

**Health-related Quality of Life in Adults
who Experienced Maltreatment during Childhood**

Abstract

Objective: The objective of this study was to assess the marginal difference in preference-based health-related quality of life (HRQoL) for adults reporting maltreatment as a child, compared to adults reporting no maltreatment.

Methods: Using data collected from adults self-reporting about adverse childhood experiences and current health status, we matched a group of adults reporting child maltreatment (CM) to a group of adults reporting no CM. Propensity score methods were used to compare cases to controls. Utilities were imputed from the SF-36 as the HRQoL measure, using the SF-6D preference-based scoring algorithm.

Results: N=2,812 self identified cases of CM were compared to N=3,356 controls. Overall covariate imbalance within each of the 25 strata was insignificant. The combined strata-level effects of CM on SF-6D utility was a reduction of 0.028 per year (95% CI, 0.022 to 0.034; $p < 0.001$). All utility losses for CM versus no CM by age group were significantly different: age 18-39: 0.042; age 40-49: 0.038; age 50-59: 0.023; age 60-69: 0.016; age 70+: 0.025.

Conclusions: Persons experiencing maltreatment during childhood have significant and sustained losses in preference-based health-related quality of life (HRQoL) in adulthood, as measured by utilities, relative to persons not experiencing maltreatment during childhood.

Key words: child maltreatment, health-related quality of life, quality-adjusted life years, cost-effectiveness analyses, outcome assessment

Introduction

There is increasing evidence that exposure to child maltreatment can lead to greater susceptibility to lifelong physical and mental health problems, including cardiovascular disease, hypertension, diabetes, anxiety disorders, depression, and substance abuse.¹⁻⁶ Child maltreatment poses a substantial risk for long-term health for many reasons. First, chronic or recurrent exposure to the stress associated with maltreatment can lead to potentially irreversible changes in the inter-related brain circuits and hormonal systems that regulate stress (e.g., sympathetic-adrenomedullary system, hypothalamic-pituitary-adrenocortical system).⁷⁻⁹ Changes in these brain systems can lead to a premature physiological aging of the body that increases vulnerability to disease over the life course.^{8,9} Second, child maltreatment also increases the risk of involvement in behavioral problems such as smoking, substance abuse, obesity, and sexual promiscuity which are, in turn, associated with a variety of long-term adverse health outcomes.^{1,10} Third, a closely related body of evidence indicates that early childhood experiences such as maltreatment also have a profound effect on a range of cognitive, social, and emotional competencies that lay the foundation for successful learning, coping, and subsequent economic productivity.^{10,11} Consequently, maltreatment and other adverse exposures may also contribute to social inequities strongly associated with premature mortality and poor health by compromising the development of skills that enable individuals to maintain or increase their socioeconomic status.^{10,12,13}

This broad range of child maltreatment's impact on health suggests that it may also have a substantial impact on its victims' life expectancy and long-term health-related quality of life (HRQoL). When assessed together, these outcomes provide information on the effect that child

maltreatment has on victims' remaining quality-adjusted life years (or QALYs) - which is a composite measure of health typically used in economic evaluations of health interventions, cost-effectiveness analyses (CEAs) in particular. Primers on how to use these methods specifically for public health interventions have been described in detail elsewhere,^{14,15} and for application to injury and violence prevention specifically.¹⁶⁻¹⁸

Assessing the impact of child maltreatment on the first of the two components of the QALY, life expectancy, is relatively straight-forward. It requires good epidemiologic data on mortality outcomes associated with the acute phase of CM and the chronic diseases associated with CM. Assessing the long-term impact of CM on the second component of the QALY, HRQoL, is more complicated. In recent years, general measures have been developed to capture the effects of illness and injury on HRQoL prior to death.¹⁹ These impacts are usually represented as an index anchored from 0 (death) to 1 (perfect health), in which the adverse health outcomes associated with the illness or injury are subsequently arrayed along this scale. Decrements in HRQoL as measured on this scale are then multiplied by length of life to estimate the QALYs associated with and without the intervention under consideration.

