



Does subtype matter? Assessing the effects of maltreatment on functioning in preadolescent youth in out-of-home care[☆]

Christie L.M. Petrenko^{a,b,c,*}, Angela Friend^{b,d}, Edward F. Garrido^a, Heather N. Taussig^{a,b}, Sara E. Culhane^a

^a Kempe Center for the Prevention and Treatment of Child Abuse and Neglect, Department of Pediatrics at the University of Colorado Denver School of Medicine, The Gary Pavilion at Children's Hospital Colorado, Anschutz Medical Campus, Aurora, CO, USA

^b Department of Psychiatry, University of Colorado Denver School of Medicine, Denver, CO, USA

^c Mt. Hope Family Center, Department of Clinical and Social Sciences in Psychology, University of Rochester, 187 Edinburgh St., Rochester, NY 14608, USA

^d Institute of Cognitive Science, University of Colorado Boulder, Boulder, CO, USA

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ABSTRACT

Objectives: Attempts to understand the effects of maltreatment subtypes on childhood functioning are complicated by the fact that children often experience multiple subtypes. This study assessed the effects of maltreatment subtypes on the cognitive, academic, and mental health functioning of preadolescent youth in out-of-home care using both “variable-centered” and “person-centered” statistical analytic approaches to modeling multiple subtypes of maltreatment.

Methods: Participants included 334 preadolescent youth (ages 9–11) placed in out-of-home care due to maltreatment. The occurrence and severity of maltreatment subtypes (physical abuse, sexual abuse, physical neglect, and supervisory neglect) were coded from child welfare records. The relationships between maltreatment subtypes and children's cognitive, academic, and mental health functioning were evaluated with the following approaches:

- (1) “Variable-centered” analytic methods:
 - a. *Regression approach:* Multiple regression was used to estimate the effects of each maltreatment subtype (separate analyses for occurrence and severity), controlling for the other subtypes.
 - b. *Hierarchical approach:* Contrast coding was used in regression analyses to estimate the effects of discrete maltreatment categories that were assigned based on a subtype occurrence hierarchy (sexual abuse > physical abuse > physical neglect > supervisory neglect).
- (2) “Person-centered” analytic method: Latent class analysis was used to group children with similar maltreatment severity profiles into discrete classes. The classes were then compared to determine if they differed in terms of their ability to predict functioning.

Results: The approaches identified similar relationships between maltreatment subtypes and children's functioning. The most consistent findings indicated that maltreated children who experienced physical or sexual abuse were at highest risk for caregiver-reported externalizing behavior problems, and those who experienced physical abuse and/or physical

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* Corresponding author.

neglect were more likely to have higher levels of caregiver-reported internalizing problems. Children experiencing predominantly low severity supervisory neglect had relatively better functioning than other maltreated youth.

Conclusions: Many of the maltreatment subtype differences identified within the maltreated sample in the current study are consistent with those from previous research comparing maltreated youth to non-maltreated comparison groups. Results do not support combining supervisory and physical neglect. The “variable-centered” and “person-centered” analytic approaches produced complementary results. Advantages and disadvantages of each approach are discussed.

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Introduction

In 2009, over 3.6 million reports to child protective services were investigated nationally, and maltreatment was substantiated for an estimated 709,939 children (U.S. Department of Health and Human Services, Administration on Children, Youth, and Families, 2010). Child maltreatment includes physical abuse, sexual abuse, physical neglect (failure to provide), supervisory neglect (lack of supervision), emotional abuse, and educational neglect (Barnett, Manly, & Cicchetti, 1993). Research suggests that the impact of maltreatment on child functioning may depend on these subtypes, but findings are sometimes inconsistent (e.g., Eckenrode, Laird, & Doris, 1993; Egeland, Sroufe, & Erickson, 1983; Manly, Kim, Rogosch, & Cicchetti, 2001; Nolin & Ethier, 2007; Toth, Manly, & Cicchetti, 1992). These inconsistencies may be partially attributable to high rates of co-occurring maltreatment subtypes (estimates range from 33 to 94% of maltreated children; Herrenkohl & Herrenkohl, 2009), differences in analytic methods, and the nature of the comparison groups (maltreated vs. non-maltreated).

The majority of studies examining the effects of maltreatment subtypes on child functioning have included non-maltreated comparison groups. While some consistent associations have emerged between specific maltreatment subtypes and outcomes (for reviews see Myers, 2011; Trickett & McBride-Chang, 1995), subtype differences are most often relative to non-maltreated youth (vs. other subtypes). More information on subtype differences within groups of maltreated children is needed, as these comparisons are particularly relevant for child welfare and service allocation decisions. For example, knowing which maltreatment subtypes or subtype combinations are associated with which outcomes may help caseworkers better tailor services to meet the needs of children on their caseloads.

A growing number of studies have examined the effects of maltreatment subtypes on outcomes within samples of maltreated children, taking into account the high rates of co-occurring subtypes (e.g., English et al., 2005; Lau et al., 2005; Litrownik et al., 2005; Pears, Kim, & Fisher, 2008; Taussig, 2002). Given the diversity in analytic approaches utilized, it is not surprising that findings of subtype differences have been equivocal (as reviewed below). Maltreatment subtype effects are also likely to be smaller within studies of maltreated samples than in studies that compare maltreated groups with non-maltreated comparison groups, and this may make effects more difficult to detect statistically. The objectives of the current study are two-fold: (1) to assess the effects of maltreatment subtypes on functioning and (2) to examine different approaches to analyzing multiple maltreatment subtypes within a maltreated sample. The following review of prior research will focus on studies examining the impact of maltreatment subtypes within maltreated samples (vs. a non-maltreated comparison group) and will be discussed within the context of the various analytic approaches selected for this study.

Approaches to analyzing multiple maltreatment subtypes

There are 2 overarching analytic approaches for assessing the effects of co-occurring maltreatment subtypes on children's functioning: “variable-centered” and “person-centered.” Each of these approaches provides somewhat different information about associations between maltreatment subtypes and child functioning. Variable-centered approaches examine the effects of individual subtype variables on functioning, after controlling for the effects of other subtypes. For example, this approach may identify that physical abuse is significantly associated with greater externalizing behavior problems, after accounting for the effects of other maltreatment subtypes (e.g., Litrownik et al., 2005). This approach provides information on individual subtype variables and their unique association with indices of child functioning. Person-centered approaches classify individuals based on their maltreatment experiences across subtype variables and then compare these classified groups of children in terms of functioning. For example, children who are classified as having experienced high severity physical abuse and high severity neglect may differ on internalizing problems from those children classified as having experienced a combination of supervisory neglect and emotional abuse (e.g., Pears et al., 2008). This approach provides information on the functioning of groups of children with similar maltreatment experiences. The variable-centered and person-centered approaches are complementary. Both have advantages and disadvantages depending on the primary goal of the analysis and nature of the population under study.

