



May 2020

Extended Foster Care in Washington State: *Technical Appendix*

This Technical Appendix contains detailed methods and results for the outcome, sensitivity, and benefit-costs analyses on Washington State’s Department of Children, Youth & Families (DCYF) extended foster care (EFC) program.

This Technical Appendix accompanies the *Extended Foster Care: Final Report*¹ which can be found on our website.

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I. Sample Identification, Data Sources, and Exclusions

Data Sources and Description of the Sample

For this study, we relied on the Research and Data Analysis (RDA) division at the Department of Social and Health Services (DSHS). RDA maintains its Integrated Client Database, which combines information on services provided by several agencies.

RDA used foster care records from the Department of Children, Youth & Families (DCYF) FamLink system to identify all youth who were in care under the auspices of DCYF on their 18th birthday between January 1, 2006, and December 31, 2018. RDA then matched to other records from other agencies to provide monthly flags for service use. Unless otherwise noted, data were available from January 1, 2004, through March 31, 2019. Agency sources and specific data are listed below.

Economic Services Administration at DSHS:

- Receipt of Temporary Assistance for Needy Families (TANF) by month (not child-only TANF)
- Receipt of Supplemental Nutrition Assistance Program ((SNAP), in Washington this is referred to as Basic Food) by month
- Homelessness indicator (housed and unhoused)

Employment Security Department:

- Wages by quarter
- Hours worked by quarter

Health Care Authority from January 1, 2007, through March 31, 2019, monthly indicators of:

- Diagnosis of mental illness
- Mental health treatment (inpatient and outpatient)
- Psychiatric hospitalization
- Receipt of psychiatric medications
- Substance abuse diagnosis
- Substance abuse treatment (inpatient and outpatient)
- Emergency department use

WSIPP's criminal history database was used to identify those in the sample with a criminal conviction between January 1998 and June 2019.

RDA has established a protocol for identifying birth parents that incorporates Department of Health birth records, records from Economic Services Administration Child Support Enforcement, and the Department of Corrections visitation records. This integrated protocol enhanced the likelihood of identifying both male and female members of our study sample who have a biological child. Births to those in the sample were identified through June 30, 2019. RDA then matched the offspring of those in the sample to the DCYF FamLink system to identify any child removals (out-of-home placements) and accepted Child Protective Services (CPS) reports.

RDA removed names and replaced them with an arbitrary research ID. This limited data set was then transmitted to WSIPP via Secure File Transfer Protocol.

WSIPP created cohort subsets of those in the sample and returned the sample with research IDs to RDA. RDA replaced the personal identifiers from the sample and transmitted the data to the Education Research Data Center (ERDC). ERDC matched those in the sample to high school and postsecondary data to provide education outcomes aggregated by cohort.

Propensity Score Weighting

To compare outcomes for those in extended care to others aging out of foster care, we used propensity score weighting, a statistical approach that minimizes the known differences between the groups. This is done using logistic regression to estimate the likelihood (probability, p) that someone in the sample would participate in EFC. We then assign a weight of $1/p$ to all participants. Those in the comparison group are weighted $1/(1-p)$. This weighting scheme will produce the average treatment effect for all outcomes. Weighting, rather than matching, allows us to retain the entire sample for analyses. Finally, by conducting a logistic regression on the weighted sample using the covariates from the matching model, we further reduce any residual bias that may remain after weighting.

EFC was expanded to include additional eligibility criteria; we took two approaches to propensity score weighting to account for changes in program eligibility. Youth were assigned to a phase in the expansion depending on the date they turned 18.

- Phase 1: January 1, 2006, through March 21, 2012: the original Foster Care to 21 program with limited enrollment;
- Phase 2: April 1, 2012, through June 30, 2013: no longer a limited number of those in postsecondary education;
- Phase 3: July 1, 2013, through March 31, 2015: permitted those engaged in activities to reduce barriers to employment;
- Phase 4: April 1, 2015, through March 31, 2016: permitted those employed at least 80 hours per month; or
- Phase 5: After April 1, 2016: permitted those with a documented medical condition.