Following nationally recommended guidelines for conducting CEAs,^{14,19,20} measures of HRQoL should reflect the values or *preferences* for the health outcomes under consideration for the population of interest. These preferences, or utilities, can be directly elicited from the affected population, or can be indirectly derived for a number of acute and chronic disease health states through the use of well-developed, generally accepted, and widely used generic HRQoL indexes, whose valuation is based on general population samples.²¹⁻²⁵

For health outcomes resulting from violence, however, few, if any studies have either directly or indirectly elicited utilities or preferences for health states under consideration. The paucity of data, particularly for health states associated with child maltreatment, is most likely due to a variety of practical and methodological challenges. These include the difficulty in defining an average health state for acute or ongoing violent episodes, the cognitive challenges in eliciting preferences for health outcomes from children,²⁶ proxy issues concerning parents or caregivers who are likely the perpetrators of violence, and other reasons associated with development of the field of child maltreatment prevention and priorities for research.²⁷

Only a few studies have assessed the long-term impact of child maltreatment on HRQoL,²⁸⁻³¹ but these have included summary measures of health that are not preference-based. A popular summary measure of health can be derived from the SF-36, or short form 36,³² which is a commonly used health state classification instrument collected alongside clinical trials. For example, Edwards et al. compared self-reports of the SF-36 in an adult population to an index measure of the number of adverse exposures, including child maltreatment, experienced during childhood (the ACE score).²⁸ The authors found an inverse relationship between ACE score (where the more adverse experiences, the higher the score) and the SF-36 overall summary measure. However, the summary measure derived from the SF-36 only measures health on a scale from 0 (worst health) to 100 (best health), but it does not explicitly incorporate preferences into its scoring algorithm, and, therefore, cannot be used to obtain preference weights for constructing the QALY. Alternatively, preference-based measures of HRQoL reflect relative desirability of a score (or index on a scale) based on tradeoffs that one would make on life

expectancy in order to achieve better HRQoL (see Gold et al.²⁰ for a more thorough examination of how to elicit preference-based measures of HRQoL).

Fortunately, new methods have been developed which enable one to translate summary measures of HRQoL such as those derived from the SF-36 into preference-based utility weights for use in CEAs. This represents an exciting advance in methodology, particularly as it is applied to health outcomes such as violence that have received such little attention in the elicitation of preference-based measures of health. The purpose of this study is to derive preference-based measures of health in adults self-reporting maltreatment during childhood. This new methodology, when incorporated with epidemiologic data on life expectancy, will provide a means for assessing lifetime losses in QALYs and for assessing the cost-effectiveness of interventions designed to prevent maltreatment during childhood.

Methods

Study Population

Data were originally collected as part of the second survey wave of the Adverse Childhood Experiences (ACE) Study at Kaiser Permanente's Health Appraisal Clinic in San Diego, California, between June and October of 1997. Complete descriptions of the study population and several analyses of this large database are available elsewhere.^{1,28} Basic demographic information was collected from participants, as well as data on adverse events experienced during childhood, current health status as measured by the SF-36 (version I), health risk

behaviors, and diseases past and present. For questions regarding adverse childhood experiences (Table 1), 5 categories of child maltreatment were included: physical abuse (2 questions), sexual abuse (4 questions), emotional abuse (2 questions), physical neglect (5 questions), and emotional neglect (5 questions). The items covering physical abuse and emotional abuse were derived from the Conflict Tactics Scale.³³ Questions on sexual abuse were adopted from Wyatt,³⁴ and the physical and emotional neglect categories were measured using the short form subscales of the Child Trauma Questionnaire.³⁵ An additional 5 categories of questions were asked regarding other adverse experiences during childhood (ACEs), including: household substance abuse (2 questions), household mental illness (2 questions), violent treatment of mother (4 questions), household member in prison (1 question), and parental separation/divorce (1 question).

Data Analysis

Our main outcome measure of interest is a preference-based health utility measure for two populations: cases - adults self-reporting child maltreatment (CM), either physical abuse, sexual abuse, emotional abuse, physical neglect, or emotional neglect during the first 18 years of life (childhood), versus controls (no CM) - those who do not report child maltreatment during childhood.

Health utility measures are calculated using the Brazier algorithm (provided by author) that maps profile-based or summary measures of health, as derived from the SF-36, onto a preference-based measure of health, as derived from the SF-6D. The SF-6D, which is a six-dimensional health state classification system based on the original design of the SF-36, includes 6

dimensions of health: physical functioning, role limitations, social functioning, pain, mental health, and vitality. In a pilot study, Brazier et al.³⁶ first reduced the SF-36 health classification scheme into the SF-6D, and then he elicited utilities from 165 health professionals and patients in the United Kingdom using both the visual analog scale (VAS) and the Standard Gamble (SG). Following positive outcomes from the pilot study, Brazier et al.³⁷ refined the original models using a representative sample of the general public, n=836, and using a variant on the standard gamble approach to elicit utilities. Several models were tested, with the fixed effects and random effects models being the most appropriate, with utility values as the dependent variable, and personal characteristics and dummies for each level of the SF-6D as independent variables. Parameters were estimated from these models and then used for the population to estimate utility indices from the SF-6D. Subsequent studies have tested the validity and reliability of the transformation formula, and it is now seen as a promising method for deriving utilities.³⁸ Details regarding the econometric modeling to derive the preference-based measure are described elsewhere.³⁷

