

Benefits of a Universal Intervention in Pediatric Medical Homes to Identify and Address Health-Related Social Needs: An Observational Cohort Study

MaryCatherine Arbour MPH, MD , Placidina Fico MPH ,
Sidney Atwood BA , Robert Sege MD, PhD

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Original Article

Running Title: Universal Intervention Identifies and Addresses HRSN

**Benefits of a Universal Intervention in Pediatric Medical Homes
to Identify and Address Health-Related Social Needs: An
Observational Cohort Study**

MaryCatherine Arbour^a, MPH, MD, Placidina Fico^a, MPH, Sidney Atwood^a, BA,

Robert Sege^b, MD, PhD

Affiliations: ^aBrigham and Women's Hospital, 75 Francis St., Boston, MA 02115, USA; ^b
Institute for Clinical Research and Health Policy Studies, Tufts Medical Center, 800 Washington
St #63, Boston, Massachusetts, USA.

***Address correspondence to:** MaryCatherine Arbour, Division of Global Health
Equity, Brigham and Women's Hospital, 75 Francis St., Boston, MA 02115, USA
[marbour@bwh.harvard.edu], 617-545-4774.

Abstract

Objective: Compare rates of identification of families with health-related social needs (HRSN) and connection to resources by targeted versus universal, pediatric clinic-based interventions.

Methods: This observational cohort study included 1677 families that received care (January 2017–May 2020) at eight pediatric medical homes in three states implementing DULCE – a universal, evidence-based intervention that addresses HRSN for families with infants. We divided the cohort into two groups using four common risk criteria in targeted programs serving families with infants; 862 families had no –high-risk| characteristics (–Risk Criteria Absent,| RCA); 815 families had –high-risk| characteristics (–Risk Criteria Present,| RCP). We compared

both groups by prevalence of HRSN and connection to supports and estimated the performance of –high-risk criteria to identify HRSN.

Results: DULCE identified 990 families with HRSN, compared to an estimated 274 families, if a risk-targeted approach had been used. More than half of RCA families had HRSN, 11% used resources at enrollment, and 42.5% accessed resources through DULCE. Simultaneously, 68.8% of RCP families had ongoing HRSN although 46.0% used resources at enrollment; 63.9% accessed additional resources through DULCE. Commonly used risk criteria had a sensitivity of 55.3% (95% CI, 52.2%–58.5%), specificity of 61.1% (95% CI, 57.2%–64.9%), positive predictive value of 68.8% (95% CI, 65.4%–72.0%), and negative predictive value of 46.9% (95% CI, 43.5%–50.4%).

Conclusions: Risk criteria commonly used to identify families for targeted interventions are imperfect proxies for HRSN. Universal, medical home-based approaches can play a key role in supporting families with infants.

Keywords

Social Determinants of Health, Screening, Universal Interventions, Targeted Interventions, Pediatric Family-centered Medical Home

What's New

Questions remain about how best to deploy evidence-based early childhood interventions to improve population health. This study examines empirically the benefits of universal delivery of a clinic-based, cross-sector approach for identifying and connecting families with health-related social needs to resources.

Introduction

Several types of evidence-based interventions (EBIs) supporting families with young children can impact multiple family and child outcomes. Early intervention can improve cognitive, language, and behavioral skills among young children with developmental delays.¹ Home visiting programs can promote children's cognitive development, positive parenting behavior, and reduce child maltreatment and healthcare utilization.^{2,3} Clinic-based parenting programs can improve screening for health-related social needs, well-child visit (WCV) attendance and immunizations, and reduce parental stress.⁴⁻⁹ However, questions remain about how best to deploy early childhood EBIs to improve population health. There is ongoing debate in the literature about whether targeted or universal approaches to preventive care are preferable. Both approaches have proven to effect positive health outcomes^{7,10-13} – with distinct advantages and trade-offs – and they have been compared, typically, from a cost-benefit standpoint.¹⁴⁻¹⁶

Many programs for families with young children target their intervention to —higher-risk| families, using observable family characteristics to determine eligibility. Targeting intends to augment an intervention's cost-effectiveness by delivering it to families who benefit most and avoiding delivery to families who do not need it.¹⁴ However, targeting may create stigma associated with receiving services and thereby limit the reach of interventions with proven benefits.^{17,18} One national study in the United Kingdom found that 59% of families referred to home visiting declined services; nearly half felt they did not need help, despite qualifying for services based on identified social disadvantages.¹⁹

Targeting may contribute to disappointingly small impacts when scaling EBIs⁴ if the observable characteristics used as —high-risk| proxies do not reliably identify families that would experience poor outcomes without intervention. A nationally representative survey, the 2011 Behavioral Risk Factor Surveillance System, found that nearly half of adults who experience poor outcomes

do not report Adverse Childhood Experiences²⁰ – i.e., nearly half of children who experience poor outcomes as adults come from –low-riskl families.

Universal interventions with tailoring offer a different approach, serving a population that is not defined by risk. The interventionist may ‘tailor’ the intervention components a family receives, or the frequency with which they receive them.²¹ Tailoring is sometimes done using pre-established criteria and an instrument – for example, a checklist²² — and ideally occurs in partnership with families.

