mixed-gender subsample of the data and then replicated on separate subsamples of female and male veterans. For both genders, the structural models supported strong mediation effects for the intrapersonal resource characteristic of hardiness, postwar structural and functional social support, and additional negative life events in the postwar period. Support for moderator effects or buffering in terms of interactions between war zone stressor level and resilience-recovery factors was minimal.

Norris, F.H. & Kaniasty, K.Z. (1992). **A longitudinal study of the effects of various crime prevention strategies on criminal victimization, fear of crime, and psychological distress.** *American Journal of Community Psychology, 20,* 625-648. Examined the effects of precautionary behavior on subsequent criminal victimization, fear of crime, and psychological distress. A sample of 538 adults was interviewed three times at 6-month intervals. Four different aspects of precaution were assessed: vigilance (alertness), locks (access control), neighbors (informal cooperation), and professionals (formal programs). In logistic regressions that controlled for 14 risk factors, precaution had no preventive effects on the occurrence of subsequent crimes. LISREL models revealed that use of neighbors was the only precaution not to increase fear of crime, although both locks and neighbors showed a capacity to buffer the effects of fear on generalized distress. It was concluded that the most promising strategy was protective neighboring. Altogether, however, the promotion of citizen-initiated prevention appears highly inadequate as a policy response to problems of crime and fear.

Norris, F.H. & Kaniasty, K.Z. (1996). **Received and perceived social support in times of stress: A test of the social support deterioration deterrence model.** *Journal of Personality and Social Psychology, 71,* 498-511. The authors evaluated the impact of receiving social support on subsequent levels of perceived social support and psychological distress in 2 independent samples of victims of severe natural disasters: Hurricane Hugo (n = 498) and Hurricane Andrew (n = 404). A social support deterioration deterrence model was proposed that stipulated that postdisaster mobilization of received support counteracts the deterioration in expectations of support often experienced by victims of major life events. LISREL analyses of data collected 12 and 24 months after Hugo and 6 and 28 months after Andrew provided strong evidence for the hypothesized model: Perceived support mediated the long-term effects on distress of both scope of disaster exposure and postdisaster received support. Theoretical and application issues of social support are discussed.

Runtz, M.G. & Schallow, J.R. (1997). **Social support and coping strategies as mediators of adult adjustment following childhood maltreatment.** *Child Abuse and Neglect, 21,* 211-226. Structural equation modelling (SEM) was used to examine whether coping efforts and social support mediate the long-term sequelae of child maltreatment. The hypothesized SEM fit the data well and indicated that the association between previous childhood sexual and physical maltreatment and current psychological adjustment appeared to be strongly mediated by social support and coping strategies. In this sample of 302 female and male university students, most of whom reported at least one episode of childhood maltreatment, perceived social support and ways of coping with earlier maltreatment appeared essential to an understanding of the relationship between childhood maltreatment and later adjustment.

Sack, W.H., Seeley, J.R., & Clarke, G.N. (1997). **Does PTSD transcend cultural barriers?: A study from the Khmer adolescent refugee project.** *Journal of the American Academy of Child and Adolescent Psychiatry, 36,* 49-54. OBJECTIVE: To determine whether the factor structure of the PTSD syndrome in Cambodian refugee youth resembles earlier reported factor studies in Caucasian samples. METHOD: 194 Khmer adolescent refugees who reported prior significant trauma (most of it massive war trauma as children) were administered the PTSD module of the Diagnostic Interview for Children and Adolescents, as part of an epidemiological study on the effects of war on this group of refugees. RESULTS: The following 4 factors were found: arousal, avoidance, intrusion, and numbing. A confirmatory factor analysis using data from the parents of this sample yielded a good fit for the 4-factor solution based on the youth data. CONCLUSIONS: The 4-factor solution from this sample resembled earlier studies on traumatized Caucasian and African-American adults. These results lend further credibility to the veracity of this diagnosis with refugee samples. PTSD as a result of prior war trauma appears to surmount the barriers of culture and language in this sample.

