



COLORADO

**Office of Children,
Youth & Families**

Division of Child Welfare

Date: September 7, 2017

To: All County Human Services Directors

From: Ann Rosales, MSW, Director - Division of Child Welfare

Title: Predictive Analytics

Regarding: Child(ren)/youth identified through predictive analytics

Key Words: Adoption, permanency, legally free, predictive analytics

Number: IM-CW-2017-0042

Information Memorandum

The purpose of this memorandum from the Division of Child Welfare (DCW) is to inform all county human/social service directors about the predictive analytics follow-up efforts. Please forward pertinent information to administrators, caseworkers, and other staff members as necessary.

In 2015, a research study was conducted by the Colorado Department of Human Services to examine factors that impact permanency for legally free children/youth in the child welfare system. Data regarding legally free children/youth was gathered from the state automated child welfare system (TRAILS) from January 2008 through August 2014 to identify predictive variables. The study identified distinct factors impacting permanency specific to age groups, ethnicity, gender, permanency goal and length of stay. Using the predictive factors, an algorithm was created to calculate the risk of emancipation. The algorithm was then applied to the legally free population in child welfare to identify children/youth with a high risk score for emancipation.

Quarterly, the predictive analytics algorithm is utilized to review the current legally freed children/youth in child welfare to generate a list of children/youth that have a high risk score for emancipation.

The current list of children/youth that have a high risk score consists of 58 statewide. The permanency specialist overseeing predictive analytics reviews the list to collect case specific information. Of the 58 children/youth, 10 are chosen to receive direct support from the DCW Permanency Specialist, until the children/youth achieves permanency or emancipate from the child welfare system. DCW's Ongoing Services Unit conducts monthly meetings to either select new children/youth from the list or review existing children/youth for further case support. The direct support provided by the DCW Permanency Specialist overseeing predictive analytics entails:

- Identifying barriers to permanency;
- Referral to Dave Thomas Foundation for Wendy's Wonderful Kids Recruiter; and
- Attending any corresponding meetings such as, but not limited to;
 - Facilitated Family Engagement Meetings (FFEM),
 - Permanency Roundtables (PRT), and
 - Staffings.

The overall goal of predictive analytics is to identify trends, themes and or systemic barriers that impede permanency efforts.

Upon the children/youth being identified via predictive analytics, the county will be notified by the DCW Permanency Specialist via email. The DCW Permanency Specialist will work in collaboration with county departments to support these children/youth. We hope predictive analytics will support county departments efforts to provide for these children/youth and families.

Attached is the research study that was previously mentioned, "*Factors affecting permanency for legally free children & youth: A study of Colorado's legally free population across age groups, 2008-2014*".

This communication has been sent to all county human services directors. Please forward pertinent information on to staff members a you deem necessary.

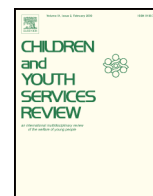
We look forward to our work together to continue to improve the safety of Colorado's children and families.

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Factors affecting permanency for legally free children & youth: A study of Colorado's legally free population across age groups, 2008–2014

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ABSTRACT

Legally freed children and youth whose parents have had their parental rights terminated have been shown to be more likely to emancipate from the child welfare system as a result of facing a series of complex factors that affect their likelihood of achieving permanency. To better understand these complex factors, the Colorado Department of Human Services' Division of Child Welfare utilized survival analysis to comprehensively examine the factors that affect permanency for legally free children and youth. Factors affecting permanency outcomes were analyzed for more than 5700 legally free children and youth within Colorado's child welfare system during the period of January 2008 to August 2014. Overall, the majority of Colorado's legally free children and youth achieved a positive permanency outcome. However, the results of the survival analysis reveal distinct factors affecting the permanency of children and youth in distinct age groups, including: children who became legally free after birth through five years in age, children who became legally free between six to twelve years in age, and youth who became legally free between thirteen to seventeen years in age. Across all age groups, African American race, number of prior involvements, permanency goal, age, number of placements while in care, and the time spent in congregate care or family-like settings were found to have statistically significant effects on the likelihood of achieving permanency. Collectively, the findings highlight the distinct factors affecting permanency across different age groups as well as the need for future research to examine the disparate factors affecting permanency outcomes across different age groups.

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1. Introduction

Legally free children, whose parents have had their parental rights terminated, are in need of a permanent home. Establishing permanent homes for legally freed children (commonly referred to as “permanency”) has become a top priority within recent decades (Smith, 2003), beginning with the passage of the *Adoption & Safe Families Act of 1997* (ASFA). Key components of ASFA include establishing permanent legal connections, improving the timeliness to permanency, and decreasing the number of children and youth who exit the child welfare system without legal permanency. Despite these laudable goals, tens of thousands of legally free children and youth continue to experience lengthy stays in the child welfare systems prior to establishing a permanent connection or, in less fortunate circumstances, emancipating from the child welfare system without achieving permanency (Cushing & Greenblatt, 2009; Noonan & Burke, 2005). The length of time that a legally free child or youth spends in care prior to achieving permanency

is determined by a collection of complex factors that affect their likelihood of achieving permanency, including race (McDonald, Poertner, & Jennings, 2007), gender (Cushing & Greenblatt, 2009), physical and mental disabilities (Connell, Katz, Saunders, & Tebes, 2006), and placement setting (Cheng, 2010; Connell et al., 2006; Cushing & Greenblatt, 2009; Zinn, 2009, 2011), among others.

Age is a prominent, but commonly understudied factor affecting the permanency of legally free children and youth. Previous research has found that each year that a child spends in foster care after the termination of parental rights reduces the likelihood of adoption by 80% (Cushing & Greenblatt, 2009). The age of a child has also been shown to be an important predictor of foster care length of stay and outcomes success, with the foster care length of stay inversely related to a child's age at the time of placement (Becker, Jordan, & Larsen, 2007). Similarly, younger children who were placed into care during their first year were found to be twice as likely to achieve permanency as older children (Kemp & Bodonyi, 2000). Collectively, previous research has demonstrated the strong effect that age can have on a child's likelihood of achieving permanency.