This study uses data from DULCE (Developmental Understanding and Legal Collaboration for Everyone), a universal, evidence-based approach for families with infants that is delivered through pediatric primary care in under-resourced communities. DULCE aims to implement the American Academy of Pediatrics’ *Bright Futures* Guidelines that recommend five WCVs within the first six months of life and that pediatric practices address social determinants of health.²³ Intervention components include a community health worker who screens for health-related social needs (HRSN) and a cross-sector team with expertise to connect families with HRSN to resources. A randomized controlled trial demonstrated – and a subsequent expansion study replicated – that DULCE increased preventive care adherence and accelerated families’ access to HRSN supports.^{24,25}

This study explored the benefits of universal delivery of a pediatric clinic-based approach for identifying families with HRSN and connecting them to resources by comparing HRSN identification and resource connection rates for two groups of participants distinguished by commonly used risk criteria for targeted programs.

Methods

Participants

Participants include 1677 families with 1691 infants (born January 2017–December 2019) that received care at eight pediatric clinics implementing DULCE in California, Florida, and

Vermont. This was a convenience sample. The Center for the Study of Social Policy contacted its Early Childhood Learning and Innovation Network for Communities, comprised of innovators committed to building comprehensive, integrated, multi-sector systems for serving young children and their families. Three communities volunteered to implement DULCE, designated a representative of their system as Early Childhood Lead, and recruited clinics serving predominantly Medicaid-insured patients and local public interest law organizations to form local DULCE teams (Table 1).²⁴

DULCE was offered to all families presenting for care with newborns up to 8 weeks of age. At sites with more newborns than one FS could serve, DULCE was offered to a random subset. All participants were followed through their six-month well-child visit (WCV).

We divided the cohort into two groups using published risk criteria from targeted EBIs serving families with infants (Early Head Start, Healthy Families America, Nurse-Family Partnership).²⁶⁻

²⁸ We identified four risk criteria corresponding to variables in the DULCE data registry: first-time parents, teen parents, foster infants, and low-income families. Because DULCE did not collect income data, families were considered low-income if they were receiving at least one means-tested benefit at enrollment (Supplemental Nutrition Assistance Program [SNAP], Special Supplemental Nutrition Program for Women, Infants, and Children [WIC], Temporary Assistance for Needy Families [TANF]). Income thresholds for benefits vary by state; in this sample, families considered low-income earned no more than 200% of the Federal Poverty Line. DULCE families with at least one of these criteria were included in the –Risk Criteria Present (RCP) group (n=815), meaning they would likely be eligible for a targeted program serving families with infants. Families who met none of the four criteria (n=862) were included in the –Risk Criteria Absent (RCA) group, meaning they would receive services from a universal intervention, such as DULCE, but not from a targeted program.

Intervention

DULCE embeds a community health worker (–Family Specialist, | FS) within a cross-sector team that includes an early childhood system representative, legal partner, clinic administrator, and medical and behavioral health clinicians. The FS attends WCVs and is families’ most frequent point of contact. The FS receives Brazelton Touchpoints™ training and identifies families’ strengths, offers developmental guidance, and screens for seven HRSN (food insecurity, financial/employment needs, housing instability, housing conditions, utilities, maternal/caregiver depression, intimate partner violence). FSs screened families around the 1-month and 4-month WCVs using validated questions from the Centers for Medicare and Medicaid Services’ Accountable Health Communities Screening tool,²⁹ Patient Health Questionnaire -9,³⁰ and the iHELLP Questionnaire’s income screening question.³¹ In addition to formal screening, FSs engage families over time and offer repeated opportunities to disclose concerns to the same trusted provider (the FS). FS consistently solicit families’ priorities and preferences (see Appendix 1) and tailor program intensity through relationship-based, goal-concordant care. The intervention is designed to last 6 months (from the newborn WCV through the six-month WCV), so the minimum expected number of FS-family contacts is five, one for each WCV. There is no limit to the maximum number of contacts. The cross-sector team meets weekly for case review, where all DULCE families are discussed at least once during their participation in DULCE. Team members collaborate to support families’ access to benefits, services, and legal protections, and to identify opportunities to affect systemwide improvements (Table 1).

Data Collection

At all DULCE sites, FS entered individual-level demographic, program participation, healthcare utilization and HRSN data into an online, custom-built registry separate from the electronic health record. At DULCE enrollment, FS entered family-reported data for variables used to define the RCP and RCA groups.

Primary Outcomes

Primary outcomes include outcomes for seven HRSN (screening completed, positive screens, resources used for food insecurity, financial/employment needs, housing instability, housing conditions, utilities, maternal/caregiver depression, intimate partner violence) and estimates of the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the risk criteria for identifying families with one or more HRSN (i.e., first-time parents, teen parents, foster infants, low-income families). Since these criteria determine who receives treatment in targeted programs, we include estimates of the number and percent of families with HRSN that would be identified using risk criteria.

Secondary outcomes included program participation (enrollment, completion, duration; number of FS encounters) and healthcare utilization (timely receipt of all WCVs, no-show rate).