In the first approach, our regression analysis (Method 1) controlled for the phase in which the youth turned 18. In the second approach (Method 2), we conducted five separate regression analyses, one for youth aging out in each phase.

The logit results for Method 1 are presented in [Exhibit A1](#) and for the separate phases of Method 2 in [Exhibit A2](#).

Exhibit A1

Logit Model Estimating the Likelihood of EFC Participation Method 1

	Coefficient		SE
Reason for last placement (compare to neglect)			
Child problem behavior	-0.279	****	0.087
Sexual abuse	-0.048	***	0.129
Physical abuse	0.008		0.106
Other	0.574		0.116
DCYF region (compare to Region 4)			
Region 1	-0.125		0.132
Region 2	-0.713	****	0.145
Region 3	-0.400	***	0.132
Region 5	-0.612	****	0.122
Region 6	-0.284	*	0.117
Female	0.021		0.076
Race/ethnicity (compare to White)			
Black	0.102		0.109
American Indian/Alaskan Native	-0.223	*	0.120
Asian	0.143		0.208
Latino	0.254	*	0.113
Program implementation phase (compare to Phase 1)			
Phase 2	1.499	****	0.130
Phase 3	1.529	****	0.138
Phase 4	0.638	****	0.135
Phase 5	0.437	***	0.134
Unemployment rate the year youth turned 18	0.113	***	0.033

Notes:

Stars indicate statistical significance: * p < 0.1, ** p < 0.05, *** p < 0.01, and **** p < 0.001.
N=5,751.

Exhibit A2

Logit Model Estimating the Likelihood of EFC Participation
Method 2

	Phase 1		Phase 2		Phase 3		Phase 4		Phase 5		
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	
Reason for last placement (compare to neglect)											
Child problem behavior	-0.770	****	0.196	-0.022	0.242	-0.234	0.172	0.234	0.276	-0.234	0.168
Sexual abuse	-0.495		0.318	-0.079	0.357	0.265	0.270	-0.256	0.390	0.265	0.246
Physical abuse	-0.369		0.235	0.010	0.298	-0.036	0.217	0.367	0.322	-0.036	0.210
Other	0.446	*	0.199	-0.267	0.440	0.595	*	0.261	0.676	*	0.352
DCYF region (compare to Region 4)											
Region 1	0.127		0.263	-0.883	*	0.391	-0.329	0.279	0.141	***	0.415
Region 2	-0.905	*	0.352	-0.790	*	0.420	-0.708	*	0.300	-1.383	0.410
Region 3	-0.281		0.267	-0.639	*	0.369	-0.650	*	0.283	-0.378	0.391
Region 5	-0.209		0.235	-0.811		0.364	-1.331	****	0.264	-0.028	0.397
Region 6	0.144		0.227	-0.501		0.313	-0.684	***	0.242	0.087	*
Female	-0.017		0.152	-0.296		0.220	0.007		0.157	-0.469	0.237
Race/ethnicity (compare to White)											
Black	-0.038		0.216	0.139		0.318	-0.018		0.222	0.387	0.351
American Indian/Alaskan Native	-0.546	*	0.288	0.186		0.354	-0.207		0.246	-0.213	0.361
Asian	0.359		0.422	0.426		0.539	0.270		0.444	-0.164	0.642
Latino	0.391	*	0.231	0.582	*	0.309	0.386	*	0.234	0.064	0.332
Unemployment rate the year youth turned 18	17.233	****	3.605	-0.424	*	0.200	-0.576	***	0.167	-0.793	0.709
N	3,060		509		749		397		1,036		
AUC	0.686		0.642		0.657		0.663		0.639		

Note:

Stars indicate statistical significance: * p < 0.1, ** p < 0.05, *** p < 0.01, and **** p < 0.001.

