Using State Administrative Data to Identify Social Complexity Risk Factors for Children

Kimberly C. Arthur, MPH[1]
Barbara A. Lucenko, PhD[2]
Irina V. Sharkova, PhD[2]
Jingping Xing, PhD[2]
Rita Mangione-Smith, MD, MPH[1,3]

[1]Seattle Children's Research Institute, Seattle, Washington

[2]Washington State Department of Social and Health Services, Division of Research and Data Analysis, Olympia, Washington

[3]University of Washington Department of Pediatrics, Seattle, Washington

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ABSTRACT

PURPOSE Screening for social determinants of health is challenging but critically important for optimizing child health outcomes. We aimed to test the feasibility of using an integrated state agency administrative database to identify social complexity risk factors and examined their relationship to emergency department (ED) use.

METHODS We conducted a retrospective cohort study among children younger than 18 years with Washington State Medicaid insurance coverage (N = 505,367). We linked child and parent administrative data for this cohort to identify a set of social complexity risk factors, such as poverty and parent mental illness, that have either a known or hypothesized association with suboptimal health care use. Using multivariate analyses, we examined associations of each risk factor and of number of risk factors with the rate of ED use.

RESULTS Nine of 11 identifiable social complexity risk factors were associated with a higher rate of ED use. Additionally, the rate increased as the number of risk factors increased from 0 to 5 or more, reaching approximately twice the rate when 5 or more risk factors were present in children aged younger than 5 years (incidence rate ratio = 1.92; 95% CI, 1.85-2.00) and in children aged 5 to 17 years (incidence rate ratio = 2.06; 95% CI, 1.99-2.14).

CONCLUSIONS State administrative data can be used to identify social complexity risk factors associated with higher rates of ED use among Medicaid-insured children. State agencies could give primary care medical homes a social risk flag or score to facilitate targeted screening and identification of needed resources, potentially preventing future unnecessary ED use in this vulnerable population of children.

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INTRODUCTION

In light of the strong evidence that exposure to social adversity in childhood is linked to poor child and adult health outcomes,[1-4] systematic strategies are needed to identify children at risk in order to provide appropriate referrals and services. Adverse childhood experiences, originally described by Felitti et al,[4] include family-related risk factors such as mental illness of a household member and exposure to abuse or neglect. There is a compelling case for identifying and addressing adverse childhood experiences and other social determinants of health at the family level because supporting parents is often the starting point for supporting children.[5]

Pediatric primary care interventions have successfully identified children with adverse childhood experiences or other social determinants of health, typically through parent report on a questionnaire. Subsequent intervention usually involves providing referrals to a social worker or appropriate community, hospital, or government programs, such as the Supplemental Nutrition Assistance Program, housing programs, utility bill assistance programs, transportation assistance, childcare providers, legal services, shelter arrangements, tax preparation support, or help in completing benefits forms or pro-

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CORRESPONDING AUTHOR

Kimberly C. Arthur, MPH
Seattle Children's Research Institute
PO Box 5371, M/S M1-9
Seattle, WA 98145-5005
kimberly.arthur@seattlechildrens.org

gram applications.[6-9] A national survey of pediatricians, however, found that only 2% report using a screening tool for children to identify adverse childhood experiences,[10] which may be due to issues regarding the feasibility of routinely having all families complete questionnaires in a busy office or clinic setting.

Many state agencies–including Medicaid agencies–already collect administrative data that could potentially be used to identify adverse childhood experiences and other social determinants of health for children and their parents. If such administrative data could be used to generate a flag or score indicating social risk, this alert could potentially be shared with the child's primary care clinician to prompt targeted screening to verify the presence of risk factors and assess the need for services or referrals to community resources, or both. In the context of limited time and resources in primary care, targeted screening may be more feasible and efficient than conducting in-person screening more broadly and may help detect challenges and reduce unmet needs for vulnerable families. Ultimately, improving access to needed services and community resources for families living with social complexity may reduce the use of potentially unnecessary services such as emergency department (ED) care.

We sought to use parent and child state administrative data to identify children's social complexity risk factors, which we defined as a set of co-occurring individual, family, or community characteristics that can have a direct impact on health outcomes or an indirect impact by affecting a child's access to care and/or a family's ability to engage in recommended medical and mental health treatments.[11] We tested the feasibility of identifying these risk factors using a cross-system integrated database in Washington State and examined the associations of both specific risk factors and number of risk factors with the rate of ED visits not resulting in inpatient admission. We hypothesized that these social complexity risk factors would be associated with greater nonemergent ED use, which may indicate need for in-person screening and intervention in the primary care medical home.