-Timely WCVs were defined based on precedent.^{7,24}

Analysis

We calculated descriptive statistics for demographic characteristics for the full cohort and for the RCA and RCP groups separately. We tested for differences between groups' demographic characteristics, program participation (percent of families offered DULCE that participated [note: all families presenting for a newborn or 1-month WCV were offered DULCE; they could opt out]; percent of families that completed DULCE [i.e., completed their six-month WCV and had FS contact then or shortly after]; number of days enrolled; number of FS encounters), healthcare utilization (percent of families attending all WCVs on time; no-show rate) and HRSN indicators (percent of families screened for all seven HRSN, for each HRSN; screened positive for one or more HRSN, for each HRSN; used HRSN resources). We used the Mann-Whitney median test for count variables, Pearson's chi-squared test for proportions and categorical variables, and the Wilcoxon rank-sum test for no-show rate. Fisher's exact probabilities were used when appropriate. We calculated the sensitivity, specificity, PPV, and NPV of the risk

criteria for identifying families with HRSN. Calculated *P*-values were two-tailed.

Ethical considerations

This study was approved by University of Chicago School of Social Administration's Institutional Review Board (IRB17-0414).

Results

Among the full sample (N=1677 families), 862 had none of the four risk criteria that would make them eligible for a targeted evidence-based program, and 815 met one or more risk criteria (RCP group). In the RCP group, 701 families met only one risk criterion: 395 were first-time parents, 105 were teen parents, 9 were foster parents, and 192 were receiving means-tested benefits at enrollment. The remaining 114 families had two risk criteria: 84 first-time parents, 29 teen parents, and one foster parent were also receiving means-tested benefits at enrollment. Figure 1 shows the breakdown of families using SNAP, WIC, and/or TANF.

Table 2 reports demographic characteristics of the sample, which reflect the populations from the low-income communities participating clinics served. In both groups, 98% of primary caregivers were mothers, nearly 95% of secondary caregivers were fathers, and approximately 55% self-identified as Hispanic/Latinx, 23% as White, and 18% as Black; roughly 64%, 24% and 4% spoke English, Spanish or both English and Spanish at home, respectively. The RCA group had fewer single parents (41% v. 52% of RCP families, $P<.001$), fewer adults living in the home (19% RCA v. 30% RCP reported 3 or more adults in the home, $P<.001$), and fewer families speaking a language other than English or Spanish at home (6% RCA v. 9% RCP, $P=0.03$).

Primary and secondary caregivers' median ages were 30 and 32 years, respectively, in the RCA group, compared to 26 and 28 years in the RCP group ($P<.001$).

Table 3 shows program participation, healthcare utilization and HRSN screening rates. In both groups, all families offered DULCE participated (i.e., none opted out), and three quarters of families completed the six-month intervention (74.9% of RCA families v. 77.5% of RCP

families, $P=0.21$). Reasons families left DULCE early did not differ by group: 62% moved away; 18% changed clinics or providers. On average, RCA families spent 184 days in program with 9 FS encounters, compared to 188 days and 10 FS encounters for RCP families ($P<.01$ for both).

Well-child visit, no-show and screening rates were similar. FS screened more than 85% of families for all seven HRSN and more than 90% for each HRSN. If FS did not enter a screen, it was assumed it was not performed.

Table 4 shows the performance of risk criteria to identify HRSN. Appendix 2 includes the questions used to identify HRSN.

Among RCA families, 53.1% screened positive for one or more HRSN, compared to 68.8% of RCP families ($P<.001$). The targeted risk criteria have a PPV of 68.8% (95% CI, 65.4%–72.0%), NPV of 46.9% (95% CI, 43.5%–50.4%), and 55.3% (95% CI, 52.2%–58.5%) sensitivity and 61.1% (95% CI, 57.2%–64.9%) specificity for identifying families with HRSN.

Table 5 and Figure 2 show HRSN outcomes. Among families with positive HRSN screens, 44.1% of RCA families and 71.2% of RCP families used HRSN resources ($P<.001$). This includes families that used resources PreDULCE (i.e., using resources at DULCE enrollment), families that used resources PostDULCE (i.e., accessed resources during DULCE enrollment), and families that used some resources PreDULCE and other resources PostDULCE.

The difference between RCA and RCP families was greatest for food insecurity, financial/employment needs, and depression – the three most prevalent HRSN. RCA families had significantly lower positive screen rates and lower resource use than RCP families.

For food insecurity, 29.5% of RCA families and 56.2% of RCP families screened positive

($P<.001$); 40.7% of RCA families and 71.8% of RCP families used resources ($P<.001$), including SNAP, WIC, food pantries, and free school meals.

For financial/employment needs, 34.3% of RCA families and 44.6% of RCP families screened positive ($P<.001$); 18.7% of RCA families and 32.0% of RCP families used resources, including child support, childcare subsidy, and disability ($P<.001$).

For maternal depression, 15.5% of RCA families and 20.5% of RCP caregivers screened positive ($P<.01$). Half of RCA families and nearly 65% of RCP families used a resource ($P<.05$), including counseling, crisis hotline, medication, and support groups.

For the other four domains, prevalence of positive screens was similarly low for RCA and RCP families: housing instability (8.2% v. 9.1%), IPV (4.8% v. 4.4%), housing conditions (each 2.8%), and utilities (1.5% v. 1.6%). These domains had lower resource utilization rates: housing conditions (56.0%), IPV (50.9%), housing instability (22.4%), utilities (16.7%).

Comparing the proportion of families with HRSN that used resources PreDULCE and PostDULCE reveals differences (Figure 2 and Table 5). Only 11.1% of RCA families with HRSN used PreDULCE resources, compared to 46.0% of RCP families with HRSN.