Sensitivity Analyses

We tested the effect of the two approaches to weighting using the standardized difference (d), calculated as the difference in the mean/proportion for the treated and comparison groups, divided by the pooled standard deviation for each covariate prior to matching. For dichotomous outcomes, we used the Cox transformation, $\ln(\text{odds ratio})/1.65$. Standardized bias values greater than 0.10 usually indicate moderate imbalance while greater than 0.25 indicates severe imbalance.² Exhibit A3 displays the percent standardized bias for each covariate in the propensity score model before and after weighting. After weighting, most differences were greatly reduced, with less than moderate bias for all covariates. We control for the covariates in all the regression analyses of outcomes. This last step is used to “clean up” residual covariate imbalance between groups.³ As shown in Exhibit A3, the balance improved using both methods. For most covariates the balance was better using Method 2, therefore, all results shown in the report are weighted using Method 2.

Exhibit A3

Characteristics of Unweight and Weight Samples

	Raw percentages			Weighted—Method 1			Weighted—Method 2		
	Control	EFC	d	Control	EFC	d	Control	EFC	d
Reason for last placement									
Neglect	0.539	0.474	0.158	0.500	0.527	-0.066	0.495	0.499	-0.010
Child problem behavior	0.387	0.276	0.307	0.352	0.319	0.090	0.355	0.351	0.012
Sexual abuse	0.094	0.099	-0.038	0.095	0.089	0.047	0.096	0.105	-0.060
Physical abuse	0.157	0.155	0.012	0.155	0.146	0.043	0.160	0.159	0.003
Other	0.113	0.190	-0.372	0.134	0.136	-0.012	0.135	0.134	0.004
DCYF region									
Region 1	0.118	0.154	-0.185	0.128	0.131	-0.018	0.127	0.140	-0.068
Region 2	0.118	0.094	0.155	0.108	0.093	0.102	0.108	0.108	-0.001
Region 3	0.143	0.128	0.081	0.139	0.134	0.023	0.138	0.130	0.037
Region 4	0.225	0.245	-0.068	0.231	0.236	-0.018	0.231	0.222	0.031
Region 5	0.185	0.152	0.145	0.220	0.228	-0.028	0.177	0.193	-0.063
Region 6	0.210	0.228	-0.061	0.175	0.177	-0.011	0.220	0.207	0.045
Female	0.508	0.529	-0.051	0.507	0.510	-0.007	0.510	0.502	0.021
Race/ethnicity									
White	0.553	0.503	0.123	0.163	0.177	-0.062	0.535	0.523	0.030
Black	0.180	0.178	0.008	0.175	0.177	-0.011	0.181	0.188	-0.029
American Indian/Alaskan Native	0.127	0.111	0.091	0.507	0.510	-0.007	0.122	0.122	-0.001
Asian	0.026	0.041	-0.280	0.122	0.108	0.082	0.032	0.032	0.004
Latino	0.114	0.167	-0.270	0.034	0.034	-0.011	0.131	0.136	-0.026
Unemployment rate the year youth turned 18	6.918	5.806	0.610	6.585	6.698	-0.043	6.575	6.606	-0.012

² Austin, P.C. (2009). Balance diagnostics for comparing the distribution of baseline covariates between treatment groups in propensity-score matched samples. *Statistics in Medicine*, 28(25), 3083-3107 and Stuart, E.A. (2010). Matching methods for causal inference: A review and a look forward. *Statistical Science: A Review Journal of the Institute of Mathematical Statistics*, 25(1), 1–21.

³ Stuart (2010).

Because most of our outcome analyses used subgroups, depending on age, we tested whether we retained covariate balance in the subgroups. As can be seen in [Exhibit A4](#), the subgroups, ages 18 to 21 and ages 21 to 23 remained well balanced.