Our study relies on a large observational study - the ACE Study, with treatments (the CM group) being assigned to experimental units without the benefits of randomization. As most observational studies do, in our study sample, systematic differences are likely to exist between CM and no CM subjects with respect to confounding covariates such as socioeconomic status and other adverse childhood experiences. Simple comparisons of HRQoL measures between CM and no CM are potentially misleading or biased in that the differences of health utility between CM and no CM could be explained by systematic between-group differences rather than the effect of maltreatment per se. Following Rosenbaum and Rubin's work,³⁹⁻⁴⁰ we use the method

of stratification based on the propensity score, a scalar function of the covariates, to approximate a randomized controlled setting and to reduce bias in estimating marginal impacts of child maltreatment on predicted utility in an observational study . The method involves dividing units into 5 age groups and then dividing them into quintiles based on the propensity score within each age group (for a total of 25 strata). Health utility measures of CM and no CM are compared for those who fall into the same strata. An overall effect of CM on utility is estimated using a weighted average of the within strata estimates with the weights equal to the proportions of the population within the strata. To assess the marginal impact of each type of CM on utility, logistic regression models are estimated with imputed health utility as the outcome variable and 5 types of maltreatment as predictors for all 25 strata. Similar to estimating the overall effect of CM on utility, the overall impact of each type of CM on utility are weighted and combined across all 25 strata to determine the overall impact of that type of CM on utility.

To create the propensity score, which is defined as the predicted probability of being maltreated during childhood, we estimate a multivariate logistic regression predicting child maltreatment using a number of covariates as explanatory variables. These covariates include basic demographics (sex, age, age squared, race), family economic variables found to be related to child maltreatment in previous research (mother's years of education; log of number of residential moves in childhood, whether parent owned own home),^{41,42} and the other 5 categories of adverse childhood experiences (ACEs) described above and in Table 1. The rationale for using the other adverse childhood exposures as covariates is to determine the *marginal* impact of child maltreatment on utility. The model, therefore, adjusts for exposure to other ACEs as potential confounders.

Significance tests for all key variables are conducted between those reporting maltreatment and those not reporting maltreatment within each of the 25 strata for both before and after subclassification. We use an analysis of variance (ANOVA) to evaluate differences in prevalence of key variables that are continuous and a two-sided Pearson's Chi-square for variables that are categorical. A p-value of <0.05 is considered significant in this analysis.

Results

Of the 8,667 in the second survey wave of the ACE study, n=7,641 (88%) agreed to complete the SF-36, and 6,815 (78.6%) completed all questions. Although there are methods used to improve estimates of SF-36 health survey scores for respondents with missing data,⁴³ due to the large sample size, we excluded these respondents from our analysis. An additional n=647 respondents were excluded because they were missing information on child maltreatment (n=25) or covariates used to develop the propensity score (n=622). Of the n=6,168 respondents remaining, average age of participants was 55.4 years (SD=14.9), 53% were female, 76% were White, and 45.6% (n=2,812) self-reported some form of maltreatment during childhood. Cases that remained did not differ substantially on demographic characteristics from the original sample. For example, those subjects who remained in the analyses were similar in age (55.4 years old versus 55.9 years of age), more males (by 1.1%) and White (by 2.1%). Therefore we feel that the cases included in this analysis are representative of this HMO population.

Table 2 contains the prevalence of each individual form of child maltreatment, as well as the correlation between maltreatment types. Physical abuse had the highest prevalence of any of the

abuse types (26%), while physical neglect was reported by the fewest participants (9%). Each maltreatment type was modestly to moderately correlated ($p < 0.05$), with the highest correlations between emotional abuse and emotional neglect (.43), although physical abuse and emotional abuse were nearly as highly correlated (.42).

A number of key variables were significantly different between the maltreated and non-maltreated populations, as previously analyzed and reported by the ACE study investigators.^{44, 45} In particular, persons in all age groups reporting CM also reported significantly higher percentages of the other 5 measured ACEs – family substance abuse, family mental illness, violence towards mother, family member in prison, and parental divorce/separation – compared to those reporting no CM. The measured economic variables were also significantly associated with CM. After applying the stratified propensity score method, this covariate imbalance was reduced to less than 5% in the 25 strata – suggesting a good match between cases and controls within each of the strata to assess the marginal impact of CM on preference-based HRQoL, or utilities.

