



Utilizing predictive modeling to enhance policy and practice through improved identification of at-risk clients: Predicting permanency for foster children

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ABSTRACT

Child welfare agencies are increasingly required to leverage their limited resources to meet nearly limitless demands. As a result, agencies are searching for new opportunities to efficiently improve policy and practice, and advances in data availability and technology have brought increased attention to the utility of predictive modeling. While the literature has often highlighted the considerable potential of predictive models leveraging “big data”, discussions of the methodology and the associated best practices remain critically absent. To address this gap, this paper provides an illustrative case involving the development and testing of models used to predict the probability of whether U.S. foster children would achieve legal permanency. The models were trained and tested using a national administrative dataset of 233,633 foster care children that discharged from state child welfare systems in 2013. The optimal model, a boosted tree, predicted whether children would achieve permanency with 97.66% accuracy. The paper concludes with a discussion of best practices detailing how agencies can utilize predictive modeling to enhance policy and practice.

1. Introduction

Child welfare agencies operate in an environment that increasingly requires using limited resources to meet nearly limitless demands. Within this environment, agencies are increasingly searching for efficient management tools that will allow them to improve the effectiveness of their policies and practice (Clarke & Margetts, 2014; Lynn, Heinrich, & Hill, 2001). Due in part to advances in computing technology as well as the increased volume at which agencies collect administrative data, predictive modeling (also commonly referred to as “predictive analytics” or “data science”) allows agencies to utilize data on past events to predict the likelihood of future events (James, Witten, Hastie, & Tibshirani, 2013; Kuhn & Johnson, 2013).¹ Over the past several decades, predictive modeling has been utilized in a variety of fields and settings to predict diverse outcomes, including the likelihood of hospital readmission (Kansagara et al., 2011; Raven, Billings, Goldfrank, Manheimer, & Gourevitch, 2009), identifying credit card fraud (Bhattacharyya, Jha, Tharakunnel, & Westland, 2011), predicting bankruptcies during the Great Recession (Serrano-Cinca & Gutiérrez-Nieto, 2013), and estimating risk among child welfare clients (Gillingham, 2015; Vaithianathan, Maloney, Putnam-Hornstein, &

Jiang, 2013). However, a concerning trend has emerged where many of the predictive models have been deemed “proprietary” (Jackson & Marx, 2017), thereby concealing the methodological processes associated with developing and testing the accuracy of predictive models. While this issue is indicative of the important ethical and legal implications raised by the emerging methodology (Bovens & Zouridis, 2002; Cohen, Amarasingham, Shah, Xie, & Lo, 2014; Cuccaro-Alamin, Foust, Vaithianathan, & Putnam-Hornstein, 2017), the development of predictive models in accordance with best practices for methodological transparency, implementation, and interpretation can considerably enhance the efficiency, effectiveness, and equity of child welfare policies and practice.

Predictive modeling offers a dynamic approach for assessing the risk that individual clients will experience adverse outcomes, with rigorous training and testing of predictive models providing agency staff with an efficient and effective process for accurately identifying at-risk clients. Agency staff can subsequently run validated predictive models on a regular basis (e.g., monthly, quarterly, or as agency needs and resources permit) to obtain dynamic predictions that reflect the changes in a client's case. In these regards, predictive models leveraging “big data” offer considerable promise for both policy and practice. Potential

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¹ More formally, predictive modeling has been defined as the process of selecting a model that best predicts the probability of an outcome (Geisser, 1993) or generates an accurate prediction (Kuhn & Johnson, 2013).

contributions include improving the ability to predict policy outcomes of interest (Cook, 2014; Jarmin & O'Hara, 2016), supporting the development of efficient policies and management within the public sector (Decker, 2014; Margetts & Sutcliffe, 2013), driving innovation within public policy and practice research (Pirog, 2014), and increasing the skills and competencies of the next generation of policy researchers (Lane, 2016). Despite the considerable promises and benefits to the field, an articulation of the predictive modeling methodology remains noticeably absent from the literature. To address this gap, this paper provides a detailed overview of the processes associated with developing, testing, and implementing predictive models, and identifies a collection of predictive modeling best practices for agencies to consider.

To achieve this purpose, this paper provides an illustrative case that details the process for developing and testing a collection of models that predict whether foster children would fail to achieve legal permanency. Establishing a permanent legal connection (i.e., “permanency”) for children placed into foster care is a critical goal for child welfare agencies, as the failure to establish permanency can result in numerous negative emotional and intellectual effects for children (Freundlich, Avery, Munson, & Gerstenzang, 2006). Due to these negative consequences, child welfare policy over the past three decades has placed an increased focus on achieving permanency for children in foster care. This paper utilizes the 2013 Adoption and Foster Care Analysis and Reporting System (AFCARS) dataset² which provides administrative data on the national population of children that were discharged from state child welfare systems in 2013. A collection of nine distinct model types were developed and tested using the population of 233,633 foster care children that exited from care. The optimal model predicted whether children would achieve permanency with 97.66% accuracy.

This paper begins with reviews of the literatures on permanency and the use of predictive modeling within child welfare agencies. The paper then provides an overview of the methodologies used to develop the predictive models, and the associated results from predicting permanency. The concluding discussion identifies a collection of predictive modeling best practices.