Exhibit A4

Covariate Balance in Age Subgroups

	Ages 18 to 21 (n=4,715)			Ages 21 to 23 (N=3,883)		
	Control	EFC	d	Control	EFC	d
Reason for last placement						
Neglect	0.473	0.476	-0.0057	0.453	0.463	-0.024
Child problem behavior	0.371	0.368	0.0091	0.385	0.376	0.024
Sexual abuse	0.094	0.105	-0.0715	0.091	0.105	-0.099
Physical abuse	0.158	0.160	-0.0097	0.158	0.161	-0.013
Other	0.126	0.124	0.0112	0.124	0.117	0.039
DCYF region						
Region 1	0.123	0.137	-0.078	0.119	0.134	-0.082
Region 2	0.110	0.108	0.010	0.111	0.106	0.030
Region 3	0.140	0.130	0.051	0.140	0.129	0.055
Region 4	0.235	0.225	0.034	0.238	0.228	0.034
Region 5	0.175	0.196	-0.084	0.179	0.204	-0.097
Region 6	0.216	0.203	0.046	0.210	0.198	0.047
Female	0.539	0.527	0.030	0.546	0.530	0.040
Race/ethnicity						
White	0.539	0.527	0.030	0.546	0.530	0.040
Black	0.185	0.196	-0.043	0.188	0.198	-0.040
American Indian/Alaskan Native	0.121	0.121	0.000	0.122	0.124	-0.013
Asian	0.028	0.029	-0.025	0.026	0.027	-0.022
Latino	0.121	0.127	-0.033	0.113	0.121	-0.051
Unemployment rate the year youth turned 18	6.960	6.996	-0.019	7.201	7.251	-0.027

For the outcomes for age 18 to 21, we compared the results of several approaches to the following analysis of our data:

- unweighted means or percentages;
- weighted means or percentages;
- adjusted means or percentages based on unweighted regression; and
- adjusted means or percentages based on weighted regression.

We found that results of weighting by the two protocols, Method 1 and Method 2, were always very similar. For that reason, we show results only from Method 2 in this table.

All regression models used the same covariates used in the propensity logits. In addition, criminal convictions controlled for conviction as a juvenile. For the parenting and child welfare outcomes, we controlled for the proportion of all births to mothers age 18 to 23 in the year the person turned 18 and whether the person had parented a child before age 18. Full regression models are available upon request.

[Exhibit A5](#) provides a comparison of methods for the dichotomous (yes/no) outcomes. [Exhibit A6](#) provides comparisons for continuous outcomes.

Exhibit A5

Effects of Extended Foster Care With and Without Weighting (Dichotomous Outcomes)

Outcome	Unadjusted percentage						Regression-adjusted percentage					
	Unweighted			Weighted			Unweighted			Weighted		
	EFC	Comp	% point diff	EFC	Comp	% point diff	EFC	Comp	% point diff	EFC	Comp	% point diff
Any mental illness dx, ages 18 to 21	69%	58%	11% ****	58%	58%	0% ns	69%	57%	12% ****	58%	57%	1% ns
Anxiety dx, ages 18 to 21	54%	37%	16% ****	40%	38%	2% *	55%	37%	18% ****	40%	39%	2% ns
Depression dx, ages 18 to 21	49%	39%	10% ****	40%	39%	1% ns	49%	38%	11% ****	39%	37%	2% ns
Outpatient MH tx, ages 18 to 21	40%	44%	-4% ****	40%	50%	-10% **	53%	44%	9% ****	41%	43%	-2% **
Inpatient MH tx, ages 18 to 21	6%	5%	1% ns	3%	5%	-2% ****	6%	5%	1% *	3%	5%	-2% ****
Alcohol dx, ages 18 to 21	12%	15%	-3% **	10%	15%	-5% ****	12%	15%	-3% *	10%	15%	5% **
Drug dx, ages 18 to 21	23%	25%	-3% *	14%	27%	-13% ****	23%	25%	-2% ns	14%	27%	-12% ****
Alcohol or drug dx, ages 18 to 21	26%	31%	-4% ***	19%	32%	-13% ****	27%	30%	-4% **	19%	31%	-13% ****
SUD outpatient tx, ages 18 to 21	9%	12%	-2% **	6%	12%	-6% ****	9%	12%	-3% **	6%	12%	-6% **
SUD inpatient tx, ages 18 to 21	3%	5%	-2% **	2%	5%	-3% ****	3%	5%	-2% **	2%	5%	-3% ****
Convictions, ages 18 to 21	15%	33%	-18% ****	13%	33%	-20% ****	16%	32%	-16% ****	14%	31%	-17% ****
Child age, ages 18 to 23	4%	26%	-21% ****	10%	20%	-10% ****	11%	24%	-12% ****	12%	23%	-11% ****
CPS intake, ages 18 to 23	12%	16%	-4% **	6%	17%	-11% ****	9%	16%	-7% ****	6%	16%	-10% ****
Child removed, ages 18 to 23	2%	6%	-3% ****	1%	7%	-6% ****	1%	6%	-5% ****	1%	6%	-5% ****