METHODS

Identification of Social Complexity Risk Factors

We performed a targeted literature search to identify studies examining the relationship between social complexity risk factors and suboptimal health care use patterns (eg, higher ED use, lower adherence to recommended well-child care visits). This search identified 12 social complexity risk factors with supporting evidence.[12-32] We examined the feasibility of identifying these 12 risk factors using administrative data included in the Washington State Department of Social and Health Services (DSHS) Integrated Client Database. We also included 6 additional social complexity risk factors because they have been studied extensively by that department in high-risk child populations[33] and in connection with behavioral health outcomes in youth.[3] The database includes medical claims and encounters; payment and service records; and arrest records. Data sources included social services (eg, child protective services), Medicaid, state mental health and substance abuse services, and state patrol (police).[34]

Of the 12 social complexity risk factors identified from the literature search, 8 (67%) could be identified using the database, 5 of which were included in analyses, in addition to the 6 risk factors previously studied by the Washington State DSHS[34] (Table 1, Supplemental Appendix, http://www.annfammed.org/content/16/1/62/suppl/DC1). Although available in the database, 3 risk factors with supporting evidence (parent substance abuse,[28] foreign-born parent,[26] and foster care[32]) were not included in study analyses because they overlapped with other risk factors. Parent substance abuse was significantly correlated with child abuse and neglect (Pearson correlation coefficient $r = 0.34$, $P < .0001$), while foster care services apply to a large subset of children with a history of abuse and neglect. We retained child abuse and neglect as the more inclusive risk factor. We chose limited English proficiency over foreign-born parent because foreign birth does not guarantee that an individual has limited English proficiency, which is the best measure of communication challenges that could affect access. We also found, in an analysis using 2015 American Community Survey data, that 92% of people in Washington who have limited English proficiency are foreign-born immigrants.[35] In the available administrative data, the best approximation of English proficiency was language spoken at home and interpreter need. Four risk factors with supporting evidence were not available in the database: low parent educational attainment,[12,19,23] single-parent household,[12,19,24,25] adolescent exposure to intimate partner violence,[27] and discontinuous insurance coverage.[29-31] Risk factors involving parents were based on biologic parents, regardless of whether they lived in the child's household. All 11 risk factors studied (Table 1) were analyzed as binary variables.

Study Population

The eligible population for this retrospective cohort study included children aged younger than 18 years as of June 30, 2008, with 1 or more months of Medicaid coverage between July 1, 2006, and June 30, 2008.

Children also had to have at least 1 biologic parent with state administrative records to be included (N = 505,367; 83% of children with Medicaid coverage). As records for both children and their parents are contained in the birth certificate, child support enforcement records, and prison visitation records, family identification codes could readily be created to link children and parents in the Integrated Client Database. The study population included 85,386 children (17%) with 1 biologic parent identified and 419,981 children (83%) with both biologic parents identified. We divided children into 2 cohorts based on age as of June 30, 2008: aged younger than 5 years (1 to 60 months) and aged 5 to 17 years (61 months and older). The Washington State Institutional Review Board approved all study procedures.

Assessment of Social Complexity Risk Factors

For eligible children, we determined the presence of the 11 social complexity risk factors during the time period spanning July 1, 2003, to June 30, 2008, with 2 exceptions: limited English proficiency and parent death. Limited English proficiency was assessed between July 1, 2005, and June 30, 2011, in order to have more complete data with the assumption that a parent or child with limited English proficiency in 2011 had limited English proficiency in previous years. Parent death was assessed for any time before July 1, 2008, because of its lifelong impact.

Assessment of ED Use

We calculated the total number of ED visits that did not result in an inpatient admission for each child using Medicaid claims records during a 1-year measurement period from July 1, 2008, to June 30, 2009.

Table 1. Social Complexity Risk Factors Having Demonstrated or Hypothesized Association With Suboptimal Health Care Use Among Children

Risk Factor	Definition of Risk Factor in Administrative Data
Parent domestic violence[13,14]	Any arrest for which a charge recorded is in a domestic violence crime category
Parent death[a]	State health department death certificates for biologic parents
Parent mental illness[15-18]	Mental health diagnosis, service encounters, procedures, or prescribed psychotropic medications recorded in medical claims or publicly funded mental health records for either biologic parent[b]
Parent criminal justice involvement[a]	Any arrest or conviction recorded by state patrol or court filings, including adjudication in state court database, for any crime category for either biologic parent
Child abuse/neglect[17]	Any family involvement (child or either biologic parent) in child welfare or child protective services system in Washington State
Homelessness[a]	Indicates at least 1 period of homelessness, including shelter stays, recorded by a financial eligibility worker during eligibility (re)determination for public assistance for child or either biologic parent
Poverty[12,19-21]	TANF benefit recorded for child[c]
Parent has limited English proficiency or speaks a language other than English at home[12,22]	Primary language other than English and indicated need for interpreter for biologic parent and/or child
Child mental illness[a]	Mental health diagnosis, service encounters, procedures, or prescribed psychotropic medications recorded in medical claims or publicly funded mental health records for child aged ≥5 y[b]
Child substance abuse[a]	Substance-related diagnosis, service or encounters recorded in medical claims or publicly funded mental health records; any arrest for which a charge recorded is in a substance-related crime category (eg, driving under the influence, possession of controlled substance) for child aged ≥12 y[b]
Child juvenile or criminal justice involvement[a]	Any arrest or conviction recorded by state patrol or court filings, including adjudication in state court database, for any crime category for child aged ≥12 y

TANF = Temporary Assistance for Needy Families.