Review of maltreatment subtype findings with variable-centered approaches

Variable-centered approaches include the regression approach and the hierarchical approach. In the regression approach, maltreatment subtype variables are analyzed as a set to see if any of the variables account for unique variance above and beyond the other subtypes. Subtype occurrence or severity ratings can be incorporated in this approach. For example, one study (Litrownik et al., 2005) used severity ratings for each maltreatment subtype within a child welfare sample ($N=519$) to examine the effect of maltreatment between ages 4 and 8 on mental health and adaptive functioning at age 8. Results indicated that greater severity of sexual abuse was related to more internalizing and externalizing behavior problems as well as difficulties with socialization over-and-above other maltreatment types. Greater physical abuse severity was related to more externalizing behavior and anger problems. Neither the severity of neglect or emotional abuse was predictive of outcomes, after controlling for other subtypes. Using the regression approach with a sample of adolescents with a history of maltreatment and out-of-home placement, Taussig (2002) found that the occurrence of physical abuse was associated with more delinquent behaviors and that neglect was associated with greater substance use.

An advantage of the regression-based approach is that it is widely accessible in most statistical programs and is flexible in terms of model building. Although the majority of studies that utilize regression-based approaches focus on the first-order effects of individual subtypes (e.g., physical abuse, neglect) on outcomes, higher-order modeling of interactions between subtypes or other maltreatment characteristics (e.g., chronicity, age of onset; English et al., 2005) is possible. A limitation with higher-order modeling, however, is that power and interpretation can become difficult depending on the number of variables and order of interactions (e.g., 3-way and 4-way interactions) examined. In addition, regression approaches focus on the relationship between maltreatment variables and child functioning.

The hierarchical approach classifies children into mutually exclusive categories based on the maltreatment subtype thought to have the most detrimental effect on youth. Subtypes of maltreatment characterized by acts of commission (i.e., sexual and physical abuse) typically supersede subtypes associated with acts of omission (i.e., neglect). For example, Lau et al. (2005) examined children's functioning after assigning them to the following discrete hierarchical categories: (1) any sexual abuse (could include any other subtype of maltreatment), (2) any physical abuse, no sexual abuse (could include neglect and/or emotional abuse), (3) neglect-only, no sexual/physical abuse (could include emotional abuse), and (4) emotional abuse only. Results indicated that children in the sexual abuse group had greater behavior problems and post-traumatic stress symptoms than did children in the neglect-only group. Children in the physical abuse group also had greater post-traumatic stress symptoms than the neglect-only group. No subtype differences were found for internalizing behavior or adaptive functioning.

An advantage of the hierarchical approach is that children are assigned to discrete groups, which are easy to create and compare. A disadvantage of the hierarchical approach is that it necessitates a priori assumptions about the relative impact of maltreatment subtypes on functioning. Research has not consistently found that one specific form of maltreatment is related to more detrimental functioning than other forms across all outcomes (e.g., Eckenrode et al., 1993; Trickett & McBride-Chang, 1995). In addition, this approach is not able to account for more than a few combinations of maltreatment subtypes and grouping children by a predetermined hierarchy may obscure the effects of other specific combinations.

Review of subtype findings with person-centered approaches

Latent class (LCA) and latent profile (LPA; also known as continuous LCA) analyses are both person-centered approaches that allow researchers to classify individuals into mutually exclusive classes based on their experiences across observed variables of interest (e.g., maltreatment subtypes; Roesch, Villodas, & Villodas, 2010). This approach identifies patterns of experiences across variables rather than combining or controlling for variables. Classes or profiles are characterized by interpreting these patterns of experiences within and between classes. LCA/LPA approaches provide statistical criteria for determining the best solution. Classification of individuals is based on the probability of their membership in each class/profile (i.e., posterior probabilities); individuals are assigned to the class to which they have the highest probability of belonging based on their experiences on observed variables (Pears et al., 2008; Roesch et al., 2010). Although individuals can be assigned to a specific class/profile, an advantage of the LCA/LPA approach relative to other classification approaches (e.g., cluster analysis) is that posterior probabilities can be retained and utilized in prediction models, which reduces the error variance within classes/profiles.

Three studies have used LCA/LPA to categorize maltreated youth based on subtype characteristics (McCrae, Chapman, & Christ, 2006; Noonan et al., 2010; Pears et al., 2008). These studies have identified class solutions that demonstrated predictive utility; however, each study used different maltreatment characteristics (e.g., subtype, perpetrator, specific acts) or additional variables (e.g., family characteristics, ethnicity) to create classes and examined different outcomes, making comparisons difficult. The most relevant study for the current investigation utilized LPA to classify children based on severities of maltreatment subtype (Pears et al., 2008). This study examined the maltreatment profiles of preschool-aged children (ages 3–6, $n=117$) with histories of maltreatment who had been placed in non-relative foster care. A 4-profile solution was related to cognitive functioning and to internalizing and externalizing behavior problems. Specifically, lower cognitive functioning was related to profiles characterized by higher severities of both physical abuse and neglect. Children with relatively high mean severities on all maltreatment subtypes had the greatest number of externalizing behavior problems. Elevated

internalizing behavior problems were found for 3 of the 4 profiles, but not for the profile characterized by elevated severities of supervisory neglect and emotional abuse.

An advantage of using LCA/LPA techniques is that co-occurring maltreatment subtypes can be modeled explicitly and children can be assigned to classes without making assumptions based on relative detrimental impact. In addition, LCA/LPA implicitly models higher-order interactions, which reduces problems with power and interpretability seen in regression-based approaches. However, the statistics involved require advanced software and training and class solutions may not work for all samples (e.g., prevalence of maltreatment forms differ by age; [U.S. Department of Health and Human Services, Administration on Children and Families, 2005](#)). In addition, large sample sizes are typically needed to obtain reliable results using these methods.