Notes:

Stars indicate statistical significance: * p < 0.1, ** p < 0.05, *** p < 0.01, **** p < 0.001, and ns=not significant.

Significance for percentage difference based on chi-square.

Significance of regression results based on the significance of the EFC coefficient.

Dx= diagnosis.

Tx = treatment.

MH=Mental health.

SUD=Substance use disorder.

CPS=Child Protective Services

Exhibit A6

Effects of EFC With and Without Weighting, Ages 18-21
(Continuous Outcomes)

Outcome	Un-adjusted means						Regression-adjusted means					
	Unweighted			Weighted			Unweighted			Weighted		
	EFC	Comp	Diff	EFC	Comp	Diff	EFC	Comp	Diff	EFC	Comp	Diff
Average annual wages	\$4,038	\$2,629	\$1,409 ****	\$4,227	\$2,731	\$1,495 ****	\$3,855	\$2,677	\$1,178 ****	\$4,228	\$2,730	\$1,498 ****
Average annual monthly TANF	0.271	0.941	-0.669 ****	0.271	0.941	-0.670 ****	0.290	0.986	-0.696 ****	0.281	0.932	-0.651 ****
Average annual monthly SNAP	2.277	3.387	-1.110 ****	1.649	3.394	-1.746 ****	2.383	3.359	-0.977 ****	1.652	3.390	-1.738 ****
Average annual monthly homeless	0.527	1.147	-0.620 ****	0.335	1.222	-0.887 ****	0.528	1.146	-0.619 ****	0.337	1.220	-0.883 ****
Annual ED visits	0.856	0.952	-0.0961 **	0.648	0.957	0.310****	0.863	0.950	-0.087 *	0.653	0.951	-0.298****

Notes:

Stars indicate statistical significance; * p < 0.1, ** p < 0.05, *** p < 0.01, and **** p < 0.001.

Significance for means based on t-test.

Significance of regression results based on the significance of the EFC coefficient.

TANF=Temporary Assistance for Needy Families.

SNAP=Supplemental Nutrition Assistance Program.

ED=Emergency department.

II. Benefit-Cost Analysis

In our standard approach to benefit-cost analysis,⁴ WSIPP estimates what the effects and monetary consequences of a program would be in Washington, given what we know about the characteristics of people in Washington. For the analysis described in this report, we look at the observed outcomes for a very specific population of foster youth in extended foster care in comparison to a similar group of foster youth. Rather than use what we know about the Washington population at large, we used information specific to our study population. Instead of projecting what the effect would be, we report what we know the effect was. [Exhibit A7](#) shows the effect sizes we entered into our benefit-cost model. [Exhibit 18](#) in the main report⁵ provides detailed benefit-cost results of those inputs.