PreDULCE resource use differed not only in domains used to define the groups, as expected (i.e., PreDULCE, 4.2% of RCA v. 13.6% of RCP families used financial/employment resources; 5.8% of RCA v. 45.4% of RCP families used food resources, $P<.001$ for both), but also for housing instability (1.5% of RCA v. 14.1% of RCP families used housing resources, $P<.01$) and maternal depression (14.6% of RCA v. 23.7% of RCP families used depression resources, $P=0.09$).

Among 195 RCA families with one or more HRSN that used resources, 188 of them accessed a new resource through DULCE and 49 had used resources PreDULCE. Among 390 RCP families with one or more HRSN that used resources, 350 used resources PostDULCE and 252 had used resources PreDULCE. Thus, most families in both groups accessed additional HRSN

PreDULCE.

The differences between RCA and RCP families' PreDULCE use of housing instability and maternal depression resources converged during enrollment, such that PostDULCE, 16.4% of RCA and 16.9% of RCP families were using housing resources ($P=0.97$) and 50.4% of RCA and 61.5% of RCP families were using maternal depression resources ($P=0.13$) (Figure 2 and Table 5). By contrast, use of financial/employment and food resources narrowed but did not close: PostDULCE, 16.6% of RCA and 25.8% of RCP families were using financial resources ($P<.001$), and 38.6% of RCA and 60.7% of RCP families were using food resources ($P<.001$). Only differences in resource use that were used to define the groups remained PostDULCE.

Discussion

To our knowledge, this is the first study to examine empirically the added benefits of universal delivery of a pediatric clinic-based approach for supporting families in under-resourced communities. It contributes to ongoing research and policy debates about how best to deploy early childhood EBIs to improve population health outcomes.^{7,11,13-16} Using data from eight pediatric clinics implementing DULCE in three states, we found that, among families lacking risk criteria commonly used to determine eligibility for targeted programs, more than half had HRSN, very few were using resources at enrollment, and half accessed resources during DULCE. Simultaneously, among families that met traditional risk criteria, 68.8% had ongoing HRSN, 46.0% used HRSN resources at enrollment, and 63.9% accessed additional resources through DULCE.

Our findings suggest that observable characteristics commonly used to identify families for targeted interventions are imperfect proxies for known threats to healthy development, such as food insecurity, financial/employment needs, and maternal depression.^{33,34} As expected, a larger proportion of RCP families screened positive for HRSN and used HRSN resources, but half of the families with HRSN (442 of 990) in this sample lacked traditional risk criteria used to target

RCA caregivers were slightly older and had other children at home, rendering them ineligible for programs for young, first-time parents.^{28,35,36} Some RCA families accessed SNAP and WIC through DULCE: it may be that their larger family size made them eligible for benefits after the baby's birth, or they may have been eligible but not connected beforehand. RCA families likely represent a combination of families specifically excluded from targeted interventions and others that may have been eligible but remained unidentified or declined targeted supports.

Based on the data in our study, a universal approach will identify many more families with HRSN than a targeted program. Within our sample of 1677 families, DULCE identified 990 families (59.0%) with HRSN, 548 of whom were RCP families that would receive an offer of targeted services. If the targeted approach were delivered outside of the medical home and enrollment rates reflected published enrollment rates for some evidence-based home visiting programs (approximately 50%),³⁷ then 274 families with HRSN would be identified. In other words, 716 families with HRSN – 72% of families with HRSN in the population – would be missed. Other healthcare-based interventions have similarly high rates of enrollment (85%–90%) and mechanisms for identifying families and connecting them to resources.^{7,8}

This paper suggests that universal healthcare-based approaches can address the HRSN of most families in low-resource communities, many of whom existing targeted programs do not reach. Intensive, targeted EBIs reach a group of the highest-risk families, providing an array of supports for them.⁴ The statistical analysis presented here underlines that targeted eligibility requirements should not serve as de facto screening tests to determine who receives support. Nonetheless, these two approaches can co-exist and complement one another. For example, one participating site has developed a protocol leveraging DULCE's universal screening to identify families that would benefit from home visiting and facilitating a warm handoff between services.³⁸

Universal approaches delivered through pediatric medical homes make good sense for families,

and high-quality primary care that is accessible, family-centered, continuous, and coordinated; they can meet some families' needs, identify other families who need and want more intensive targeted supports, and facilitate warm handoffs to community resources. Nearly all families access pediatric care, rely on pediatric clinics as trusted sources of information, and consider clinics a convenient, less-stigmatizing source of support – some families report perceptions of stigma associated with targeted parenting programs.^{12,18,39} DULCE gains efficiencies by meeting families in pediatric clinics where families already bring their children and by tailoring the intensity of support based on families' needs and desires – as evidenced by slightly shorter enrollment (by 4 days) and one fewer encounter among RCA families. Some of these efficiencies relate to DULCE's design — it begins at birth when families have frequent contact with the healthcare system, lasts only 6 months, and embeds a cross-sector team that can problem-solve complex needs. Others are related to family engagement with pediatric care more generally — such as avoidance of costly, time-intensive recruitment phases with low uptake and unproductive churn.