However, the existing literature on permanency has yet to fully investigate whether different factors are associated with achieving permanency for children and youth of differing ages. A notable limitation of previous permanency research has been the tendency for studies

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to treat children and youth of different ages as a homogenous population as opposed to distinct sub-populations (Connell et al., 2006; Noonan & Burke, 2005; Potter & Klein-Rothschild, 2002). Another common approach within previous research has been to include age groups as explanatory variables within multivariate models (Becker et al., 2007; Kemp & Bodonyi, 2002; McDonald et al., 2007; Testa, 2001). While this approach provides valuable insight into the effect that different age groups can have on permanency outcomes, the approach fails to construct separate explanatory models that could be utilized to determine the factors that affect the likelihood of achieving permanency across different age groups. Collectively, the extant research perpetuates the problematic assumption that a child who became legally free at a young age experiences a similar likelihood of achieving permanency as a youth who became legally free at the age of 17, and is rapidly approaching emancipation from the child welfare system. Kemp and Bodonyi (2000) have voiced a similar concern about the tendency of child welfare research to treat children and youth of disparate ages as a homogenous group, noting a need for research that enables comparisons of permanency outcomes across different age groups. More recently, research on permanency outcomes by Casey Family Programs (Rogg, Davis, & O'Brien, 2011) has highlighted the need for research to better understand the differences in permanency across various age groups. Together, these studies underscore the need for a better understanding of the factors affecting the likelihood of achieving permanency across different age groups.

To address the critical need for a better understanding of the factors affecting permanency across different ages, this article reports on the efforts of the Colorado Division of Child Welfare's (DCW) Research and Analysis, Permanency Services, and Youth Services units to utilize a series of Cox regression models to identify the factors affecting permanency for legally free children and youth within different age groups. As part of its performance management process, DCW's units used existing program data to examine the permanency outcomes of 5773 legally free children and youth in Colorado between 2008 and 2014. Overall, the vast majority of Colorado's legally free children and youth achieved a positive permanency outcome, with 88.4% of the population achieving permanency. The results demonstrate that children and youth in different age groups are affected by different factors, with children who became legally free between birth and the age of five experiencing a different set of factors than children who became legally free between the ages of 6 and 12, and youth who became legally free between the ages of 13 and 17. In addition to identifying the unique factors affecting permanency for children and youth within each of the three age groups, this analysis also identifies a collection of factors affecting permanency across all age groups. African American race, number of prior involvements, permanency goal, age, number of placements while in care, and the time spent in congregate care or family-like settings were found to have statistically significant effects on the likelihood of achieving permanency across all age groups.

2. Methods

Data for this analysis was collected from Trails, Colorado's Statewide Automated Child Welfare Information System (SACWIS) in September of 2014. Trails serves as the state's case management system, with case-workers legally required to enter all pertinent information related to a child welfare case into the Trails system. To obtain the sample, the requisite data was pulled from Trails using a combination of search parameters, logic, and filters. The sample for the analysis consisted of all children and youth who were legally free between the periods of January 1, 2008 and August 31, 2014.¹ For the purposes of this analysis, legally freed children and youth were defined as any child or youth that

was legally free for adoption as the result of both of the child or youth's parents having their parental rights legally terminated. The total sample size for the analysis was 5773 children and youth. Building upon previous research demonstrating the disparate permanency outcomes by age type (Becker et al., 2007; Connell et al., 2006; Larsen-Rife & Brooks, 2009; Rogg et al., 2011), this analysis examined the likelihood of achieving permanency across different age groups. Legally free children and youth within the sample were divided into three age categories, based upon the age that the child or youth became legally free: birth through five years old ('<1–5'), six through 12 years of age ('6–12'), and 13 through 17 years of age ('13–17').

This analysis utilized survival analysis (also known as Time-to-Event analysis) in the form of stratified Cox regression models to examine the factors affecting the likelihood of whether legally free children and youth achieved permanency. Survival analysis provides an appropriate methodology for modeling the time to an event, such as permanency, by estimating the likelihood of occurrence for a given outcome and the factors associated with an increased or decreased risk. The methodology accounts for censored cases² that did not experience an event during the period of analysis and incorporates information from censored and uncensored cases in estimating the probability of an event occurring. A detailed description of the Cox regression models is provided within the 'Results' section of this article.

2.1. Operational measures

This section provides an overview of the outcome and predictor variables that were used in the analysis. Based upon a review of the extant literature as well as the professional opinions of the Division of Child Welfare's Permanency Services, Youth Services, and Research and Analysis units, a collection of predictor variables that could affect the likelihood of achieving permanency were identified.

2.1.1. Outcome variables

The outcome variables for this analysis measure the time to achieving permanency which was calculated via a two-step process. In the first step, a dichotomous 'Permanency Achieved' variable was constructed with the variable coded as 0 for cases where a child or youth did not achieve permanency and 1 for cases where permanency was achieved. Cases where a child or youth did not achieve a permanent outcome consisted of cases that ended due to death, a failed adoption,³ running away, or emancipation as well as those cases that were censored due to the child continuing to be legally free as of the last day of the analysis. Cases with a permanency outcome consisted of children and youth who were either adopted or placed for adoption⁴ during the period of analysis, had a guardianship, were living with another relative, or were reunited with their parents.

In the second step, the 'Legally Free Length of Stay' outcome variable was calculated by determining the number of months that a child was legally free until they achieved a permanent outcome or emancipated from the child welfare system (Orsi, 2015). The length of stay was calculated by subtracting the date that the parental rights of both parents were terminated and the child became legally free from the date that the Division of Child Welfare ended its involvement with the child. For children and youth without an involvement end date, a censoring date of August 31, 2014 (the last day of the period of analysis) was included. The 'Legally Free Length of Stay' variable was divided by 30 to calculate the number of months that a child was legally free prior to the permanency event.

² Censored cases consisted of cases where a child or youth did not achieve permanency due to emancipation, a failed adoption, running away, or death as well as those cases that were right-censored due to the child continuing to be legally free as of the last day of the analysis.