Table 3 shows overall mean utility differences comparing cases (CM) to controls (no CM), by age group and type of child maltreatment. Overall, respondents reporting CM had a marginal utility difference (or disutility) of 0.028 (95% CI 0.022-0.034) compared to respondents reporting no CM. This result is in the range of what Walters and Brazier⁴⁶ estimated as a minimally important difference (0.011 to 0.097) in utility for the SF-6D as measured in 11 studies. For every age group, the overall marginal difference in utilities for those reporting CM compared to those reporting no CM were statistically significant at $p < 0.05$, with the largest

difference occurring in the 20-39 age group and the smallest difference occurring in the 60-69 age group. Imputed utility scores by age group are provided for cases and controls in Table 4.

Table 3 also shows that across all ages, emotional neglect (EN) had the strongest influence on the marginal disutility, followed by sexual abuse (SA) and physical abuse (PA). Neither emotional abuse (EA) nor physical neglect (PN) significantly impacted the disutility across all age groups. However, type of maltreatment impacted the disutility differentially within each age group. For example, for ages 19-49, PA, SA, and EN significantly impacted disutility. For age 50-59, however, only PA significantly impacted disutility, and for age 60-69, only SA and EN significantly impacted disutility. For those 70 and older, only EA significantly impacted disutility. In fact, the influence of EA on disutility was only significant in those 70 years and older.

Discussion

In this study we found that persons experiencing maltreatment during childhood had significant and sustained losses in preference-based health-related quality of life (HRQoL) in adulthood, as measured by utilities, compared to persons not experiencing maltreatment during childhood.

Overall, adults self-reporting any form of maltreatment during childhood had a yearly loss of 0.03 quality-adjusted life years (QALYs), or 11 days per year. Physical abuse, sexual abuse, and emotional abuse alone significantly reduced HRQoL per year, 0.015, 0.016, and 0.026, respectively; while emotional abuse or physical neglect alone did not. Preference-based HRQoL, or utility, losses for the CM group compared to a no CM group significantly differed for all age

groups, with higher differential losses in utilities found in the youngest age group (0.04 QALYs, or 15 days per year). These differential losses diminished with increasing age up until 70+ years, at which time the marginal difference in utility losses between the CM and no CM groups increased.

The retrospective nature of the self-reporting data may be one explanation for the declining differences in utility as age increases, with the slight exception of the 70+ age group. One might question the reliability of older age groups in self-reporting events that may have occurred, in some cases, more than a half-century ago. However, there is accumulating evidence that suggests that the unreliability of retrospective reports of trauma is overstated.⁴⁷⁻⁴⁸ For example, in another analysis using the ACE data, researchers found that Cohen's kappa was in the good to excellent range when a test re-test reliability of the ACE measure was conducted.⁴⁹ In addition, other analyses from the ACE study have not found that the association between ACEs and HRQoL decreases with age.²⁸

The recollection of personally experienced events such as child maltreatment may have more to do with when the maltreatment occurred and factors occurring during childhood than the age of the respondent. Memories occurring before age three and a half are very unlikely to be recalled and memories in the age three to six range are also less likely to be recalled than those occurring during a later age.⁵⁰ Older age when the maltreatment ended, maternal support following the disclosure of maltreatment, and more severe maltreatment have all been found to be associated with an increased likelihood of disclosure.^{51,52} It could be that the effect of CM on HRQoL is mediated by the biologic or psychologic developmental stage of the individual, with certain types

of maltreatment resulting in differential effects over time. While these data suggest that this phenomenon might exist, more research in this area is warranted, particularly surrounding the effects on HRQoL of different combinations of abuse and other adverse outcomes experienced during childhood.

Other than the retrospective nature of the data, there are a number of limitations with this study that should be considered. First, categories of maltreatment and other adverse exposures are defined by a limited number of survey questions. As such, there could exist wide exposure variance within each category of exposure that is not accounted for in the model. For example, two persons responding “Yes” to family substance abuse could have very different exposures to this behavior in terms of adverse HRQoL. Second, the sample is not representative of the US population and includes a group who has (at the time of the data collection) good health care coverage and access to healthcare. Thus, we can not easily draw the conclusion that these utility losses would be higher or lower in other populations. Although we suspect that in populations with limited access to healthcare, and mental health services in particular, the marginal difference in utilities (or disutilities) between cases and controls might be even greater.