Vreven, D.L., Gudanowski, D.M., King, L.A., & King, D.W. (1995). **The civilian version of the Mississippi PTSD Scale: A psychometric evaluation.** *Journal of Traumatic Stress, 8,* 91-109. This three-part study examined the reliability and validity of the civilian version of the Mississippi Scale for Combat-Related PTSD using data from the nonveteran participants in the National Vietnam Veterans Readjustment Study. The Civilian Mississippi Scale had a raw score distribution that was roughly symmetric, with an acceptable degree of dispersion and a reasonably high internal consistency reliability coefficient. Overall, however, measurement precision was weaker than that for the military version of the instrument, and confirmatory factor analytic findings differed from those found for the military version. Preliminary investigations of validity were in the form of correlations with indices of stressful life events, a PTSD symptom count, and measures of demoralization and active expression of hostility. The Civilian Mississippi Scale emerged from the various analyses as a PTSD measure with potential but requiring further validational study and perhaps some refinement.

IDRAC, A LEBANESE NONGOVERNMENTAL ORGANIZATION SPECIALIZING IN MENTAL HEALTH

Elie G. Karam, PhD

The Institute for Development Research and Applied Care (IDRAC) was officially founded by experts in the field of mental health in 1995. They had been conducting research and delivering psychiatric and psychological services at the department of psychiatry and psychology at St. George Hospital in Beirut since 1980. IDRAC has a basic mission to promote research in mental health, disseminate education to the Lebanese public at large, and deliver free clinical treatment to at-risk groups of the Lebanese population.

The founding members of IDRAC were faced in 1980 with a grim reality. There were no data on mental health disorders in Lebanon. In addition, there were no available instruments to assess prevalence of these disorders, and, most of all, the Lebanon Wars had been ravaging the country for five years. The big questions were: How are we being affected? What is the future holding for us? What shall we do about it?

Part of IDRAC's focus has been the development of suitable assessment instruments for research in Lebanon. The War Events Questionnaire was developed to allow the assessment of individual exposure to war events. One of the first instruments to be translated was the Diagnostic Interview Schedule (DIS). Translation of the Composite International Diagnostic Interview (CIDI) came next and aimed at building diagnoses in the two most widely used classification systems: the US DSM and the WHO ICD systems. IDRAC is an official WHO training center for the Arabic CIDI. The Diagnostic Interview for Children and Adolescents was needed when assessment of prevalence of disorders in children and adolescents became imperative in Lebanon. All three versions (child, adolescent, parent) have been used now in research conducted by IDRAC. Several other shorter instruments also have been adapted, e.g., Yale-Brown Obsessive-Compulsive Scale, Hamilton Rating Scale for Depression, and Beck Depression Inventory.

Among IDRAC's projects is a prospective study, conducted in three phases, on four Lebanese communities differentially exposed to war. These were followed prospectively for 6 years and interviewed three times from 1989 to 1994 (4 years after the end of the Lebanon wars). This work was partly supported by NIMH. One study examined the birth cohort effect on the prevalence of depression. This international study included sites in North America, Puerto Rico, Western Europe, the Middle East, Asia, and the Pacific Rim, and was supported partly by NIMH and a Fulbright scholarship to one of us. Another study assessed the phenomenology of depression following bereavement and addressed key definitional issues in the DSM classification. IDRAC staff have also conducted extensive and comprehensive assessment of the prevalence of substance use and dependence in the university population and in the community at large. This work was supported in part by the Middle East Council of Churches and the Lebanese National Council for Scientific Research (LNCSR). In addition, the comorbidity of psychiatric and substance use disorders was studied in a large (N=1643) sample of psychiatric admissions to the St. George Neurosciences Unit. And lastly, the prevalence of acute mental health responses in children and adolescents was extensively studied beginning in April 1996 after the "Grapes of Wrath" Israeli operation in South Lebanon and the West Bekaa. This was followed by a prospective study of the same population in May 1997, and was supported in part by UNICEF, the Lebanese High Relief Committee, and the LNCSR.