³ Children or youth that experienced a failed adoption exited the sample at the date of the failed adoption and did not re-enter the sample.

⁴ Placed for adoption was defined as an adoption that was in the process of being finalized.

¹ Children and youth within the sample became legally free at any point between January 2008 and August 2014 and could have entered or exited the sample at any time between those dates.

2.1.2. Predictor variables

2.1.2.1. Race. Previous permanency research has noted that minority children have the poorest permanency outcomes (Larsen-Rife & Brooks, 2009; McDonald et al., 2007) and that African American children are at a considerably higher risk for poor outcomes (Potter & Klein-Rothschild, 2002). Race variables were constructed using data on Federal race categories entered into the Trails database. Categories consisted of: Caucasian, Asian, Black/African-American, Hawaiian/Other Pacific Islander, Hispanic, Native American/Alaskan Native, Two or More Races, and Unable to Determine. For ease of analysis (as well as small sample sizes for several of the categories), the Federal race categories were condensed into four categories: Caucasian, Hispanic, African American, and other races.

2.1.2.2. Gender. Males have been shown to achieve permanency at a lower rate than females (Kemp & Bodonyi, 2000). A dichotomous gender variable was constructed with females coded as 0 and males coded as 1.

2.1.2.3. Physical Disability. Previous research has noted that children with physical disabilities are significantly less likely to achieve a positive outcome (Courtney & Wong, 1996) and to remain in care for significantly longer periods of time (Connell et al., 2006). A dichotomous variable was constructed for children and youth who caseworkers had reported in the case notes as having a physical disability.

2.1.2.4. Mental Disability. Children and youth diagnosed with mental disabilities have been found to be significantly less likely to achieve permanency (Courtney & Wong, 1996). A dichotomous variable was constructed for children and youth who caseworkers had reported in the case notes as having a mental disability.

2.1.2.5. Neglect & Abuse. The category of abuse or neglect experienced by a child or youth was utilized to construct abuse and neglect variables.⁵ Abuse consisted of intra-familial, third-party and institutional abuse, while neglect consisted of intra-familial, third-party, and institutional neglect.

2.1.2.6. Number of involvements before removal. Children and youth with previous involvements in the child welfare system have been found to achieve lower levels of permanency (Connell et al., 2006). A continuous variable was created to measure the number of involvements with the child welfare system that a child or youth experienced prior to being removed from the home and eventually becoming legally free. While involvements with the system can be broadly defined to include initial referrals, safety assessments, or the opening of a child welfare case, this analysis used a more restrictive definition with involvements operationalized as the opening of a child welfare case.

2.1.2.7. Age at termination of parental rights (TPR). The age of a child or youth at the termination of parental rights was calculated by subtracting a child or youth's date of birth from the date that the child or youth became legally free due to both parents having their parental rights terminated.

2.1.2.8. Permanency Goal. A categorical variable was constructed to reflect the most recent permanency goal for a legally free child or youth. Permanency goals consisted of: adoption/guardianship or Other Planned Permanent Living Arrangement (OPPLA)⁶. Previous research

has noted that the use of OPPLA goals has a negative impact on the likelihood of adoption, and that when a goal is changed to OPPLA efforts to achieve permanency often cease, resulting in youth aging out of foster care prior to achieving permanency (Cushing & Greenblatt, 2009).

2.1.2.9. County. A categorical county variable was constructed to examine the effect of differing county practices on permanency outcomes. The variable identified the county in which a legally free child or youth was most recently placed. Among Colorado's 64 counties, the 10 largest counties are responsible for nearly 90% of the child welfare population. These 10 counties were included within the categorical variable, while a Balance of State category was used to condense the other 54 counties into a single group within the variable.

2.1.2.10. Siblings in Care. Research indicates that siblings have similar experiences within child welfare systems (Connell et al., 2006; Webster, Shlonsky, Shaw, & Brookhart, 2005). The Case ID field within Trails was utilized to identify legally free children with a legally free sibling. For those children and youth with legally free siblings, the Case ID was utilized to designate groups of legally free siblings.

2.1.2.11. Number of Placements. Previous research has noted that youth who experience multiple placements are less likely to achieve permanency as a result of experiencing fewer opportunities to develop relationships with potential adoptive families (Cushing & Greenblatt, 2009). A continuous variable was created to measure the number of times that a child or youth resided in a placement outside of their own home after the date that they became legally free. Placements were tracked using the 'Unique Placement ID' variable within Trails, which records each unique setting in which a child was placed.

2.1.2.12. Months in a Congregate Care Setting. Children residing in residential settings have fewer opportunities to develop permanency connections while in care (Becker et al., 2007). A continuous variable was created to calculate the number of months that a legally free child or youth was in a congregate care setting. Congregate care was defined as a group home or center, a psychiatric residential treatment facility, a residential child care facility, a residential child care facility shelter, a therapeutic residential child care facility, a psychiatric residential treatment facility, a transitional living placement, detention, or a Division of Youth Corrections facility.

2.1.2.13. Months in a Family-Like Setting. Previous research has found that kinship care, commonly defined as living with relatives or close family friends, can delay permanency (Connell et al., 2006), though more recent research by Koh (2010) has raised doubts about previous perceptions that regarded kinship placements as having an adverse effect on legal permanence. A continuous variable was created to calculate the number of months that a legally free child or youth was in a family-like setting. A family-like setting was defined as residing in either a foster care placement or residing with kin.

3. Results

The results of the analysis are presented in two parts. The first part presents an overview of the descriptive statistics for each of the three age groups. The second part presents an explanatory analysis comprised of a collection of Cox regression models measuring the factors affecting permanency for each age group.

3.1. Descriptive analysis

Table 1 presents the descriptive characteristics for legally freed children and youth across the three age groups. The three groups are comprised of children who became legally free between the ages within the specified age group and remained in the state's child welfare system

⁵ Due to difficulties within the Trails system in linking the maltreatment type associated with a referral to a removal, information on maltreatment type was not collected for all children.