Despite these limitations, translated over a typical lifespan of an individual (age 75 years, for example), these data suggest that persons experiencing maltreatment as a child have a marginal decrease in at least two years of undiscounted quality-adjusted life expectancy, compared to persons not experiencing CM. A CEA of an intervention designed to prevent CM, therefore, would include 2 QALYs saved for every case of maltreatment prevented. These results represent a floor effect of the true impact of CM on QALYs for three reasons. First, these estimates do not

include losses in life years associated with maltreatment resulting in death. In 2004, for example, an estimated 1,490 child homicides resulted from maltreatment.⁵³ Our estimates of QALYs lost in a maltreated population also do not account for differential mortality rates associated with chronic diseases found to be correlated with CM. And of potential greater impact, our estimates do not include HRQoL losses incurred during the acute stage of the maltreatment.

These utility loss estimates are also conservative in that other adverse childhood exposures (ACEs) are essentially controlled for in the estimation of the propensity score, thus making the utility losses estimated in this analysis *marginal* to any utility losses that could occur with co-existing ACEs. Dong et al.⁴⁵ found that the presence of one ACE resulted in significantly higher odds (between 2 and 17.7 times) of reporting additional ACEs. As shown by the reduction in SF-36 score by increasing number of self-reported ACEs in Edwards et al.,²⁸ we would expect utility losses to also increase with an increasing number of ACEs. The marginal effect of the other ACEs may be less influential than the effect of CM on utility, however. To test this, we estimated utility losses by ACE score and found that individuals with five or more ACEs had a marginal utility difference of 0.067. Compared with individuals with zero ACEs an individual with five or more ACEs would have a marginal decrease of at least five years (over their lifespan) of undiscounted quality-adjusted life expectancy.

The results presented in this study are an important first step for developing the benefits measure for use in economic evaluations. Economic evaluations, CEAs in particular, are critical for policy makers charged with making allocation decisions with scarce public health resources. Using a composite measure, such as the QALY, allows the decision maker to consider effects of

the intervention on length of life and quality of life simultaneously. Applications of CEAs to interventions that prevent CM are ideal because of the impact on life expectancy previously suggested by the literature and on quality of life as indicated by these results. If CEAs of interventions to prevent CM are to be successful, further research into differential mortality losses associated with victims of CM is essential. This would require a serious commitment to collecting and analyzing longitudinal data in these victimized children. Improvements in HRQoL assessment in children, both in defining the dimensions of health appropriate for this age group and in improving elicitation methods is also needed. When coupled with the long-term losses in HRQoL presented in this paper, analysts will have a complete accounting of QALYs that could be saved per case of child maltreatment prevented.