2. Legal permanency and the use of predictive modeling by child welfare agencies

Achieving permanency continues to be an enduring challenge for state child welfare systems. Previous studies have found that nearly 1 in 10 foster care children lack legal ties to a permanent family (Craig & Herbert, 1997; Sheldon, 1997), and that over 20,000 children and youth annually exit foster care without permanency (U.S. Department of Health and Human Services Administration, 2017). Over the past several decades, child welfare policies and practice have focused on supporting and strengthening families to prevent the need to remove children from their homes (Pelton, 1991). However, the safety of children is paramount, and in those instances where a child's safety is threatened, child welfare agencies remove the child from the home and place him or her in a safe and stable environment. After removal, reunifying children with their families is the preferred outcome (Barth & Berry, 1987), but in some instances reunification may not be feasible, and it may be in the best interest of a child to remain in out of home care until a permanent legal connection with a parent or guardian is established. The Children's Bureau within the U.S. Department of

Health & Human Services defines legal permanency as consisting of reunification with the child's parent or primary caretaker, living with other relatives, adoption, or guardianship. In contrast, reasons that children fail to achieve permanency include emancipating from state child welfare systems at the age of 18, or running away (Orsi, Lee, Winokur, & Pearson, 2017).

Establishing permanency is a critical task for child welfare agencies, as the failure to achieve permanency can have considerable adverse effects on children, including enduring difficulties in interacting with others, challenges in achieving independence, diminished academic, social and emotional development (Avery, 2010; Harden, 2004), and a decreased ability to effectively cope with stress (Freundlich et al., 2006). In turn, these effects can result in adverse outcomes that include failing to graduate from high school (Burley & Halpern, 2001), unemployment or underemployment (Courtney, Piliavin, Grogan-Kaylor, & Nesmith, 2001), and homelessness or incarceration (Keller, Cusick, & Courtney, 2007).

Given the critical importance of permanency, child welfare policy over the past three decades has sought to support permanency for children in foster care, though with mixed levels of success (Kemp & Bodonyi, 2002). The Adoption Assistance and Child Welfare Act of 1980 (P.L. 96-272) requires state child welfare agencies to engage in permanency planning and case plan reviews to ensure that foster care children are provided with a detailed plan for achieving permanency. The Multiethnic Placement Act (P.L. 103-382) in 1994 sought to remove obstacles to transracial adoptions with the goal of increasing permanency for minority children. Finally, the Adoption and Safe Families Act of 1997 (ASFA; P.L. 105-89) provided enhanced support for achieving permanency, by introducing a collection of reforms designed to increase the establishment of permanency in a timely manner.

The enhanced policy focus on establishing permanency has informed caseworker practice in notable ways. For instance, the decision-making timeframes established under ASFA (P.L. 105-89) has underscored the need for caseworkers to utilize efficient practices for promoting permanency (Smith & Donovan, 2003). However, this focus on efficiency can have an adverse effect where caseworkers narrowly focus on routine service completion and documentation (Tilbury, 2004) as opposed to spending their time conducting high quality contacts with clients or developing the effective caseworker-client relationships that are critical for achieving case goals (but that are not explicit requirements under the policy). Further complicating matters, child welfare practice has been considerably impacted by a combination of increasing caseloads (English & Pecora, 1994), diminishing organizational resources (Malatesta & Smith, 2014), and a lack of caseworker access to pertinent data for making informed decisions about permanency (Barth & Berry, 1987). Finally, the combined challenges of administrative decision making (Jun & Weare, 2010; Lindblom, 1959; Simon, 1957) and organizational resource constraints (Heinrich, 2002) has resulted in agency administrators and caseworkers facing difficult policy and practice questions about how to most efficiently and effectively deliver services to child welfare clients.

Predictive modeling can provide agencies with access to accurate information in a timely fashion, which can positively influence decision-making processes in a manner that improves client quality of life (Walker, Damanpour, & Devece, 2010) while also improving organizational efficacy (Bretschneider, 1990). Predictive modeling has become an increasingly popular tool over the past several decades with child welfare agencies developing, testing, and implementing various predictive modeling methodologies to enhance the decision-making processes utilized by caseworkers and administrators. These include models used to predict the likelihood that a child will be maltreated (Camasso & Jagannathan, 2000), the probability of child fatalities (Florida Department of Children and Families, 2014), and the risk of being reported for maltreatment at a young age (Putnam-Hornstein & Needell, 2011; Vaithianathan et al., 2013). These and other child welfare predictive models should be commended for employing rigorous,

² The AFCARS data used in this publication were made available by the National Data Archive on Child Abuse and Neglect, Cornell University, Ithaca, NY, and have been used with permission. Data from the Adoption and Foster Care Analysis and Reporting System (AFCARS) were originally collected by the Children's Bureau. Funding for the project was provided by the Children's Bureau, Administration on Children, Youth and Families, Administration for Children and Families, U.S. Department of Health and Human Services. The collector of the original data, the funder, the Archive, Cornell University and their agents or employees bear no responsibility for the analyses or interpretations presented here.

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