Many (252 of 390) RCP families that DULCE connected to resources were using some HRSN resource preDULCE. This is unsurprising: we used SNAP, WIC and/or TANF enrollment to define the RCP group, and it is well-established that existing food benefits are insufficient to meet many families' food needs.⁴⁰ HRSN are associated with underlying poverty, so families with needs in one domain often have other HRSN. The fact that so many families used some HRSN resources and simultaneously had unmet needs suggests the inefficiency and inadequacy of existing systems; families with multiple HRSN must navigate multiple programs, and programs may not always sufficiently meet needs.

These findings have several implications for policymakers and system leaders. When considering which EBIs to fund in a community, leaders should aim for a mix of universal and targeted programs. They should intentionally create linkages to leverage universal programs'

collaboration between programs to offer families comprehensive, cross-sector support in a convenient manner.⁴¹

Limitations

The definitions of RCP and RCA groups do not perfectly align with risk criteria in other targeted interventions serving infants zero to six months old. DULCE did not collect income data, so we used participation in means-tested benefits (SNAP, WIC, TANF) as proxies for low-income.

Income thresholds for benefits vary by state, SNAP and WIC enrollment had been decreasing across the country at the time of this study,⁴² and some RCA families later connected to benefits, suggesting they may have had low income. This convenience sample is not representative of the US population or US healthcare facilities. This is a post-hoc, observational comparison; relationships identified are not causal.

Conclusion

The four characteristics commonly used to identify families for targeted interventions are poor proxies for known threats to healthy development. Study findings suggest that systems intended to support families with infants in low-resource communities may miss nearly three quarters of families with health-related social needs by utilizing targeted approaches exclusively. Universal, pediatric clinic-based approaches can play a key role in early childhood systems' support of healthy development for all families.

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Declaration of Competing Interest

All authors have no conflicts of interest to disclose.

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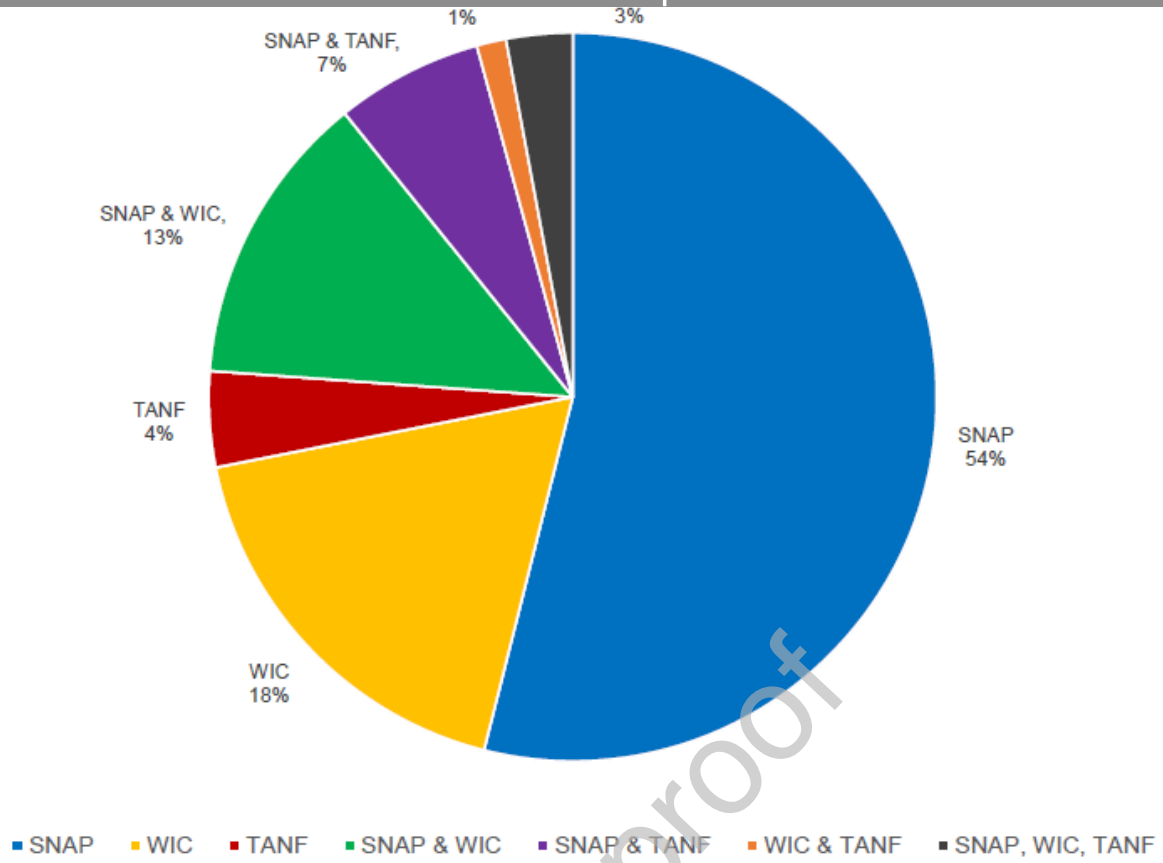


Figure 1. Means-tested Benefits Use Among "Risk Criteria Present" Families at Enrollment