⁶ The OPPLA term is often used interchangeably with APPLA (Another Planned Permanent Living Arrangement).

Table 1
Demographics of legally free children (January 2008–August 2014).

Variable	<1–5 years	6–12 years	13–17 years	All Ages
# of legally free children	3839 (66.5%)	1655 (28.7%)	279 (4.8%)	5773
Permanency outcome (by type)				
Adoption	3552 (92.5%)	1256 (75.9%)	173 (62.0%)	4981 (86.3%)
Living with other relatives	36 (0.9%)	34 (2.1%)	5 (1.8%)	75 (1.3%)
Reunification	2 (0.1%)	10 (0.6%)	5 (1.8%)	17 (0.3%)
Guardianship	10 (0.3%)	14 (0.9%)	2 (0.7%)	26 (0.5%)
Emancipated	21 (0.6%)	118 (7.1%)	58 (20.8%)	197 (3.4%)
Other (death, runaway, failed adoption)	4 (0.1%)	10 (0.6%)	10 (3.6%)	24 (0.4%)
Censored (still in care)	214 (5.6%)	213 (12.9%)	26 (9.3%)	453 (7.8%)
Age at TPR in years (mean)	2.0	8.4	14.3	4.4
Race				
Caucasian	1602 (41.7%)	765 (46.2%)	153 (54.8%)	2520 (43.7%)
Hispanic	1498 (39.0%)	626 (37.9%)	89 (31.9%)	2513 (38.3%)
African American	421 (11.0%)	162 (9.8%)	25 (9.0%)	608 (10.5%)
Other races	318 (8.3%)	102 (6.2%)	12 (4.3%)	432 (7.5%)
Male	2052 (53.5%)	850 (51.4%)	124 (44.4%)	3026 (52.4%)
Siblings in Care	2189 (57.0%)	1250 (75.5%)	176 (63.1%)	3615 (62.6%)
Physical Disability	169 (4.4%)	102 (6.2%)	16 (5.7%)	287 (5.0%)
Mental Disability	75 (2.0%)	144 (8.7%)	26 (9.3%)	245 (4.2%)
Ten-large counties				
Adams	536 (14.0%)	236 (14.3%)	28 (10.0%)	800 (13.9%)
Arapahoe	422 (11.0%)	133 (8.0%)	25 (9.0%)	580 (10.1%)
Boulder	141 (3.7%)	49 (3.0%)	11 (3.9%)	201 (3.5%)
Denver	854 (22.3%)	331 (20.0%)	37 (13.3%)	1222 (21.2%)
El Paso	424 (11.0%)	205 (12.4%)	45 (16.1%)	674 (11.7%)
Jefferson	394 (10.3%)	151 (9.1%)	24 (8.6%)	569 (9.9%)
Larimer	104 (2.7%)	52 (3.1%)	15 (5.4%)	171 (3.0%)
Mesa	182 (4.7%)	106 (6.4%)	26 (9.3%)	314 (5.4%)
Pueblo	176 (4.6%)	56 (3.4%)	9 (3.2%)	241 (4.2%)
Weld	166 (4.3%)	102 (6.2%)	19 (6.8%)	287 (5.0%)
Balance of State counties	440 (11.5%)	234 (14.1%)	40 (14.3%)	714 (12.4%)
Legally Free Length of Stay in months (median)	8.0	15.0	16.0	10.0
Neglect ^a	2326 (60.6%)	766 (46.3%)	85 (30.5%)	3177 (55.0%)
Abuse	481 (12.5%)	322 (19.5%)	75 (26.9%)	878 (15.2%)
# of Involvements before Removal (mean)	0.7	1.6	1.6	1.0
Permanency Goal				
Adoption/guardianship	3803 (99.1%)	1459 (88.2%)	193 (69.2%)	5455 (94.5%)
OPPLA	36 (0.9%)	196 (11.8%)	86 (30.8%)	318 (5.5%)
# of Placements (mean)	2.2	4.1	4.4	2.8
Months in Congregate Care (mean)	0.5	6.7	6.6	2.5
Months in Family-Like Setting (mean)	24.0	37.6	37.8	28.6

^a Due to difficulties within the Trails system in linking the maltreatment type associated with a referral to a removal, information on maltreatment type (including neglect and abuse) was not collected for all children.

until they achieved a permanency outcome. Children in the <1–5 group accounted for the vast majority of the legally freed population (66.5%), followed by children in the 6–12 group (28.7%), and youth in the 13–17 group (4.8%). Across all age groups, the majority of children achieved a permanency outcome of adoption. The percentage of children and youth that were adopted ranged from a high of 92.5% for children in the <1–5 group to a low of 62.0% for youth in the 13–17 group. The other positive permanency outcomes were considerably less common, with no more than 2.5% of the children and youth achieving permanency through living with other relatives, reunification with their parents, or having a guardianship. Among children and youth that did not achieve permanency, emancipation from the child welfare system was the most prominent reason, with 0.6% of children in the <1–5 group 7.1% of children in the 6–12 group, and 20.8% of youth in the 13–17 group emancipating from the system without achieving permanency. The percentage of children and youth that failed to achieve permanency due to the reasons of a failed adoption, running away, or death was considerably less common with a high of 3.6% for the 13–17 group. Finally, the percentage of children that were censored as a result of being in care on the last day of the period of analysis was 5.6% for the <1–5 group, 12.9% in the 6–12 group, and 9.3% for youth in the 13–17 group.

The legally free population within Colorado was found to be demographically diverse. The mean age that children and youth became legally free was 2 years for the <1–5 group, 8.4 years for the 6–12 group,

and 14.3 years for the 13–17 group. In terms of race, Caucasian was the predominant race for legally free children and youth, followed by Hispanic, African American, and other races. Unlike the other three racial groups, the percentage of Caucasian children and youth increased across the three age groups. Males accounted for the majority of the <1–5 and 6–12 groups, while females were the majority of the 13–17 group. Across all age groups, the majority of legally free children and youth (57.0% to 75.5%) had a legally free sibling in care. Finally, relatively few legally free children and youth were found to have a physical or mental disability.