References

1. Felitti VJ, Anda RF, Nordenberg D, et al. The relationship of adult health status to childhood abuse and household dysfunction. *Am J Prev Med.* 1998;14:245–258.
2. Kendall-Tackett K. *Treating the Lifetime Health Effects of Childhood Victimization.* Civic Research Institute Inc.: Kingston, NJ, 2003.
3. Kolko DJ. Child physical abuse. In Myers JEB, Berliner L, Briere J, Hendrix CT, Reid TA, Jenny CA (eds.) *The APSAC Handbook on Child Maltreatment, second edition.* Thousand Oaks, CA: Sage Publications, Inc., 2002.
4. Malinosky-Rummell R, Hansen DJ. Long-term consequences of childhood physical abuse. *Psychological Bulletin.* 1995;114(1):68–79.
5. Putnam FW. Ten-year research update review: child sexual abuse. *J American Academy of Child and Adolescent Psychiatry.* 2003;42(3):269–278.
6. Paolucci EO, Genuis ML, Violato C. A meta-analysis of the published research on the effects of child sexual abuse. *J Psychology.* 2001;135(1):17–36.
7. National Research Council and Institute of Medicine. *From Neurons to Neighborhoods: The Science of Early Childhood Development. Committee on Integrating the Science of Early Childhood Development.* Shonkoff JP, Phillips DA (eds.). Board on Children, Youth, and Families, Commission on Behavioral and Social Sciences and Education. Washington, D.C.: National Academy Press, 2000.
8. McEwen BS, Seeman T. Protective and damaging effects of mediators or stress: Elaborating and testing concepts of allostasis and allostatic load. In Adler NE, Marmot M, McEwen BS, Stewart J (eds.) *Socioeconomic Status and Health in Industrial Nations: Social, Psychological and Biological Pathways.* *Annals of the New York Academy of Science.* 1999;896:30–47.
9. Seeman TE, Singer B, Horwitz R, McEwen BS. The price of adaptation-allostatic load and its health consequences: McArthur studies of successful aging. *Archives Intern Med.* 1997;157:2259–2268.
10. Repetti RL, Taylor SE, Seeman TE. Risky families: family social environments and the mental and physical health of offspring. *Psychological Bulletin.* 2002;128(2):330–366.
11. Hekman JJ. Skill formation and the economics of investing in disadvantaged children. *Science.* 2006;312(5782):1900–1902.
12. Taylor SE, Lerner JS, Sage RM, Lehman BJ, and Seeman TE. Early environment, emotions, responses to stress, and health. *J Personality.* 2004;72(6):1365–1394.
13. Williams DR, Collins C. US socioeconomic and racial differences in health: patterns and explanations. *Annual Review Sociology.* 1995;21:348–386.
14. Haddix A, Teutsch S, Corso P. (eds.). *Prevention effectiveness: A guide to economic evaluation and decision analysis.* Oxford University Press: New York, NY, 2003.
15. Owens D. Analytic Tools for Public Health Decision Making. *Medical Decision Making* 2002;22(5):S3-S10.
16. Aos S, Phipps P, Barnoski R., Lieb, R. *The comparative costs and benefits of programs to reduce crime.* Seattle, WA: Washington State Institute for Public Policy, 2001.
17. Hornick JP, Paetsch JJ, Bertrand LD. *A manual on conducting economic analysis of crime prevention programs.* National Crime Prevention Centre, 2002.
18. Miller TR, Levy DT. Cost outcome analysis in injury prevention and control: A primer on methods. *Injury Prevention.* 1997;3:288–93.

19. Miller W, Robinson L, Lawrence R. (eds.). *Valuing health for regulatory cost-effectiveness analysis*. Washington DC: National Academy of Sciences, Institute of Medicine, 2006.
20. Gold M, Siegel J, Russell L, Weinstein M. *Cost-effectiveness in health and medicine*. Oxford University Press: New York, NY, 1996.
21. Kaplan R, Anderson J. A General Health policy model: Update and Applications. *Health Services Research*. 1988;23(2):203-235.
22. Patrick D, Erickson P. *Health Status and Health Policy: Allocating resources to Health Care*. New York: Oxford University Press; 1993.
23. Shaw J, Johnson J, Coons S. U.S. Valuation of the EQ-5D Health States: Development and Testing of the D1 Valuation Model. *Medical Care*. 2005;43(3):203-220.
24. Brazier J, Roberts J. The Estimation of a Preference-Based Measure of Health from the SF-12. *Medical Care*. 2004;42(9):851-859.
25. Torrance G, Feeny D, Furlong W, Barr R, al. e. Multiattribute Utility Function for a Comprehensive Health Status Classification System: Health Utilities Index Mark 2. *Medical Care*. 1996;34(7):702-722.
26. Matza LS, Swensen AR, Flood EM, Secnik K, Leidy NK. Assessment of health-related quality of life in children: a review of conceptual, methodological, and regulatory issues. *Value in Health*. 2004;7(1):79-92.
27. Corso PS, Lutzker J. The need for economic analysis in child maltreatment prevention research. *Child Abuse & Neglect*. 2006; 30:727-738.
28. Edwards, VJ, Anda, RF, Felitti, VJ, & Dube, SR. Adverse Childhood Experiences and Health-Related Quality of Life as an Adult. In K. Kendall-Tackett (ed.) *Victimization and Health*, American Psychological Association, 2003.
29. Holbrook TL, Hoyt DB, Coimbra R, Potenza B, Sise M, Anderson JP. High rates of acute stress disorder impact on quality of life outcomes in injured adolescents: mechanism and gender predict acute stress disorder risk. *J of Trauma*. 2005;59(5):1126-1130.
30. Walker EA, Gelfand A, Katon WJ, Koss MP, Von Korff M, Bernstein D et al. Adult health status of women with histories of childhood abuse and neglect. *Am J Med*. 1999;107(4):399.
31. Dickinson LM, de Gruy FV, Dickinson WP, Lark M, Andib LM. Health-related quality of life and symptom profiles of female survivors of sexual abuse. *Arch Fam Med*. 1999;8(1):35-43.
32. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care*. 1992;30(6):473-83.
33. Straus MA. Measuring intrafamily conflict and violence: the Conflict Tactics (CT) scales. *J Marriage and Family*. 1979; 41, 75-88.
34. Wyatt GE. The sexual abuse of Afro-American and White-American women in childhood. *Child Abuse & Neglect*. 1985; 9:507-519.
35. Bernstein DP, Fink L, Handelsman L, Foote J, Lovejoy M, Wenzel K, Sapereto E, Ruggiero J. Initial reliability and validity of a new retrospective measure of child abuse and neglect. *Am J Psychiatry*. 1994;151; 1132-1136.
36. Brazier J, Usherwood T, Harper R, Thomas K. Deriving a preference-based single index from the UK SF-36 health survey. *J Clin Epidemiol*. 1998;51(11):1115-1128.
37. Brazier J, Roberts J, Deverill M. The estimation of a preference-based measure of health from the SF-36. *J of Health Economics*. 2002;21:271-292.