The current study

The current study sought to examine the effects of maltreatment subtypes on the cognitive, academic, and mental health functioning of preadolescent youth in out-of-home care using 2 variable centered approaches (regression, hierarchical) and one person centered approach (latent class). Maltreatment subtypes examined included physical abuse, sexual abuse, physical neglect, and supervisory neglect, as these subtypes are those most likely to lead to child welfare investigations. Examining three analytic approaches using the same sample may provide greater insight into subtype effects and add to the growing body of literature on the effects of maltreatment subtype(s) on youth functioning.

Methods

Participants

Recruitment. Participants included youth and their current caregivers who were recruited between 2002 and 2009 for a randomized controlled trial of a preventive intervention for preadolescent youth (ages 9–11) placed in out-of-home care. This preventive intervention is known as the Fostering Healthy Futures (FHF) program and is described elsewhere ([Taussig, Culhane, & Hettleman, 2007](#)). Data utilized in the current study were collected from baseline interviews that occurred prior to randomization. Children were recruited if they met the following criteria: (1) they had been placed in out-of-home care by court order due to maltreatment within the preceding year, (2) they had lived with their current caregiver for at least 3 weeks, (3) they were not known to be significantly developmentally delayed, and (4) they were not monolingual Spanish speakers, as the interviews, testing, and intervention were conducted in English. When multiple members of a sibling group were eligible, one sibling was randomly selected to participate. Participation was voluntary and could not be court ordered. Ninety-two percent ($n = 373$) of children and their caregivers who met inclusion criteria agreed to participate in baseline interviews (pre-randomization). Data from children interviewed at baseline were excluded from the current analyses if their maltreatment records did not provide enough information to code maltreatment severity ($n = 22$) or if they did not experience 1 of the 4 primary subtypes (sexual abuse, physical abuse, physical neglect, supervisory neglect) of maltreatment that were the focus of the current study ($n = 17$). Children excluded for these reasons were more likely to be female ($\chi^2 = 6.00$, $p = .014$) and to have lower academic achievement scores (mean difference = -4.67 , $t = -2.05$, $p = .041$). They did not differ from the rest of the sample on any other demographic characteristics described below or variables of interest in the current study ($ps > .05$).

Participant characteristics. The study sample of 334 youth was 48.5% female, with a mean age of 10.30 ($SD = 0.90$). The racial/ethnic distribution of children (non-exclusive categories) was 48.8% Caucasian, 46.7% Hispanic/Latino, 27.8% African-American, 12.6% Native American, and 2.1% Asian. Children were placed primarily in non-relative foster (44.6%) or kinship (51.5%) care, while the remainder (3.9%) were placed in group homes, shelters, or residential treatment centers.

Procedures

This study was approved by the university's Institutional Review Board, and informed consent and assent were obtained from all participants. Youth and their current caregivers were interviewed by separate interviewers, typically in their homes. Children and caregivers were each paid \$40.00 for their participation. Legal petitions filed in the dependency and neglect court proceedings and social histories completed by caseworkers (used to code maltreatment) were obtained from participating counties' Departments of Human Services.

Measures

Maltreatment subtypes. Occurrence and severity of each subtype of maltreatment was assessed using the Maltreatment Classification System (MCS; [Barnett et al., 1993](#)) to code social histories completed by caseworkers and the legal petitions filed in the dependency and neglect court proceedings. Two trained research assistants coded each maltreatment record and final codes for each maltreatment subtype (i.e., occurrence and severity rating) were determined by consensus coding. Senior investigators were consulted if consensus could not be reached. Occurrence was coded as "yes/no" and severity was rated

on a scale from 1 to 5, with 5 representing the greatest severity. Children who did not experience a subtype of maltreatment received a 0 for occurrence and severity on that subtype. Estimates of interrater agreement on the MCS have ranged from .67 to 1.0 across several studies (Kim & Cicchetti, 2006; Manly, Cicchetti, & Barnett, 1994; Manly et al., 2001; Pears et al., 2008).

The current study focused on physical abuse, sexual abuse, physical neglect, and supervisory neglect, as these are the subtypes most reliably reported and are typically the primary reasons for child welfare referrals. Emotional abuse was not included in this study, as previous research with this sample indicates that emotional abuse is not a unitary construct and that functioning varies significantly depending on the subtype of emotional abuse (Taussig & Culhane, 2010). Only maltreatment that occurred within the 2 years prior to the dependency and neglect filing was coded because of concerns that information about past history of maltreatment would not be consistent and reliable across cases. However, a history of prior out-of-home episodes for the target child (yes = 1, no = 0) was used as a proxy measure of maltreatment chronicity.

Cognitive functioning. Children completed the Kaufman Brief Intelligence Test (K-BIT; $n = 166$) or the Kaufman Brief Intelligence Test, Second Edition (K-BIT-2; $n = 168$). The K-BIT and K-BIT-2 (Kaufman & Kaufman, 1990, 2004) are screening measures of intellectual functioning that yield Verbal, Nonverbal, and Composite estimates of IQ. Both versions of the K-BIT include 2 verbal subtests and one nonverbal subtest. The Verbal subtests were re-designed for the K-BIT-2 (Kaufman & Kaufman, 2004) to reduce subjectivity in scoring and to eliminate the need for the examinee to read items. The nonverbal subtest is similar in both versions. Split-half reliability coefficients ranged from .81 to .94 across both versions for the age range of the current study (Kaufman & Kaufman, 1990, 2004). Correlations between the K-BIT-2 and the original K-BIT were high in the standardization sample and ranged from .79 to .86 (Kaufman & Kaufman, 2004). In the current study, cognitive outcomes were indexed using both the Verbal and Nonverbal IQ scores because large discrepancies between Verbal (Mean = 91.66, SD = 13.28) and Nonverbal ($M = 99.59$, SD = 15.22) scores were common (37% of children had discrepancies of greater than 1 standard deviation).

Academic functioning. Children completed the Wechsler Individual Achievement Test, Screener (WIAT; $n = 166$) or the WIAT, Second Edition, Abbreviated (WIAT-2A; $n = 168$) (The Psychological Corporation, 1992, 2001). The WIAT and WIAT-2A both include measures of single word reading, spelling, and mathematics. The main difference between the WIAT and WIAT-2A is the format of the mathematics subtest. Split-half reliability coefficients ranged from .87 to .97 across both versions for the age range covered in this study. Correlations between the WIAT and WIAT-2A ranged between .78 and .88 in standardization studies (The Psychological Corporation, 2001). In this study, academic functioning was indexed using the WIAT composite score.