Legally free children and youth experienced diverse factors in regard to their experiences within the child welfare system after becoming legally free. The median⁷ length of time that children and youth were in care ranged from 8.0 months for the <1–5 group to 16.0 months for the 13–17 group. Similar to other children and youth entering Colorado's child welfare system, legally freed children and youth were considerably more likely to have entered the system as a result of neglect as opposed to abuse. However, the proportion of children and youth that experienced abuse relative to neglect increased across the three age groups, with 12.5% of children in the <1–5 group experiencing

⁷ The median was reported due to the presence of a small number of cases where children were legally free for extended periods of time. These cases exerted a strong influence on the mean for the Legally Free Length of Stay in months, with means of 12.3 for the <1–5 group, 30.3 for the 6–12 group, and 23.6 for the 13–17 group.

abuse while 26.9% of the 13–17 group had been abused. The mean number of involvements with the child welfare system that a child or youth experienced prior to being removed from the home and then becoming legally free was 0.7 for the youngest age group and 1.6 for the 6–12 and 13–17 groups. Across all age categories, the majority of children had a most recent permanency goal of adoption/guardianship, ranging from a high of 92.5% for children in the <1–5 group to a low of 62.0% for youth 13–17 years in age. In contrast, the percentage of children and youth that had a permanency goal of OPPLA increased across the age groups, from a low of 0.9% for the <1–5 group to a high of 30.8% for the 13–17 group. The mean number of placements experienced by legally free children and youth increased across the three age groups with a mean of 2.2 placements for the <1–5 group to 4.4 placements for the 13–17 group. Finally, there were considerable differences between the time that children and youth within the three age groups spent in congregate care and family-like settings. Children in the <1–5 group spent an average of 0.5 months in congregate care compared to 6.7 months for the older age groups. In contrast, legally free children and youth spent considerably greater amounts of time in family-like settings. Children in the <1–5 group spent an average of 24.0 months in family-like settings compared to a maximum of 37.8 months for the 13–17 age group.

Collectively, the descriptive results shown in Table 1 provide a detailed understanding of Colorado's legally free population. These figures point to the distinct differences between the three age groups, with children in the <1–5 group possessing characteristics that are unique when compared to children in the 6–12 and 13–17 age groups. Building upon the findings from the descriptive analysis, a collection of Cox regression models were constructed to provide the requisite insight into the factors affecting permanency for the children and youth in the three age groups.

3.2. Survival analysis

Separate Cox regression models were constructed to examine the factors affecting permanency for the three age groups, with each child or youth included in the models as a single case. Cox regressions model the hazard for an event, with the hazards for this analysis consisting of the time to achieving permanency. The hazard ratio outcome variables for the models were constructed utilizing the combination of the dichotomous 'Permanency Achieved' variable and the 'Legally Free Length of Stay' variable. Predictor variables included in the models consisted of: Race, Gender, Physical Disability, Mental Disability, Involvements before Placement, Age at TPR, Permanency Goal, Siblings in Care, Neglect & Abuse, County, Number of Placements, Months in a Congregate Care Setting, and Months in a Family-Like Setting. While the Neglect & Abuse variable was a theoretically- and practically-important variable, the variable was dropped from the models due to concerns about the impact of missing data on the models.⁸

Cox models assume a proportional hazard relationship for each predictor variable, where the relationship between the hazard functions for multiple values of predictor variables remain proportional over time. Testing the proportional hazard assumptions for the Cox models was conducted through a two-step process. In the first step, Kaplan–Meier curves and univariate Cox models were utilized to determine whether each predictor variable met the proportionality assumption. The County and Race variables were found to violate the proportionality assumption. The County variable was stratified within each model in order to correct for its lack of proportionality. Despite its lack of proportionality,

race was retained within the model due to its theoretical importance (Connell et al., 2006; Kemp & Bodonyi, 2002; McDonald et al., 2007) and due to the reasonable assumption that the relationships between race groups would remain constant over time (Orsi, 2015). In the second step, the proportionality of the continuous variables was examined by testing the significance of time-dependent versions of the Number of Placements, Months in Congregate Care, and Months in Family-Like Setting. The three variables were interacted with the log of time and the inclusion of the time-dependent versions within the models revealed that the variables violated the proportionality assumption. To correct for proportionality, the three variables were interacted with the log of time and included within the models as time-dependent variables (Hosmer, Lemeshow, & May, 2008).

Previous child welfare research has noted the strong effect that siblings can have on a child or youth's ability to achieve permanency (Connell et al., 2006; Guo & Wells, 2003; Shlonsky, Webster, & Needell, 2003; Webster et al., 2005; Wulczyn & Zimmerman, 2005). The permanency outcomes of sibling groups are significantly determined by the outcomes of the other siblings within the group, thereby violating the independent observations assumption. To control for the lack of independence within sibling groups, this analysis utilized the Wei, Lin, and Weissfeld (1989) method (WLW method) which has been utilized in previous child welfare research to correct for the influence of sibling groups on permanency outcomes (Guo & Wells, 2003). Following the WLW method, the models were stratified on whether children or youth had at least one legally free sibling, and the standard errors were clustered on sibling groups.