38. Kaplan RM, Groessl EJ, Sengupta N, Sieber W, Ganiats TG. Comparison of measured utility scores and imputed scores from the SF-36 in patients with rheumatoid arthritis. *Med Care*. 2005;42(1):79–87.
39. Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. *Biometrika*. 1983; 70:41–55.
40. Rosenbaum PR, Rubin DB. Reducing bias in observational studies using subclassification on the propensity score. *J Am Stat Assoc*. 1984; 79(387):516–24.
41. Brown SE. Social Class, Child Maltreatment, and Delinquent Behavior. *Criminology*. 1984; 22(2): 259–78.
42. Coleman PK, Maxey CD, Rue VM, Coyle, CT. Associations between voluntary and involuntary forms of perinatal loss and child maltreatment among low-income mothers. *Acta Paediatrica*. 2005; 94(10):1476–1483.
43. Kosinski M, Bayliss M, Bjorner JB, Ware JE. Improving estimates of SF-36 health survey scores for respondents with missing data. *Monitor*. 2000; Fall:8–10.
44. Dube SR, Anda RF, Felitti VJ, Chapman D, Williamson DF, Giles WH. Childhood abuse, household dysfunction and the risk of attempted suicide throughout the life span: Findings from Adverse Childhood Experiences Study. *JAMA*. 2001;286:3089–3096.
45. Dong M, Anda RF, Felitti, VJ, Dube SR, Williamson DF, Thompson TJ, Loo CM, Giles WH. . The Interrelatedness of Multiple Forms of Childhood Abuse, Neglect, and Household Dysfunction. *Child Abuse & Neglect*. 2004;28(7):771–784.
46. Walters SJ, Brazier JE. Comparison of the minimally important difference for two health state measures: EQ-5D and SF-6D. *Quality in Life Research*. 2005 14:1523–1532.
47. Brewin, CR, Andrews B., Gotlib, IH. Psychopathology and early experience: A reappraisal of retrospective reports. *Psychological Bulletin*. 1993;113: 82–98.
48. Hardt J, Rutter M. Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. *J Child Psychology and Psychiatry*. 2004; 45, 260–273.
49. Dube SR, Williamson DF, Thompson T, Felitti VJ, Anda RF. Assessing the reliability of retrospective reports of adverse childhood experiences among adult HMO members attending a primary care clinic. *Child Abuse & Neglect*. 2004;28(7):729–737.
50. Rogers ML. *Factors influencing recall of childhood sexual abuse*. *J Traumatic Stress*. 1995;8(4):691–716.
51. Goodman GS, Ghatti S, Quas JA, et al. A prospective study of memory for child sexual abuse: new findings relevant to the repressed-memory controversy. *Psychol Sci*. 2003;14(2):113–118.
52. Ghatti S, Edelstein RS, Goodman GS, et al. What can subjective forgetting tell us about memory for childhood trauma. *Mem Cognit*. 2006;34(5):1011–1025.
53. Department of Health and Human Services, Administration on Children, Youth, and Families. *Child Maltreatment 2004* [online]. Washington (DC): Government Printing Office, 2006. [Cited 2006 August 10]. Available from: <http://www.acf.hhs.gov/programs/cb/pubs/cmo4/index.htm>.