Mental health functioning. Caregivers completed the Child Behavior Checklist (CBCL) and youth completed the Trauma Symptom Checklist for Children (TSCC). The CBCL (Achenbach & Rescorla, 2001) is a widely used measure that produces standardized scores for Internalizing, Externalizing, and Total Behavior Problems. Its authors report acceptable levels of internal consistency (alphas ranging from .78 to .97) and test-retest reliability (correlations ranging from .82 to .94) (Achenbach & Rescorla, 2001). The Internalizing and Externalizing scales were used in the current study.

The TSCC (Briere, 1996) is a youth-report measure of post-traumatic stress and related symptomatology. It assesses symptoms of anxiety, depression, anger, posttraumatic stress, dissociation, and sexual concerns with 54 questions rated on a four-point scale anchored at 0 and 3, with 3 indicating more symptoms. Reliability estimates (Cronbach's alpha) range from .67 to .89 across the standardization sample and 3 child abuse centers reported in the TSCC technical manual (Briere, 1996). A composite score was created for this study by averaging responses across all 54 items (Range: 0–2.06).

Data analysis plan

Regression models. Two regression models were used to examine the unique contributions of maltreatment subtypes on functioning. In the first model, dichotomous variables representing the occurrence (yes/no) of the four subtypes of maltreatment were used to predict functioning. In the second model, the severity ratings for the four subtypes of maltreatment were used to predict functioning. Both models controlled for whether or not youth had had a prior episode of out-of-home care. Unstandardized regression coefficients are reported to provide information on the magnitude of change in functioning given a 1-unit increase in subtype variables. Squared semi-partial correlation coefficients are also provided as a measure of effect size and represent the unique variance in youth functioning accounted for by a given subtype.

Hierarchical models. Based on hierarchical approaches used in prior studies (Lau et al., 2005; Manly et al., 2001), participants were classified as follows: (1) sexual abuse alone or in combination with any other subtype; (2) physical abuse alone or in combination with physical or supervisory neglect (no sexual abuse); (3) physical neglect alone or in combination with supervisory neglect; and (4) supervisory neglect alone. Children were assigned to one of the mutually exclusive categories based on their maltreatment histories. Contrast codes were used to test the theoretical assumptions of the hierarchical approach, namely that: (1) the sexual abuse group would have worse functioning than the other 3 maltreatment groups, (2) the physical abuse group would have worse functioning than the 2 neglect groups, and (3) the physical neglect group

Table 1
Frequencies and mean severities of maltreatment subtypes experienced by youth.

Maltreatment subtype	Frequency % (n)	Mean severity (SD) full sample (with zeros)
Physical abuse	26.9 (90)	0.48 (0.93)
Sexual abuse	9.0 (30)	0.26 (0.89)
Physical neglect	52.4 (175)	1.24 (1.40)
Supervisory neglect	84.7 (283)	1.83 (1.49)

Note: Severity ratings range from 0 to 5. Children who did not experience a given subtype of maltreatment received a 0 rating for that subtype.

would have worse functioning than the supervisory neglect only group. Analyses controlled for whether or not youth had had a prior episode in out-of-home care.

Latent class models. Latent class analysis (LCA) was conducted using MPlus version 6.11 (Muthen & Muthen, 1998–2010). Maltreatment severity ratings were treated as ordinal variables using LCA (vs. continuous variables in LPA) because intervals between severity levels within a maltreatment subtype are unlikely to be equal and to allow for more detailed interpretation of specific severity levels within and between identified classes. The primary goal for using LCA is to identify the most parsimonious number of classes with similar patterns of maltreatment in a heterogeneous sample and then to compare average outcome measures across classes. The estimated parameters of the best fitting latent class model represent posterior probabilities, or in other words, the probability that an individual belongs to a particular class. Multiple fit indices were used to identify the optimal number of latent classes; fit indices included the sample size adjusted Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC), entropy, and the Bootstrapped Likelihood Ratio Test (BLRT). AIC and BIC are indicators of relative goodness-of-fit that penalize models for estimating too many parameters. Lower values of BIC and AIC suggest better relative fit. Entropy reflects how well classes can be distinguished and takes into account how accurately individual cases were classified given a specific class solution (Roesch et al., 2010). Entropy values greater than .7 are considered adequate, with values closer to 1 reflecting better fit. BLRT is an inferential test used to determine whether a model with k classes significantly improves model fit over a model with $k - 1$ classes (Roesch et al., 2010). The interpretability of class solutions was also considered by examining conditional response probabilities (CRPs). CRP is most easily understood within the context of the current study as the proportion of individuals *within* a specific class who have experienced a given severity level of a maltreatment subtype. CRP values were examined within and across classes to identify patterns for interpretation. Prior episode of out-of-home care was included as a covariate in all LCA models. For the purpose of reporting class membership, participants were assigned to a latent class based on their highest-class membership probability. Following the selection of the optimal class solution, youth functioning was compared statistically within MPlus based on the posterior probabilities for each class. This approach is analogous to ANCOVA, where the dependent variables correspond to measures of cognitive, academic, and mental health functioning and independent variables correspond to class membership. Cohen's d s are provided as the measure of effect size for significant class comparisons.

Results

Sample characteristics on study variables

The frequencies and mean severities of each maltreatment subtype are presented in Table 1, and means for measures of cognitive, academic, and mental health functioning are presented in Table 2. Over half (59.3%) of youth experienced more

Table 2
Means and standard deviations for dependent variables by maltreatment subtype using regression occurrence models.

	Sexual abuse n = 30	Physical abuse n = 90	Physical neglect n = 175	Supervisory neglect n = 283	Total sample N = 334
K-BIT Verbal	90.53 (14.14)	90.87 (13.15)	90.51 (13.27)	92.47 (12.87)	91.66 (13.28)
K-BIT Nonverbal	98.70 (15.74)	100.28 (14.06)	99.15 (16.61)	99.81 (14.96)	99.59 (15.22)
WIAT Composite	91.50 (15.45)	90.10 (13.74)	88.85 (12.64)	90.02 (13.42)	89.64 (13.57)
CBCL Internalizing	60.00 (12.07)	61.78 (11.02)	61.09 (11.09)	59.83 (11.55)	60.17 (11.28)
CBCL Externalizing	65.93 (9.79)	65.04 (11.20)	62.00 (12.01)	60.94 (11.76)	61.50 (11.96)
TSSC Mean	0.79 (0.46)	0.70 (0.46)	0.64 (0.38)	0.65 (0.41)	0.66 (0.41)

K-BIT = Kaufman Brief Intelligence Test; WIAT = Wechsler Individual Achievement Test; CBCL = Child Behavior Checklist; TSSC = Trauma Symptom Checklist for Children.