Fig. 1 displays the graphical hazard functions for the number of months from becoming legally free to reaching the permanency event for the three age groups. The figure highlights the statistically significant differences between the hazard ratios of the three age groups ($p < 0.001$). Within the <1–5 group, 50% of legally free children reached a permanency event by the eighth month while 75% reached the permanency event by the 13th month, and 90% reached the event by the 22nd month. In contrast, legally free children and youth in the 6–12 and 13–17 age groups were legally free for extended periods of time before reaching a permanency event. Within the 6–12 group, 50% of legally free children reached a permanency event by the 15th month while 75% reached the event by the 37th month, and 90% reached the event by the 87th month. Due to the shorter duration between the age that they became legally free and the age of 18 in which they could legally emancipate from the system, youth in the 13–17 group faced a considerably shorter window for experiencing the permanency event. For example, youth that became legally free

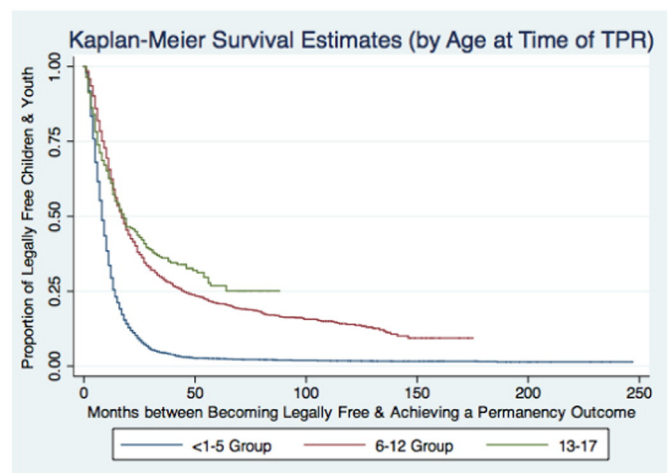


Fig. 1. Kaplan–Meier survival estimates (by age at time of TPR).

⁸ Due to difficulties within the Trails system in linking the maltreatment type associated with a referral to a removal, information on maltreatment type was not collected for all children. Nearly 30% of cases were missing data on the type of neglect and abuse experienced by the child or youth. Accordingly, the Neglect & Abuse variable was dropped from the models.

at the age of 13 had up to 72 months to achieve permanency before emancipating from the system while youth that became legally free at the age of 17 had 12 months to achieve permanency before emancipation. Within this age group, 50% of youth 13–17 reached a permanency event by the 15th month while 75% reached the event by the 36th month and 90% reached the event by the 57th month. Collectively, the figure illustrates that the time periods to permanency differ for children in each of the three age groups. The figure raises the subsequent question of whether different factors are associated with the time to permanency for children of different ages.

3.3. Factors affecting permanency for children <1–5

The results of the models are reported using hazard ratios, which calculate the ratio of the rate at which legally free children and youth experience a permanency event (Table 2). A hazard ratio of 1.0 indicates that at a given point in time, there is no difference in the likelihood of achieving permanency, while a hazard ratio of 2.0 indicates that the likelihood of achieving permanency doubles. Similarly, a hazard ratio of 0.5 indicates that the likelihood of achieving permanency decreases by half. Among the three age groups, legally free children between the ages of <1 through 5 experienced the highest level of positive permanency outcomes and had comparatively fewer factors affecting these outcomes. Among children in this age group, African American race, prior involvements, and the time spent in a congregate care or kinship setting were found to have statistically significant effects on the likelihood of achieving permanency. Compared to Caucasian children, young African American children had a hazard ratio of 0.77 indicating that they had a 23% smaller hazard for achieving a positive permanency outcome ($p < 0.05$). Each additional involvement with the child welfare system prior to becoming legally free resulted in a child in this age group having a 19% smaller hazard for achieving permanency ($p < 0.001$). Whether a legally free child was placed into a congregate care setting or a family-like setting was found to have similar effects on the child's likelihood of achieving a positive outcome. Each additional month that a child was placed in a congregate care setting was associated with a 4% smaller hazard ($p < 0.001$) while each additional

month that a child was placed in a family like setting was associated with a 3% smaller hazard ($p < 0.001$).

3.4. Factors affecting permanency for children 6–12

Among the three groups, children that became legally free between the ages of 6 through 12 experienced a greater number of factors affecting the likelihood that they would achieve a positive permanency outcome. Within this age group, African American race, gender, prior involvements, permanency goals, number of placements, and the time spent in congregate care or family-like settings were found to have statistically significant effects on the likelihood of achieving permanency. Compared to Caucasian children, African American children had a 36% smaller hazard for achieving permanency ($p < 0.01$). Male children within this age group had a 17% smaller hazard ($p < 0.01$). Each additional involvement with the child welfare system that a child experienced prior to becoming legally free was associated with a 9% smaller hazard ($p < 0.001$). The most recent permanency goal assigned to a child in the 6–12 group was found to have an especially strong effect on permanency. Compared to children with a current permanency goal of adoption/guardianship, children with a goal of OPPLA had a 97% smaller hazard for achieving permanency ($p < 0.001$). This figure highlights the need for greater attention to the use of OPPLA goals and provides strong evidence that an OPPLA goal should only be used as a permanency goal of last resort. Each additional placement that a child experienced after becoming legally free resulted in the child having a 6% smaller hazard ($p < 0.001$). Finally, whether a legally free child was placed into a congregate care or family-like setting was also found to have similar effects on the likelihood of whether a child in the 6–12 group was likely to achieve permanency. Each additional month that a child in the age group was placed in either congregate care or a family-like setting resulted in the child's hazard decreasing by 2% ($p < 0.001$ for both measures).

3.5. Factors affecting permanency for youth 13–17

Youth in the 13 through 17 age group had fewer factors affecting permanency but also had the lowest level of positive permanency

Table 2
Cox regression models on factors affecting the likelihood of achieving permanency (by age group).