IDRAC also provides free regular outpatient clinics for various mental health disorders. In addition to the regular clinical work delivered since 1980, large-scale treatment programs have been developed, including regular therapeutic intervention during the Lebanon Wars. Classroom-based first-line treatment of children and adolescents was initiated by our group in several schools exposed to war (supported by UNICEF and the Lebanese Ministry of Interior). The prospective evaluation of the efficacy of this treatment is underway. We also are conducting specific long-term treatment and follow-up of all children and adolescents who lost one or both parents since April 1996 (supported by the Hariri Foundation).

IDRAC can be reached by fax at 961-1-582560 and by e-mail at egkaram@dm.net.lb. A home page <www.IDRAC.org.lb> will be operative starting January 1998.

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PILOTS UPDATE

What do you do when the PILOTS Thesaurus contains no terms relevant to your subject?

This happened when we were asked to search the PILOTS database for papers relevant to the subject of the lead article in this issue of the *PTSD Research Quarterly*. The term "structural equation modeling" occurs nowhere in the PILOTS Thesaurus, not even as an "entry term" referring the user to an appropriate descriptor. We were given some additional terms subsumed under SEM—"confirmatory factor analysis," "path analysis," "causal modeling," and "covariance structure analysis," as well as the names of several computer programs—but none of these appeared in the Thesaurus either. So how were we to find the publications our reviewers required?

We began by deciding which descriptor best matched the terms we had been given. The closest fit seemed to be "methodology" or "experimental design." These terms yielded over 200 citations, with no assurance that more than a handful of these would be relevant to structural equation modeling.

If using the controlled vocabulary of the PILOTS Thesaurus did not work, it was time to try natural language searching. In this case, our reviewers had suggested several terms that unambiguously described what they were looking for. Those papers in which SEM played a role sufficiently important that our reviewers would want to discuss them were likely to reveal their methodology in title or abstract. And there seemed little chance that any of the phrases we might use in a natural language search would have additional meanings irrelevant to our purpose.

So we used the "topic" index (which looks in the title, abstract, and descriptor fields) to search for the terms that our reviewers had suggested. By using adjacency searching, we avoided retrieving papers in which the two words of a phrase might both appear, but not in the sense that we required: `path adj analysis` confined our search output to the specific phrase we sought, eliminating the need to wade through psychoanalytic studies in which the word "path" might have been used metaphorically. We used truncation to catch variant forms: by typing `structural adj equation adj model$` we would find occurrences of the phrase where the last word appeared as "model," "models," "modeling," or "modelling." We entered seven topic searches using natural language, and retrieved a total of fifty publications. These gave our reviewers a good starting point for their survey of the use of SEM in traumatic stress research.

Had the results of this search strategy been inadequate, there are some other tricks we might have tried. We could have examined the indexing of the publications our initial search retrieved, to see if some descriptor or natural language phrase commonly occurred in the papers we deemed most relevant to our interest, and then conducted further searches using those. The lists of references given in each paper we found might have led us to additional publications of interest.

Moving beyond our own database, we could have selected the most relevant papers that we found by searching PILOTS, and located their citations in other databases. This would give us clues to ways in which we could find similar papers in these databases that might not have been indexed in PILOTS. Also, we could have used the Science Citation Index and Social Sciences Citation Index databases to find subsequent papers that cited relevant papers that we had found through PILOTS.

Not all searches require such extensive strategies. Often a very simple search will retrieve the information needed. But it's worth remembering that there are a lot of tactics in an experienced literature searcher's bag of tricks. You may not have the time, or the occasion, to learn all of them. But if you know a librarian or information specialist, you know the right person to ask for help when your search turns out to be more complicated than you expected.

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