Note: Means not shown when occurrence of maltreatment subtype = no. Variables are not mutually exclusive. Higher scores on the K-BIT and WIAT reflect better performance. Higher scores on the CBCL and TSSC reflect more mental health problems.

Table 3

Means and standard deviations for dependent variables by maltreatment subtype classification using the hierarchical model.

	Sexual abuse <i>n</i> = 30	Physical abuse <i>n</i> = 78	Physical neglect <i>n</i> = 128	Supervisory neglect <i>n</i> = 98
K-BIT Verbal	90.53 (14.14)	90.23 (13.38)	90.48 (13.29)	94.68 (12.60)
K-BIT Nonverbal	98.70 (15.74)	100.19 (14.57)	99.38 (16.67)	99.67 (13.71)
WIAT Composite	91.50 (15.45)	88.55 (13.33)	88.65 (12.51)	91.22 (14.44)
CBCL Internalizing	60.00 (12.07)	62.73 (11.12)	60.73 (11.12)	57.35 (11.65)
CBCL Externalizing	65.93 (9.79)	65.23 (11.42)	61.17 (12.30)	57.59 (11.32)
TSCC Mean	0.79 (0.46)	0.69 (0.45)	0.62 (0.38)	0.64 (0.40)

K-BIT = Kaufman Brief Intelligence Test; WIAT = Wechsler Individual Achievement Test; CBCL = Child Behavior Checklist; TSCC = Trauma Symptom Checklist for Children.

Note: Groups are labeled by the predominant maltreatment subtype characterizing the group. The sexual abuse group can include children with any other maltreatment subtype. The physical abuse group can include children with either form of neglect, but not sexual abuse. The physical neglect group can include children with supervisory neglect, but not physical or sexual abuse. The supervisory neglect group consists of children with only this subtype. Higher scores on the K-BIT and WIAT reflect better performance. Higher scores on the CBCL and TSCC reflect more mental health problems.

than 1 of the 4 subtypes of maltreatment examined with a mean of 1.73 (SD = 0.72, Range 1–4) subtypes. Approximately one third of the youth (*n* = 113) had had a prior episode in out-of-home care.

Regression models

Regression models using dichotomous subtype variables. Table 2 provides means and standard deviations of dependent variables by maltreatment subtype. When all four dichotomous subtype variables were included in regression models, several subtypes uniquely accounted for significant variance in functioning after controlling for the other subtypes. Physical abuse was related to a greater number of caregiver-reported externalizing behavior problems ($B = 4.48$, $t = 2.93$, $p = .004$, $sr^2 = .025$) and supervisory neglect was associated with higher Verbal IQ scores ($B = 4.99$, $t = 2.39$, $p = .017$, $sr^2 = .017$). Sexual abuse approached significance in predicting greater caregiver-reported externalizing behavior problems ($B = 4.14$, $t = 1.83$, $p = .068$, $sr^2 = .010$) and greater youth-reported trauma symptoms ($B = 0.14$, $t = 1.79$, $p = .075$, $sr^2 = .010$). Physical neglect did not predict any of the dependent variables. Having a prior episode of out-of-home care was a significant predictor of lower academic achievement ($B = -3.55$, $t = -2.24$, $p = .026$, $sr^2 = .015$), after controlling for maltreatment subtypes.

Regression models using subtype severity variables. The pattern of associations between maltreatment subtypes and dependent variables differed somewhat when severity variables were included in regression models. Physical abuse severity was associated with more caregiver-reported internalizing ($B = 1.59$, $t = 2.36$, $p = .019$, $sr^2 = .016$) and externalizing ($B = 2.62$, $t = 3.72$, $p < .001$, $sr^2 = .040$) behavior problems. Sexual abuse severity approached significance in predicting higher levels of youth-reported trauma symptoms ($B = 0.05$, $t = 1.84$, $p = .067$, $sr^2 = .010$), but was not associated with caregiver-report of mental health problems. In contrast to results from analyses using the dichotomous variables, physical neglect severity was associated with more internalizing problems ($B = 0.95$, $t = 2.12$, $p = .035$, $sr^2 = .013$) and approached significance in predicting greater externalizing problems ($B = 0.84$, $t = 1.81$, $p = .072$, $sr^2 = .009$). Supervisory neglect severity did not predict any of the dependent variables. Having a prior episode of out-of-home care predicted lower academic achievement ($B = -3.76$, $t = -2.35$, $p = .019$, $sr^2 = 0.017$).

Hierarchical model

Table 3 provides means and standard deviations of dependent variables by the hierarchical maltreatment groups. Contrast coding of the maltreatment hierarchy revealed some findings complementary to the regression-based models. Specifically, all 3 contrasts were significant for caregiver-reported externalizing behavior problems, indicating that (1) the sexual abuse group had more externalizing behavior problems relative to the other groups ($B = 4.52$, $t = 2.03$, $p = .043$, $sr^2 = .012$), (2) the physical abuse group had more externalizing behavior problems than the 2 neglect groups ($B = 7.94$, $t = 3.88$, $p < .001$, $sr^2 = .042$), and (3) the physical neglect group had more externalizing behavior problems than the supervisory neglect group ($B = 3.45$, $t = 2.20$, $p = .029$, $sr^2 = .014$). For internalizing problems, the physical abuse group had more internalizing problems than the 2 neglect groups ($B = 5.31$, $t = 2.70$, $p = .007$, $sr^2 = .021$), and the physical neglect group had more internalizing problems than the supervisory neglect only group ($B = 3.20$, $t = 2.13$, $p = .034$, $sr^2 = .013$). In terms of cognitive functioning, the supervisory neglect group had better Verbal IQ scores than the physical neglect group ($B = -4.00$, $t = -2.24$, $p = .026$, $sr^2 = .015$). On the TSCC, the sexual abuse group approached significance suggesting that this group had more youth-reported trauma symptoms than the other groups ($B = 0.15$, $t = 1.84$, $p = .067$, $sr^2 = .010$). Similar to other models, a prior episode of out-of-home care was associated with poorer academic achievement ($B = -3.67$, $t = -2.32$, $p = .021$, $sr^2 = .016$).