Variable	<1–5 years (2161 observations)			6–12 years (1239 observations)			13–17 years (174 observations)			All Ages (3574 observations)		
	Hazard ratio	Robust standard error	95% confidence interval	Hazard ratio	Robust standard error	95% confidence interval	Hazard ratio	Robust standard error	95% confidence interval	Hazard ratio	Robust standard error	95% confidence interval
Race (Reference group: Caucasian)												
Hispanic	0.95	0.06	0.84 1.08	0.86	0.07	0.73 1.02	1.22	0.29	0.76 1.93	0.93	0.05	0.84 1.04
African American	0.77*	0.10	0.59 0.99	0.64**	0.11	0.46 0.89	0.40	0.25	0.12 1.39	0.73**	0.08	0.60 0.90
Other races	1.00	0.12	0.80 1.26	0.72	0.15	0.47 1.09	0.89	0.69	0.20 4.02	0.98	0.10	0.80 1.20
Male	1.00	0.05	0.91 1.11	0.83**	0.05	0.74 0.94	1.32	0.29	0.86 2.05	0.95	0.04	0.88 1.02
Physical Disability	1.09	0.11	0.89 1.32	1.05	0.17	0.76 1.45	0.88	0.40	0.36 2.14	1.04	0.10	0.87 1.25
Mental Disability	0.78	0.12	0.57 1.07	0.90	0.13	0.67 1.20	0.75	0.58	0.16 3.39	0.84	0.10	0.65 1.07
# of Involvements before Removal	0.81***	0.02	0.77 0.85	0.91***	0.02	0.86 0.95	0.99	0.08	0.84 1.16	0.88***	0.02	0.85 0.92
Permanency Goal (Reference group: Adoption & guardianship)												
OPPLA	0.04	0.11	0.00 12.66	0.03***	0.02	0.01 0.12	0.01***	0.01	0.00 0.06	0.05***	0.03	0.02 0.14
Age at TPR	0.98	0.02	0.95 1.01	0.98	0.02	0.95 1.02	1.30**	0.11	1.10 1.54	0.98**	0.01	0.96 0.99
Number of Placements ^a	1.00	0.01	0.98 1.02	0.94***	0.01	0.93 0.96	0.93***	0.01	0.91 0.96	0.96***	0.01	0.95 0.97
Months in Congregate Care ^a	0.96***	0.01	0.95 0.97	0.98***	0.00	0.97 0.99	1.01	0.01	0.99 1.02	0.98***	0.00	0.98 0.99
Months in Family-Like Setting ^a	0.97***	0.00	0.97 0.98	0.98***	0.00	0.98 0.99	0.99**	0.00	0.98 1.00	0.98***	0.00	0.98 0.99

Note: Cox regression with robust standard errors clustered on sibling groups (1173 clusters). Observations consist of clustered sibling groups.

Coefficients in the four models are hazard ratios.

The models were stratified on the county and siblings in care variables in order to correct for proportionality.

^a Time-dependent covariate that was interacted with the log of time to correct for proportionality issues.

* Statistically significant at the following levels: $p < 0.05$.

** Statistically significant at the following levels: $p < 0.01$.

*** Statistically significant at the following levels: $p < 0.001$.

outcomes across the three age groups. Among the youth, permanency goals, additional placements, months in a family-like setting, and age were found to affect the likelihood of achieving permanency. Compared to youth with a permanency goal of adoption/guardianship, youth with a goal of OPPLA had a 99% smaller hazard for achieving permanency ($p < 0.001$). Each additional placement that a youth experienced while in care resulted in the youth having a 7% smaller hazard ($p < 0.001$). Unlike the other two age groups, the time that youth spent in congregate care or family-like settings were not found to have similar effects on the likelihood of achieving permanency. While each additional month in congregate care was not found to have a statistically significant effect, each additional month that a youth spent in a family-like setting resulted in the youth having a 15% smaller hazard for achieving permanency ($p < 0.001$).

Finally, age was found to have a positive effect on the likelihood of a legally free youth achieving permanency. For youth that became legally free between 13 and 17 years of age, a one year increase in the age that they became legally free resulted in the youth having a 30% larger hazard for achieving permanency ($p < 0.001$). The implications of this finding are not immediately clear. The finding could be indicative of DCW's increased focus on achieving permanency for older youth that are closest in age to emancipating. In its monthly C-Stat meetings,⁹ DCW and the Colorado Department of Human Services' executive management team review the population of legally free children that are at risk of emancipating in the next three years and regularly discuss options for removing barriers to permanency. At the same time, the finding could also be attributed to a reluctance to terminate parental rights for older youth without first identifying a permanent legal connection. Additional research is necessary in order to develop a better understanding of the relative effects of these hypothesized explanations on the increased likelihood of older youth achieving a positive permanent outcome.

3.6. Factors affecting permanency across all ages

While this analysis focuses on the distinct factors affecting permanency for each age group, a fourth model (hereafter referred to as 'All Ages') was constructed to examine the factors that consistently affected permanency across all age groups. Across all groups, African American race, number of prior involvements, permanency goal, age, number of placements while in care, and the time spent in congregate care or family-like settings had statistically significant effects on the likelihood of achieving permanency. When compared to Caucasian children, African American children and youth had a 27% smaller hazard for achieving permanency ($p < 0.01$). Each additional involvement prior to removal that a child or youth experienced resulted in the child or youth's hazard decreasing by 12% ($p < 0.001$). When compared to a child or youth with a permanency goal of adoption/guardianship, children and youth with a goal of OPPLA had a 95% smaller hazard ($p < 0.001$). Across all age groups, a one year increase in the age that a child or youth became legally free resulted in the child or youth having a 2% smaller hazard ($p < 0.01$). Each additional placement that a child or youth experienced while in care resulted in the child or youth having a 4% smaller hazard ($p < 0.001$). Finally, whether a legally free child or youth was placed into a congregate care setting or a family-like setting was once again found to have similar effects on the likelihood of whether the child or youth was likely to achieve permanency. Across all age groups, each additional month that a child or youth was placed in congregate care or a family-like setting decreased a child or youth's hazard for achieving permanency by 2% ($p < 0.001$ for both measures).

⁹ In 2012, CDHS implemented C-Stat, a management strategy that analyzes performance using the most currently available data. During monthly C-Stat meetings DCW and CDHS leadership utilize data to measure the impact of policies and programs and to make informed, collaborative decisions to align efforts and resources to affect positive change. Additional information at on C-Stat can be found at: <https://sites.google.com/a/state.co.us/performance-management/>.