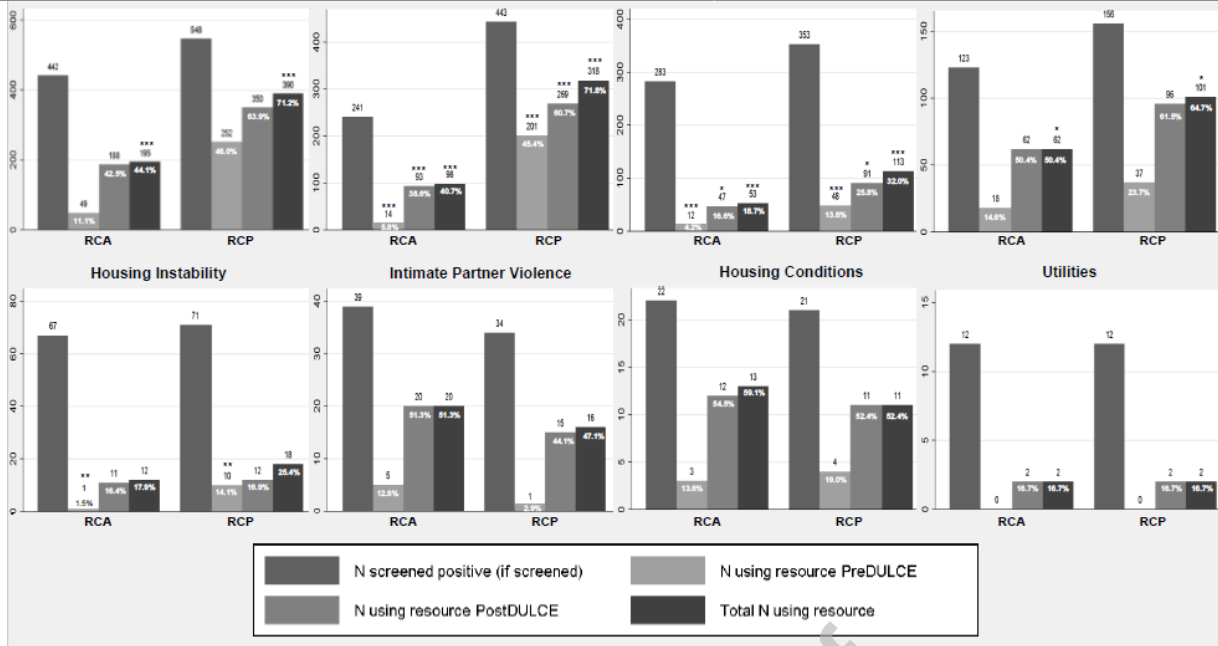


Figure 2. Resource Use in Families with Identified Health-Related Social Needs (HRSN), by HRSN Domain and Study Group

RCA = Risk Criteria Absent. RCP = Risk Criteria Present. PreDULCE = prior to DULCE enrollment. PostDULCE = during DULCE enrollment.

Statistical significance levels are indicated as * = 0.05, ** = 0.01, *** = 0.001 and reflect statistically significant differences between the RCA and RCP groups for each outcome.

Note that total number of families using resources does not equal the sum of families using resources PreDULCE and PostDULCE because families that screened positive despite using PreDULCE resources were offered additional resources. Those families are counted once in using PreDULCE resources, once in PostDULCE resources (if they used new resources), and once in total using resources.

	Early Childhood System Lead Agencies	Clinic Partners	Legal Partners
Unique contribution	Accountable for a local system of services for families with young children	Offer universal reach and longitudinal relationships with families	Offer a professional orientation toward problem-solving and advocacy
Expertise	Well-versed in community resources for families and training opportunities for FS	Well-versed in the use of standard protocols to improve quality of care	Well-versed in family rights and system responsibilities
Role on team	Inform team of available community resources, champion evidence-informed practices, influence policy	Provide ongoing monitoring of families' status and coaching of the FS to respond to unique infant and family circumstances	Lend a policy lens and expertise, offer ongoing identification of supports and strategies to address family needs
Communities			
Alameda County, CA	First 5 Alameda	Highland Pediatric Clinic (Oakland, CA)	East Bay Community Law

Lamoille Valley, VT	Lamoille Family Center	Appleseed Pediatrics	Vermont Legal Aid
Los Angeles County, CA	First 5 Los Angeles	The Children's Clinic (Long Beach, CA)	Legal Aid Foundation of Los Angeles
		The Children's Clinic – The S. Mark Taper Foundation Health Center	Legal Aid Foundation of Los Angeles
		Northeast Valley Health Corporation, Sun Valley Health Center	Legal Aid Foundation of Los Angeles
		Northeast Valley Health Corporation, Newhall Health Center	Legal Aid Foundation of Los Angeles
		St. John's Well Child and Family Center	Neighborhood Legal Services of Los Angeles County
Palm Beach County, FL	Children's Services Council of Palm Beach County	C.L. Brumback Health Center	Legal Aid Society of Palm Beach County, Inc.