Table 4
Model fit indices for maltreatment subtype severity latent class solutions.

Model	AIC	adjBIC	Entropy	BLRT	Classes: n, %
1 class	3349	3361	n/a	n/a	1: n = 332, 100%
2 class	2878	2903	0.69	61.45, p < .001	1: n = 284, 75% 2: n = 84, 25%
3 class	2866	2903	0.72	52.34, p < .001	1: n = 157, 47% 2: n = 135, 41% 3: n = 40, 12%
4 class	2858	2907	0.80	48.15, p < .001	1: n = 154, 47% 2: n = 109, 33% 3: n = 41, 12% 4: n = 28, 8%
5 class	2870	2933	0.81	26.99, p = .43	1: n = 160, 48% 2: n = 76, 23% 3: n = 38, 11% 4: n = 34, 10% 5: n = 24, 7%

AIC = Akaike Information Criterion; adjBIC = sample size adjusted Bayesian Information Criterion; BLRT = Bootstrapped Likelihood Ratio Test.

Note: Lower BIC and AIC values indicate better fit. Entropy should be greater than 0.7. Values closer to 1 are better.

Latent class models

Model fit indices for latent class solutions ranging from 1 to 5 classes can be found in Table 4. Comparison of indices suggested that the 4-class solution was the best-fitting model relative to the 1-, 2-, 3-, and 5-class solutions and it provided the most substantively meaningful interpretation. All classes in the 4-class solution represented at least 8% of the sample.

All 4 classes contained members who experienced multiple subtypes of maltreatment. However, the predominant maltreatment subtype and the extent to which members experienced multiple subtypes of maltreatment varied by class. All members of Class 1 (referred to as the Supervisory Neglect Class; $n = 154$) had experienced supervisory neglect, with the majority at low levels of severity (severity level 1 CRP = .70). Members of Class 1 were also the least likely to have experienced multiple subtypes of maltreatment; less than a third of members experienced physical neglect (CRPs = .30), one-seventh experienced physical abuse (CRPs = .15), and a negligible number experienced sexual abuse (CRPs < .01).

Class 2 (referred to as the Physical Neglect Class; $n = 109$) was comprised of children who had experienced physical neglect, ranging in severity from 1 to 5. Supervisory neglect (CPRs = .79) was the most common co-occurring child maltreatment subtype in Class 2. A small number of children in Class 2 had histories of mild physical (CRPs = .16, all severity 1) or sexual (CRPs = .05, all severity 1) abuse.

All children in Class 3 (referred to as the Physical Abuse Class; $n = 41$) had experienced physical abuse with severities ranging from 1 to 4. Some children also had experienced physical neglect (CRPs = .33) evenly distributed across severities and/or moderate to severe supervisory neglect (CRPs = .36, all severity 3 or 5). A small percentage of children in Class 3 had experienced moderate sexual abuse (CRPs = .10, all severities 2–4).

Class 4 (referred to as the Sexual Abuse/Mixed Class; $n = 28$) includes the largest relative percentage of youth with a sexual abuse history, with more than half of children experiencing sexual abuse (CRPs = 0.51, majority severity levels 3 and 4). The large majority of children in Class 4 had experienced moderate to severe supervisory neglect (CRPs = .86, most at severity 4), and over a third had experienced moderate physical neglect (CRPs = .39). Some children in Class 4 had also experienced physical abuse (CRPs = .27, all severity 1 or 4).

A prior episode out-of-home care significantly distinguished the Physical Neglect (Class 2) from the Supervisory Neglect (Class 1, $p = .024$) and the Physical Abuse (Class 3, $p = .001$) classes. Children in the Physical Neglect class were more likely than children in either the Supervisory Neglect or Physical Abuse classes to have a prior episode of out-of-home care.

Table 5
Means and standard errors for dependent variables by maltreatment subtype classification using latent class model.

	Sexual abuse/mixed $n = 28$	Physical abuse $n = 41$	Physical neglect $n = 109$	Supervisory neglect $n = 154$
K-BIT Verbal	86.90 (2.46)	90.27 (2.22)	90.64 (1.48)	94.08 (1.05)
K-BIT Nonverbal	98.12 (2.77)	98.75 (2.23)	99.44 (1.76)	100.31 (1.26)
WIAT Composite	87.03 (2.42)	90.56 (2.55)	88.49 (1.45)	90.57 (1.15)
CBCL Internalizing	61.66 (2.01)	60.45 (1.71)	61.81 (1.17)	58.57 (0.98)
CBCL Externalizing	61.51 (2.64)	64.29 (2.11)	61.89 (1.44)	59.62 (1.06)
TSCC Mean	0.74 (0.08)	0.70 (0.08)	0.63 (0.04)	0.65 (0.04)

K-BIT = Kaufman Brief Intelligence Test; WIAT = Wechsler Individual Achievement Test; CBCL = Child Behavior Checklist; TSCC = Trauma Symptom Checklist for Children.

Note: Classes are labeled by predominant maltreatment subtype, although all classes have members with comorbid maltreatment subtype patterns. Higher scores on the K-BIT and WIAT reflect better performance. Higher scores on the CBCL and TSCC reflect greater mental health problems.

Table 6
Summary of significant differences by maltreatment subtypes using three modeling approaches.

	Regression models: occurrence	Regression models: severity	Hierarchical models	Latent class models
K-BIT Verbal	SN ↑	None	SN > PN	SN > SA
K-BIT Nonverbal	None	None	None	None
WIAT Composite	priorEP ↓	priorEP ↓	priorEP ↓	None
CBCL Internalizing	n/a	PA ↑, PN ↑	PA > PN + SN, PN > SN	PN > SN
CBCL Externalizing	SA ↑, PA ↑	PA ↑, PN ↑	SA > other types, PA > PN + SN, PN > SN	PA > SN
TSCC Mean	SA ↑	SA ↑	SA > other types	None

K-BIT = Kaufman Brief Intelligence Test; WIAT = Wechsler Individual Achievement Test; CBCL = Child Behavior Checklist; TSCC = Trauma Symptom Checklist for Children; SA = sexual abuse; PA = physical abuse; PN = physical neglect; SN = supervisory neglect; priorEP = prior out-of-home episode.