4. Discussion

This analysis examined the factors affecting permanency for legally free children and youth utilizing a series of Cox regression models. While this article has highlighted the distinct factors affecting the permanency of children and youth across distinct age groups, a collection of factors were found to have consistent effects on the likelihood of achieving permanency in the majority of the models. Months in a family-like setting was found to have the most consistent effect, with each additional month in a family-like setting reducing the hazard for achieving permanency by 1 to 3%. This finding supports previous research suggesting that kinship care can decrease the likelihood of achieving permanency (Connell et al., 2006; Cushing & Greenblatt, 2009; Koh, 2010; Smith, 2003). While previous research has suggested that children or youth in kinship care may be less likely to exit care than children in congregate care settings (Smith, 2003), this analysis finds that legally free children and youth in congregate care settings experience a similar likelihood of achieving permanency as children in family-like settings. Months in a congregate care setting was a significant factor in three of the models with each additional month decreasing the hazard for achieving permanency by 2 to 4%. Race was found to have a negative effect in three of the models, with African American and children having hazards for achieving permanency that were between 23% and 36% smaller than Caucasian children and youth.¹⁰ The consistent findings of adverse outcomes for African American children in combination with the lack of significant findings for the other racial groups underscores the disparity faced by African American children within child welfare systems. These findings contribute to a growing body of research that highlights the disparity of African American children and the subsequent need for the identification of policy solutions that can improve the outcomes of African American children and youth (Magruder & Shaw, 2008; Roberts, 2002; Shaw, Putnam-Hornstein, Magruder, & Needell, 2008). The number of previous involvements was also significant in three of the models, with each additional involvement resulting in the child or youth being having a hazard that was 9% to 19% smaller. The number of placements that a legally free child or youth experienced while in care was also significant in three of the models, with each additional placement resulting in the child's hazard for achieving permanency decreasing by 4 to 7%. Finally, permanency goals were found to have strong, consistent effects in three of the four models. In comparison to children and youth with a permanency goal of adoption/guardianship, children and youth with an OPPLA goal had hazard rates that were between 95% and 99% smaller. This finding provides strong evidence of the negative effects that an OPPLA goal can have on legally free children and youth.

Several of the variables included in the models were found to have less consistent effects. The age of a child or youth at the time that they became legally free had significant effects in the 13–17 and All Ages models. While the larger coefficient in the 13–17 model suggests that older youth are more likely to achieve permanency the closer that they are to the age of 18, the coefficient in the All Ages model highlights the reduced likelihood of achieving permanency for each year later in life that a child or youth becomes legally free, with each additional year decreasing the hazard by 2%. Gender was significant in one of the models with males in the 6–12 group being less likely than females to achieve a permanent outcome. This finding highlights the need for increased efforts to achieve permanency for males between the ages of six and 12. Finally, physical and mental disabilities did not have any statistically significant effects. Children and youth that were identified by caseworkers as having a mental or physical disability were not found to be more or less likely to achieve permanency.

¹⁰ While race was not found to be a statistically significant factor in the 13–17 model, the wide confidence intervals for the model (i.e., 0.12 to 1.39) suggest that the sample size is a factor in the lack of statistical significance within this age group.

This analysis' findings have provided important policy and program implications for Colorado's child welfare system, and DCW has begun efforts to utilize the findings to influence policy and practice in a manner that further increases the likelihood that Colorado's legally free children and youth achieve permanency. As part of this effort, DCW has begun to engage county staff, stakeholders, and service providers on the analysis' findings and policy and practice implications. Utilizing the equations from each of the survival analysis models, DCW has calculated 'Emancipation Risk Scores' for the nearly 1000 children and youth that were legally free as of February 2015. Based on these scores, DCW staff has begun to identify those legally free children and youth with the highest levels of emancipation risk in each of the 3 age groups. Utilizing these emancipation risk scores, DCW staff has begun to engage county stakeholders in discussions about children and youth with elevated risk of emancipation and identify pertinent policies, practices, and resources that could be leveraged to help obtain permanency. While these collective efforts are best characterized as nascent and their effectiveness has not yet been ascertained, these efforts provide a new, empirically-based approach for affecting policy and practice to ensure that legally free children and youth in Colorado continue to achieve high levels of permanency.

While this analysis provides several important contributions to the existing literature, the results of this analysis are subject to several limitations. Most notably, this analysis focuses on the legally free population within a single state. As noted by Smith (2003), states can differ in the ways that they define permanency. Accordingly, a critical need exists to conduct a detailed review of differences in state permanency definitions prior to generalizing the findings from this analysis to other states. In addition, Colorado's child welfare system utilizes a state-supervised and county-administered format, with the state responsible for providing oversight while Colorado's 64 counties are responsible for the administration of county-level child welfare systems. The extent that the findings from a state-supervised, county-administered system are generalizable to a state-administered child welfare system is an empirical question worth pursuing. While the use of a single-state presents a notable limitation on the extent that the case is generalizable to other states, single-state studies are common within the child welfare literature (Connell et al., 2006; Kemp & Bodonyi, 2000; Orsi, 2015; Yamolskaya, Armstrong, & King-Miller, 2011). A second notable limitation exists in regard to the lack of data on maltreatment type. Due to limitations in the data this analysis did not control for the type of maltreatment experienced by legally free children and youth. Maltreatment type is a theoretically important variable that provides critical insight into the types of trauma that legally free children and youth experienced and may still be working to resolve while in care. However, due to the limitations of the data nearly 30% of cases were missing data on the type of neglect and abuse experienced by the child or youth. After careful consideration by the DCW staff, the maltreatment type variable was dropped from the models due to concerns about the impact of missing data.

These limitations aside, this analysis offers an important contribution to the existing literature on permanency outcomes for legally free children and youth, by examining the factors affecting permanency outcomes across different age groups. In doing so, this analysis builds upon previous research by drawing attention to the problematic assumption within the existing literature that children and youth of different ages experience similar likelihoods of achieving permanency. The results of this analysis demonstrate that children and youth in different age groups are affected by different factors. While this analysis highlighted the importance of constructing different explanatory models for different age groups, this analysis also identified factors that were

consistent across the majority of age groups. Across all age groups, African American race, number of prior involvements, permanency goal, age, number of placements while in care, and the time spent in congregate care or family-like settings were found to have statistically significant effects on the likelihood of achieving permanency.

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