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	Total (n=1677)	Risk Criteria Absent (n=862)	Risk Criteria Present n=815)	P value^a
Characteristic	N (%)	N (%)	N (%)	
Child sex ^b				
Male	865 (52)	441 (51)	424 (52)	.70
Female	811 (48)	421 (49)	390 (48)	
Child age at enrollment (median, IQR, days)	7 (4-15)	7 (4-15)	7 (4-15)	> .99
Primary caregiver ^c				
Mother	1638 (98)	839 (98)	799 (98)	< .001 ^d
Father	17 (1)	13 (2)	4 (1)	
Foster parent	10 (1)	0 (0)	10 (1)	
Other caregiver ^e	7 (0)	5 (1)	2 (0)	
Primary caregiver marital status ^f				
Single	673 (47)	299 (41)	374 (52)	< .001
Married	536 (37)	333 (46)	203 (28)	
Domestic partner	234 (16)	93 (13)	141 (20)	
Divorced	1 (0)	0 (0)	1 (0)	
Primary caregiver age, median (IQR)	28 (23-33)	30 (26-35)	26 (21-31)	< .001
Primary caregiver race ^g				
Hispanic/Latinx	780 (55)	407 (56)	373 (53)	.20
White	322 (23)	170 (23)	152 (22)	
Black	260 (18)	114 (16)	146 (21)	
Asian	48 (3)	24 (3)	24 (3)	
Pacific Islander	14 (1)	9 (1)	5 (1)	
Native American	6 (0)	3 (0)	3 (0)	
Secondary caregiver ^h				
Father	1054 (94)	537 (93)	517 (94)	.73
Grandparent	35 (3)	20 (4)	15 (3)	
Mother	19 (2)	10 (2)	9 (2)	

Foster parent	2 (0)	0 (0)	2 (0)	
Legal guardian	1 (0)	1 (0)	0 (0)	
Secondary caregiver age, median (IQR)	30 (25-36)	32 (28-37)	28 (23-34)	< .001
Number of adults in home ^l				
1	102 (6)	47 (6)	55 (7)	< .001
2	1111 (69)	611 (75)	500 (63)	
3	219 (14)	93 (11)	126 (16)	
4 or more	180 (11)	64 (8)	116 (15)	
Number of children in home ^l				
1	553 (36)	6 (1)	547 (72)	< .001 ^k
2	504 (33)	400 (52)	104 (14)	
3	292 (19)	230 (30)	62 (8)	
4 or more	185 (12)	135 (18)	50 (7)	
Primary language spoken at home ^l				
English	1064 (64)	547 (65)	517 (64)	.03
Spanish	401 (24)	213 (25)	188 (23)	
English & Spanish	62 (4)	34 (4)	28 (4)	
Other ^m	124 (8)	49 (6)	75 (9)	

Abbreviations: IQR, interquartile range; RCA, risk criteria absent; RCP, risk criteria present.

^a*P* values from Mann-Whitney median tests for count variables and Pearson's chi-squared tests for categorical variables. In the case of categorical variables exhibiting values with less than 5 observations, the Fisher's exact *P* value was used.

^bThere was 1 family with unknown child sex.

^cThere were 5 families with an unknown primary caregiver relationship to child.

^dConsistent with the risk criteria definitions, the RCP group had more households with 1 child or foster parents (*P* < .001 for both).

^e4 Legal guardians, 2 Grandparents, 1 Other caregiver.

^fPercentages calculated among 1444 families with known primary caregiver marital status.

^gPercentages calculated among 1430 families with known primary caregiver race.

^hPercentages calculated among 1125 families that reported a secondary caregiver.

^jPercentages calculated among 1534 families with known number of children at home.

^kConsistent with the risk criteria definitions, the RCP group had more households with 1 child ($P < .001$). The targeted interventions used as a reference to define the RCP group specifies first-time mothers as an eligibility criterion. The 6 responses in the RCA group are first-time parents whose relation to the infant was not listed as —motherl for either the primary or secondary caregiver.

^lPercentages calculated among 1651 families with known primary language spoken at home.

^mAmharic, Arabic, ASL, Bengali, Creole, Dari, French, Igbo, Khmer, Mam, Nepali, Pashto, Popti, Portuguese, Punjabi, Russian, Samoan, Sinhala, Swahili, Tagalog, Tamil, Thai, Tigrigna, Turkish, Vietnamese, Yoruba, English & Other, Spanish & Other.

Table 3. Program Participation, Healthcare Utilization, and Identification of Health-Related Social Needs, by Study Group

Study Outcome Variable	Risk Criteria	Risk Criteria	P value ^a
	Absent (n=862)	Present (n=815)	
Program Participation			
Families offered DULCE that enrolled, N (%)	862 (100)	815 (100)	> .99
Families that completed DULCE, N (%)	646 (74.9)	632 (77.5)	.21
Families that left DULCE early ^b , N (%)	216 (25.1)	183 (22.5)	
Reasons Given for Leaving DULCE Early, N (%)	138 (100)	92 (100)	
Moved home	85 (61.6)	58 (63.0)	0.64
Changed clinic or provider	29 (21.0)	13 (14.1)	
Lost to follow-up	17 (12.3)	15 (16.3)	
Family Requested	6 (4.4)	5 (5.4)	
Baby died or removed from home	1 (0.7)	1 (1.1)	
Program duration, median (IQR), d	184 (147–197)	188 (167–204)	.002
Encounters, median (IQR), n	9 (6–13)	10 (7–14)	.004
Healthcare Utilization			
Infants receiving all WCVs on time ^c , N (%)	383 (45.0)	348 (43.2)	.45
No-show rate, mean (SE), %	4.8 (0.4)	5.4 (0.5)	.73