Note: Italics reflect differences that approached significance ($p < .10$). Higher scores on the K-BIT and WIAT reflect better performance. Higher scores on the CBCL and TSCC reflect more mental health problems. Up (↑) or down (↓) arrows indicate that mean functioning scores increased/decreased with occurrence or greater severity of the specific subtype of maltreatment.

A comparison of children's functioning by class membership revealed several significant differences (see Table 5). Similar to other methods examined, children in the Physical Abuse class had more externalizing problems than children in the Supervisory Neglect class ($p = .050$, $d = 0.35$). Children in the Physical Neglect class had more internalizing problems than children in the Supervisory Neglect class ($p = .041$, $d = 0.27$). Children in the Supervisory Neglect class had higher verbal IQ scores than children in the Sexual Abuse/Mixed class ($p = .009$, $d = 0.55$). No class differences were identified for nonverbal IQ, academic achievement, or youth-reported trauma symptoms. See Table 6 for a summary of maltreatment subtype differences across the 3 approaches.

Discussion

The current investigation is one of a small number of studies to examine the effects of maltreatment subtype on cognitive, academic, and mental health functioning within a sample of children who had all experienced maltreatment. Children with histories of maltreatment often experience multiple subtypes, which make evaluating subtype effects challenging. The current study employed several analytic approaches, using both variable-centered and person-centered methodologies, to assess the effects of maltreatment subtype on functioning. The 3 analytic approaches included: (1) a regression approach, (2) a hierarchical approach, and (3) a latent class approach. This is the first study to utilize these 3 specific approaches and one of only a few studies that have compared approaches for analyzing co-occurring maltreatment subtypes (e.g., Lau et al., 2005; Litrownik et al., 2005). The effects of maltreatment subtypes on children's functioning were relatively consistent across all 3 approaches used in the current study (see Table 6 for a summary).

Consistent subtype differences identified across methods

Many findings from the current study replicate those from the broader body of literature. Specifically, a robust relationship was found in the current study between physical abuse (occurrence or severity) and externalizing behavior problems across all 3 approaches. This finding was not surprising given that aggression and externalizing problems are the most extensively documented clinical consequences associated with physical abuse in the literature (for a review see Myers, 2011). Sexual abuse and physical neglect were also independently associated with more externalizing behavior problems when comparisons were made with the regression and hierarchical approaches. Children who have been sexually abused often have more externalizing behavior problems than youth without sexual abuse histories; however, the level of problems does not always reach clinically significant levels (Myers, 2011), which may partially account for the less robust effect across approaches in the current study. Physical neglect has also been associated with externalizing behavior problems (e.g., English et al., 2005; Trickett & McBride-Chang, 1995), although this relationship has received more limited investigation and has been complicated by the use of different operational definitions of neglect subtypes.

In terms of internalizing behavior, physical neglect was consistently related to elevated problems across methods, which is consistent with multiple previous studies (e.g., English et al., 2005; Manly et al., 2001; Trickett & McBride-Chang, 1995). Physical abuse was also associated with more internalizing behavior problems when comparisons were made with the hierarchical and regression approaches. While less robust than the association between externalizing behavior problems and physical abuse, an association between internalizing symptoms and physical abuse is also commonly reported (Myers, 2011). In contrast to the large body of research that has documented an association between sexual abuse and caregiver-reported internalizing symptoms (Myers, 2011), the current study did not find this relationship. The relatively small number of children with sexual abuse in the current sample and within maltreatment group comparisons (vs. comparison with a non-maltreated group) may account for this difference. However, the relationship between sexual abuse and youth-reported

trauma symptoms approached significance in analyses using the hierarchical and regression approaches, which is consistent with previous research (Lau et al., 2005; Trickett & McBride-Chang, 1995).

A few studies that have compared maltreated to non-maltreated youth have investigated the effects of maltreatment subtypes on cognitive and academic functioning. These studies generally report that neglect has the most detrimental effects on cognitive functioning and academic achievement, but that physical abuse is more often related to disciplinary referrals and suspensions, relative to non-maltreated youth (Eckenrode et al., 1993; Veltman & Browne, 2001). The current study did not find any subtype differences in nonverbal IQ scores or academic achievement. These findings, if replicated, might suggest that maltreatment subtype has little influence in these domains above and beyond the occurrence of maltreatment. Chronicity of maltreatment may play a larger role in predicting academic functioning for maltreated youth, as a prior episode of out-of-home placement was related to lower academic achievement in this sample across analytic methods.

Unique findings: The importance of examining supervisory neglect separately

The current study adds greater insight into the effects of supervisory neglect on child functioning. The majority of studies combine multiple forms of neglect (e.g., physical, supervisory, emotional), but the current study found that children with predominately supervisory neglect differed significantly from other maltreated youth (including those with physical neglect) on verbal IQ scores. Specifically, findings from all 3 methodological approaches suggested that children with low severity supervisory neglect tended to have relatively higher verbal IQ scores than other maltreated youth. Children with low severity supervisory neglect were the least likely of all maltreated youth to have experienced other forms of maltreatment. In addition, they also tended to have relatively fewer internalizing and externalizing behavior problems than children with other or multiple forms of maltreatment. It is important to note, however, that although children with supervisory neglect were functioning relatively better on measures of verbal IQ and behavioral functioning than other maltreated groups, their mean scores on these measures were half to a full standard deviation worse than the mean scores of normative samples. Consequently, findings from the current study do not suggest that children who experience supervisory neglect are functioning as well as their non-maltreated peers, but they do suggest that studies should not combine supervisory and physical neglect in analyses designed to tease apart the effects of neglect on functioning. Additional study of this issue is warranted, however, as previous studies that have examined the effects of physical and supervisory neglect separately within maltreated samples have not found this relationship on measures of mental health or adaptive functioning (English et al., 2005; Litrownik et al., 2005).