Exhibit A7

Effects Entered in the Primary Benefit-Cost Analysis

Outcome	Effect size	SE	Tx N	p-value
Anxiety disorder, ages 18 to 21	0.0721	0.0460	956	0.1167
Major depressive disorder, ages 18 to 21	0.0612	0.0460	956	0.1837
Hospitalization (psychiatric), ages 18 to 21	0.2373	0.0546	956	0.0000
ED visits, ages 18 to 21	-0.2541	0.0369	956	0.0000
Public assistance, ages 18 to 21	-0.3243	0.0358	985	0.0000
Earnings, ages 18 to 23	0.9408	0.0504	457	0.0000
Food assistance, ages 18 to 21	-0.5005	0.0360	985	0.0000
Convictions, ages 18 to 21	-0.6431	0.0457	985	0.0000
Alcohol use disorder, ages 18 to 21	-0.2819	0.0715	956	0.0000
Illicit drug use disorders, ages 18 to 21	-0.4640	0.0598	956	0.0000
Child abuse & neglect (participant's child), ages 18 to 23	-0.7136	0.1097	598	0.0000
Out-of-home placement (participant's child), ages 18 to 23	-1.1915	0.2557	598	0.0000

Note:

ED=Emergency department.

When computing the value of those changes in outcomes, we make adjustments to match the comparison group. For example, the former foster youth in our study had much lower earnings than the average Washington youth. While we would normally set our expected outcomes to match the average Washington youth, for this study we use the earnings we observe for the comparison group. The changes to our typical model are described in the paragraphs below.

Earnings

In our standard approach, we typically estimate the value of changes in labor market earnings compared to the general population of all adults in the labor market. However, the comparison group in this study showed a very different pattern of earnings than did average adults in the labor market. Therefore, we adjusted our assumptions to reflect the earnings observed by individuals in our comparison group. WSIPP's benefit-cost model estimates the total value of the compensation that an individual receives.⁶ We use the observed earnings for the comparison group in place of the general population earnings. We then account for benefits and changes in the labor market over the five years we observed the program.

⁴ See WSIPP's Technical Documentation. For more detail see Exhibit 4.9.10 in WSIPP's Technical Document.

⁵ Miller et al. (2020).

⁶ Ibid, Exhibit 4.2.6

Reports of Child Abuse and Neglect

WSIPP's [Technical Documentation](#) displays the population assumptions for the cumulative likelihood of an incidence of child abuse or neglect by follow-up year.⁷ We adjust our estimates for the overall rate of subsequent Child Protective Services (CPS) interaction by multiplying the general population rate in each year by the ratio of the incidence in the overall population (5.4%) to the incidence in the comparison group (8.7%) as measured at age 5.

Out-of-Home Placement

WSIPP's Technical Document displays the population assumptions for the likelihood of out-of-home placement after a CPS event.⁸ We adjust our estimates for the overall rate of out-of-home placement to reflect the observed rate. We multiply the expected rate in each year by the ratio of subsequent placement in the comparison group (5.2%) to that in the overall population (1.0%) measured at age five.

Emergency Department Visits

We replace the general percentage of the population with an emergency department visit in a given year (14.2%) with the average annual percentage with an emergency department visit in a year observed comparison group (41.4%) and assumed that this population incurs the same costs as the general population.⁹

Inpatient Mental Health Treatment

We used the average percentage of the comparison group with a psychiatric hospitalization of acceptance into inpatient mental health treatment in the comparison group (2.6%) and assumed that this population incurs the same cost per year as the seriously mentally ill population.¹⁰

Major Depressive Disorder

We adjust the model such that onset is assumed to occur before age 20 and the percentage of people who have the disorder within their lifetime matches that observed in the comparison group at age 20 (38.5%). These adjustments reflect what we know about the population and may be less than the total value of the program.

Illicit Drug Use Disorder

We adjust the model such that onset is assumed to occur before age 20 and the percentage of people who have the disorder within their lifetime matches that observed in the comparison group at age 20 (27.6%). These adjustments reflect what we know about the population and may be less than the total value of the program.

⁷ [Ibid, Exhibit 4.10.1.](#)

⁸ [Ibid, Exhibit 4.10.4.](#)

⁹ [Ibid, Exhibit 4.3.6.](#)

¹⁰ [Ibid, Exhibit 4.6.5.](#)

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