Screening Rates			
Families screened for 7 HRSN	758 (87.9)	695 (85.3)	.11
Families screened for food insecurity	822 (95.4)	788 (96.7)	.17
Families screened for financial/employment needs	825 (95.7)	791 (97.1)	.14
Families screened for maternal depression	792 (91.9)	763 (93.6)	.17
Families screened for housing instability	819 (95.0)	779 (95.6)	.58
Families screened for intimate partner violence	807 (93.6)	767 (94.1)	.68
Families screened for housing conditions	798 (92.6)	748 (91.8)	.67
Families screened for utilities	802 (93.0)	753 (92.4)	.61
Screen Positive Rates ^d			
Families with 0 positive screens	391 (46.9)	249 (31.2)	< .001
Families with 1 positive screen	224 (26.9)	187 (23.5)	
Families with 2 positive screens	138 (16.6)	229 (28.7)	
Families with 3 positive screens	46 (5.5)	92 (11.5)	
Families with 4 positive screens	22 (2.6)	31 (3.9)	
Families with 5 positive screens	11 (1.3)	9 (1.1)	
Families with 6 positive screens	1 (0.1)	0 (0)	

Abbreviations: d, days; HRSN, health-related social need(s); IQR, interquartile range; min, minutes; n, number; RCA, risk criteria absent; RCP, risk criteria present; SE, standard error; WCVs, well-child visits.

^a*P* values from Mann-Whitney median tests for count variables and Pearson's chi-squared tests for continuous and categorical variables. In the case of categorical variables exhibiting values with less than 5 observations, the Fisher's exact *P* value was used. *P* value for the no-show rate from the Wilcoxon rank-sum test.

^bFamilies that dropped out of DULCE prior to completing their six-month well-child visit.

^cPercentages calculated among 851 and 806 families in the RCA and RCP groups, respectively, with known WCV-timeliness data for their infants.

^dPercentages calculated among 833 and 797 families in the RCA and RCP groups, respectively, who were screened for HRSN at least once.

Needs Within Study Cohort, by Study Group

	Risk Criteria Absent	Risk Criteria Present
	(n=833) ^a	(n=797) ^a
Families with 1+ positive HRSN screens, n (%)	442 (53.1)	548 (68.8)
Families with 0 positive HRSN screens, n (%)	391 (46.9)	249 (31.2)
Parameter, % (95% CI)		
Sensitivity	55.3 (52.2 – 58.5)	
Specificity	61.1 (57.2 – 64.9)	
Positive Predictive Value	68.8 (65.4 – 72.0)	
Negative Predictive Value	46.9 (43.5 – 50.4)	

Abbreviations: HRSN, health-related social need(s).

^aAmong the 862 and 815 RCA and RCP families, respectively, 833 RCA and 797 RCP families were screened for HRSN at least once.

Table 5. Screening Results and Resource Use in Families with Identified Health-Related Social Needs (HRSN), by HRSN Domain and Study Group

HRSN Screening Domain ^a	Total N Screened		Screened Positive N (%)			Using Resource PreDULCE ^b N (%)			Using Resource PostDULCE ^b N (%)			Total Using Resource ^{b,c} N (%)		
	RC A	RC P	RC A	RC P	P value	RC A	RC P	P value	RC A	RC P	P value	RC A	RC P	P value
1 or more HRSN	833	797	442 (53.1)	548 (68.8)	<.001	49(11.1)	252 (46.0)	<.001	188(42.5)	350 (63.9)	<.001	195(44.1)	390(71.2)	<.001

Food Insecurity	822	788	241 (29.3)	443 (56.2)	<.001	14 (5.8)	201 (45.4)	<.001	93 (38.6)	269 (60.7)	<.001	98 (40.7)	318 (71.8)	<.001
Financial/Employment Needs	825	791	283 (34.3)	353 (44.6)	<.001	12 (4.2)	48 (13.6)	<.001	47 (16.6)	91 (25.8)	.02	53 (18.7)	113 (32.0)	<.001
Maternal Depression	792	763	123 (15.5)	156 (20.4)	.01	18 (14.6)	37 (23.7)	.09	62 (50.4)	96 (61.5)	.13	62 (50.4)	101 (64.7)	.02
Housing Instability	819	779	67 (8.2)	71 (9.1)	.51	1 (1.5)	10 (14.1)	.009	11 (16.4)	12 (16.9)	.97	12 (17.9)	18 (25.4)	.29
IPV	807	767	39 (4.8)	34 (4.4)	.71	5 (12.8)	1 (2.9)	.38	20 (51.3)	15 (44.1)	.61	20 (51.3)	16 (47.1)	.72
Housing Conditions	798	748	22 (2.8)	21 (2.8)	.96	3 (13.6)	4 (19.0)	>.99	12 (54.5)	11 (52.4)	.54	13 (59.1)	11 (52.4)	.66
Utilities	802	753	12 (1.5)	12 (1.6)	.88	0(0)	0(0)	N/A	2(16.7)	2(16.7)	.58	2(16.7)	2(16.7)	>

Abbreviations: HRSN, health-related social need(s); IPV, intimate partner violence; RCA, risk criteria absent; RCP, risk criteria present.

^aIndividual HRSN domains ordered by prevalence of positive screens.

^bPercents calculated using N Screened Positive as the denominator.

^cThe total number of families using resources is not equal to the sum of families using resources PreDULCE (i.e., at DULCE enrollment) and those using resources PostDULCE (i.e., accessed during DULCE enrollment) because families that screened positive, despite using PreDULCE resources, were offered additional, different resources. Those families are counted once in the using PreDULCE resources, once in PostDULCE resources (if they used new resources), and only once in total using resources.