Differences across analytic methods in the current study

Despite many consistent findings, a few differences in subtype effects were noticed across analytic methods in the current study. These differences may be due to the index of maltreatment utilized (i.e., occurrence or severity) or characteristics of the analytic approaches. For example, a few differences emerged in the regression approach depending on whether subtype occurrence or severity variables were used. Differences were primarily noted for physical and supervisory neglect subtypes. Specifically, the severity of physical neglect was related to internalizing and externalizing behavior problems, but the occurrence of physical neglect was not. In contrast, the occurrence of supervisory neglect was related to higher verbal IQ scores, but the severity of supervisory neglect was not. These differences may be due to the type of association (i.e., linear, nonlinear) between subtype severity and functioning and the relative number of cases at each severity level. In addition to variations due to the indices of maltreatment analyzed, the method of classification may also have led to differences across methods. For example, both the latent class and hierarchical approaches assigned individuals to groups based on maltreatment profiles. The a priori classification system used in the hierarchical approach may have accentuated group differences whereas statistical assignment based on similar patterning in the latent class approach may have reduced these differences.

Possible sources of variability in findings across studies using maltreated samples

A limitation within the body of work on maltreatment subtype effects is the heterogeneity of methodologies used, which complicates the ability to draw conclusions across studies. Currently, there is insufficient evidence for a “gold-standard” approach to address this important issue. Only a small number of studies have examined the effects of maltreatment subtypes on functioning within samples of children who have all experienced maltreatment (e.g., English et al., 2005; Lau et al., 2005; Litrownik et al., 2005; Pears et al., 2008; Taussig, 2002). Findings from the current study are consistent with some subtype differences in functioning identified in these studies, but not with others. Given the small number of studies, the fact that these studies have employed heterogeneous methods, and the substantial variability in findings across maltreatment subtypes and domains of functioning, it is difficult to compare results and synthesize meaningful conclusions across studies at this time. Results from the current study add to this growing body of literature, but additional studies are needed before clear patterns can be identified.

In addition to heterogeneous statistical methodologies, additional factors may contribute to the variability in findings across studies. These factors include: (1) differences in the overall sample size and the relative proportion of children per subtype, (2) the age of the children under investigation, (3) the subtypes of maltreatment examined, (4) the measures used

to assess functioning, and (5) the nature of the sample being studied. Studies that have examined the effects of maltreatment subtype on children's functioning using similar approaches within a maltreated sample have ranged in sample size from 117 (Pears et al., 2008) to 519 (Lau et al., 2005; Litrownik et al., 2005). The distribution of cases across maltreatment subtypes is likely to influence the ability to detect effects. For example, in the Lau et al. study, sexual abuse (20.2% of the sample, ages 0–8) was associated with greater post-traumatic symptoms than neglect when analyzed with the hierarchical approach. In contrast, Litrownik et al., using the same sample, did not find an association between sexual abuse (9.1% of the sample, ages of 4–8) and post-traumatic stress using a regression-based approach. The age of participants is another important consideration. The majority of studies examining maltreatment subtype effects have been conducted with the LONGSCAN sample on Age 8 functioning (English et al., 2005; Lau et al., 2005; Litrownik et al., 2005). Maltreatment experiences often vary by age (U.S. Department of Health and Human Services, Administration on Children and Families, 2005), and thus it is likely that subtype effects on children's functioning would also differ by age.

Studies have also varied in the subtypes of maltreatment included in analyses and whether additional aspects of maltreatment were modeled (e.g., age of onset, chronicity, past maltreatment subtypes; English et al., 2005). For example, most other studies have included emotional abuse in analytic models. The current study did not include emotional abuse because prior research with this sample identified that emotional abuse is not a unitary construct and that functioning differs significantly depending on the subtype of emotional abuse experienced (Taussig & Culhane, 2010). In addition, different forms of neglect are often grouped together, especially in hierarchical models. As discussed above, results from the current study do not support combining supervisory and physical neglect as this may obscure some group differences in functioning. Finally, results from the current study may also differ from the results of other studies because maltreatment was only measured during the 2 years prior to the filing of the dependency and neglect legal petition. Chronicity of maltreatment may have a bigger impact on functioning in some domains than either the occurrence or severity of specific maltreatment subtypes, particularly during certain developmental stages (Bolger & Patterson, 2001; Manly et al., 1994, 2001).

Implications

Findings from the current study have implications for treatment planning, resource allocation, policy, and legal decisions. Results from the current study indicate that children who have experienced abuse, especially physical abuse, are at higher risk for caregiver-reported externalizing behavior problems than children who have experienced neglect. Children who have been physically abused and children who have experienced physical neglect were those at greatest risk for caregiver-reported internalizing symptoms, while sexual abuse seemed to be associated with youth-reported trauma symptoms. Although mental health screening and individualized treatment planning is warranted for all maltreated youth (Romanelli et al., 2009), these findings highlight potential behavioral targets for preventive interventions for those children with subthreshold symptoms or at risk for mental health problems based on specific maltreatment experiences. Specifically, results suggest that preventive interventions effective in targeting externalizing symptoms should be considered for youth who have been physically abused and that interventions effective in targeting internalizing symptoms should be considered for youth who have been physically abused, sexually abused, and/or physically neglected. Children who experienced predominantly low severity supervisory neglect tended to have better levels of functioning across most domains relative to other maltreated youth in out-of-home care. When resources are scarce, it may be necessary to prioritize services for the more high-risk youth who have experienced other types of maltreatment. Results also indicated that poor academic functioning is associated with multiple episodes of out-of-home care, suggesting that children with multiple episodes should be closely monitored for academic difficulties. In addition, findings from the current study may be relevant for legal decisions (e.g., placement, reunification) and policy decisions within agencies (e.g., coordination with mental health agencies, allocation of services, triage).

Conclusions

In summary, the current study provides evidence that children's functioning varies by the maltreatment subtype(s) they have experienced. Consistent subtype effects in mental health and cognitive functioning were found across several analytic approaches that accounted for the occurrence or severity of multiple maltreatment subtypes. Future research is needed to evaluate if these findings vary by age, developmental timing or chronicity of maltreatment, living situation (i.e., out-of-home care vs. with biological parents), and presence or absence of additional risk factors (e.g., community violence exposure). Additional studies are needed of maltreatment subtype effects on functioning in samples of children who have all experienced maltreatment. Such studies are particularly relevant for child welfare and service allocation decisions. Further comparisons of methodological approaches with varying samples will aid in determining the relative utility among approaches. Until evidence of a "gold standard" approach emerges, researchers should consider the advantages and disadvantages of each approach and their interpretive distinctions prior to selecting which approach to use.

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