Table 1. Questions used to define child maltreatment (CM) outcomes and other adverse childhood exposures (ACEs)

Category	Question(s)	Response Options	Criterion for Category
Physical Abuse (PA):	Did a parent or other adult in the household... Push, grab, shove or slap you? Hit you so hard that you had marks or were injured?	Never, once or twice, sometimes, often, very often	Often or very often <i>OR</i> Sometimes, often, very often
Sexual Abuse (SA):	Did an adult 5 years older than you... Touch or fondle you in a sexual way? Had you touch his/her body in a sexual way? Attempt intercourse (oral, vaginal, or anal) with you? Have intercourse (oral, vaginal, or anal) with you?	Yes/No	Yes to any question
Emotional Abuse (EA):	Did a parent or other adult in the household... Swear at, insult, or put you down? Act in a way that made you afraid you would be physically hurt? Threaten to hit or throw something at you but didn't?	Never, once or twice, sometimes, often, very often	Often or very often to any question
Physical Neglect (PN):	I didn't have enough to eat I knew there was someone there to take care of me and protect me My parents were too drunk or too high to take care of me I had to wear dirty clothes There was someone to take care of me if I needed it	Never (1), rarely (2), sometimes (3), often (4), very often (5)	Summary score of 15+
Emotional Neglect (EN):	There was someone in my family who helped me feel important or special? People in my family looked out for each other? I felt loved People in my family felt close to each other My family was a source of strength and support	Never (1), rarely (2), sometimes (3), often (4), very often (5)	Summary score of 15+

Witnessing Maternal Violence:	Did your father or stepfather or mother's boyfriend ever: Push, grab, slap, or throw something at your mother or stepmother?	Never, once or twice, sometimes, often, very often	Often or very often
			<i>OR</i>
	Kick, bite, hit with a fist or something hard?		Sometimes, often, or very often
			<i>OR</i>
	Repeatedly hit her over at least a few minutes?		Once or twice, sometimes or very often
			<i>OR</i>
	Threaten or hurt her with a knife or gun?		Once or twice
Household Mental Illness:	Was someone in your household: Depressed or mentally ill?	Yes/No	Yes to either question
	Attempt suicide?		
Household Substance Abuse:	Was someone in your household: A problem drinker or alcoholic?	Yes/No	Yes to either question
	Did you live with anyone who used street drugs?		
Household Criminal Activity	Did a household member ever go to prison?	Yes/No	Yes
Parental Divorce or Separation	Were your parents ever divorced or separated?	Yes/No	Yes

Table 2. The prevalence and intercorrelation between types of CM

CM type	Prevalence (N=6,168)		Correlations				
	No.	%	PA	SA	EA	PN	EN
PA	1,609	26	1.00				
SA	1,298	21	0.16	1.00			
EA	626	10	0.42	0.16	1.00		
PN	558	9	0.20	0.12	0.24	1.00	
EN	876	14	0.30	0.16	0.43	0.37	1.00

PA=physical abuse; SA=sexual abuse; EA=emotional abuse; PN=physical neglect; EN=emotional neglect

Table 3. Marginal Utility Differences between CM (Cases) and No CM (Controls) (and 95% CI) by Age Group and Type of Child Maltreatment

Age group	Any CM	PA	SA	EA	PN	EN
19-39	0.042* (.027 – .056)	.023* (.004 – .042)	0.029* (.011 – .046)	0.003 (-.029 – .035)	0.018 (-.013 – .049)	0.039* (.015 – .063)
40-49	0.038* (.025 – .051)	0.021* (.006 – .036)	0.019* (.004 – .035)	0.003 (-.029 – .023)	0.011 (-.042 – .020)	0.033* (.011 – .054)
50-59	0.023* (.011 – .036)	0.017* (.002 – .031)	0.005 (-.010 – .021)	0.007 (-.026 – .040)	0.014 (-.014 – .041)	0.015 (-.008 – .038)
60-69	0.016* (.004 – .029)	0.005 (-.011 – .022)	0.018* (.003 – .034)	0.004 (-.034 – .026)	0.011 (-.016 – .037)	0.028* (.005 – .050)
70+	0.025* (.010 – .040)	0.011 (-.012 – .033)	0.012 (-.007 – .031)	0.051* (.009 – .093)	0.027 (-.007 – .061)	0.017 (-.014 – .047)
All	0.028* (.022 – .034)	0.015* (.007 – .023)	0.016* (.009 – .023)	0.010 (-.005 – .025)	0.013 (-.030 – .056)	0.026* (.015 – .037)

* Indicates significance at $p < 0.05$

Table 4. Predicted Utilities, by Sample Populations

Age group	No Child Maltreatment (CM)	CM
19-39	0.7990	0.7575
40-49	0.7863	0.7481
50-59	0.7873	0.7642
60-69	0.7815	0.7650
70+	0.7534	0.7295
ALL	0.7813	0.7534