Note: Based on Washington State administrative data. Four risk factors could not be identified using the available administrative data: (1) low parent educational attainment, (2) single parent in household, (3) adolescent exposure to intimate partner violence, and (4) discontinuous insurance coverage.

[a] Risk factor hypothesized to have an association with suboptimal health care use.

[b] Full list of codes used to identify parent/child mental illness and child substance abuse is given in the Supplemental Appendix, available at http://www.annfammed.org/content/16/1/62/suppl/DC1/.

[c] The income of a TANF family of 3 in Washington State with any housing expenses was approximately 38% of the 2008 Department of Health and Human Services Poverty Guidelines.

Statistical Analysis

We used Poisson regression analysis to examine the association between each social complexity risk factor and ED use because our outcome was number of ED visits occurring during a specified period of time (1 year), generating incidence rate ratios (IRRs).[36] We constructed additional multivariate models examining the association between number of risk factors and the rate of ED visits. To test for a dose-response pattern, we constructed a model in which the number of risk factors was entered as a continuous predictor. All identifiable risk factors were included in all models, except child substance abuse, child mental illness, and child juvenile or criminal justice involvement, which were not included in the analyses of children aged younger than 5 years because of low prevalence. Given our large sample size, we established a threshold of $P < .0001$ a priori to determine statistical significance. When interpreting our findings, however, we focused on effect size and confidence intervals, given

the known problems with determining significance based on *P* values.[37]

We adjusted all models for child age, sex, race/ethnicity, medical complexity, and length of Medicaid coverage (months). Child demographics were based on enrollment data obtained from each of the social and health information systems in which the child was served. We determined medical complexity using the more conservative version of the Pediatric Medical Complexity Algorithm (PMCA),[38] which uses diagnoses in administrative billing data to classify children into 3 categories: (1) no chronic illness (eg, febrile seizure), (2) noncomplex chronic illness (eg, epilepsy), or (3) complex chronic illness (eg, epilepsy with chronic respiratory insufficiency). For each child, PMCA was applied to a 3-year period (2006-2008) of retrospective *International Classification of Diseases 9th Revision – Clinical Modification* (*ICD-9-CM*) codes in Washington Medicaid data. We also adjusted for clustering[39] by family because 16% of the younger cohort and 28% of the older cohort had at least 1 sibling with the same biologic mother and father. Analyses were performed using SAS 9.3 software (SAS Institute, Inc).

RESULTS

Approximately 80% of our study population had at least 1 social complexity risk factor (Table 2). The most prevalent were parent criminal justice involvement (seen in 44.0% in the younger age-group and 40.4% in the older age-group), parent mental illness (31.1% and 32.7%), and child abuse or neglect (27.7% and 34.5%).

Table 2. Cohort Characteristics (N = 505,367)

Characteristic	All Children		Children With ≥1 Emergency Department Visits	
	<5 Years (n = 180,198)	5-17 Years (n = 325,169)	<5 Years (n = 62,512)	5-17 Years (n = 69,015)
Sex, female, %	48.8	49.1	47.2	49.0
Age, mean (SD), y	1.8 (1.4)	10.3 (3.6)	1.5 (1.4)	10.5 (3.8)
Race or ethnicity, %				
Hispanic	29.5	27.3	34.6	32.0
Non-Hispanic				
White	36.1	48.3	32.8	44.8
African American	5.7	8.4	6.1	8.7
Asian, Native Hawaiian, or other Pacific Islander	3.6	4.4	2.9	2.7
American Indian or Alaska Native	3.3	4.8	3.9	6.0
Two or more races	1.6	2.4	1.8	2.8
Unknown race/ethnicity	20.1	4.5	17.8	3.1
Medicaid eligibility, mean (SD), mo	9.9 (3.2)	10.3 (3.2)	11.5 (1.6)	11.5 (1.7)
Medical complexity, %				
Healthy (no chronic disease)	84.2	78.8	81.2	70.6
Noncomplex chronic disease	11.0	15.9	12.8	20.9
Complex chronic disease	4.8	5.3	6.0	8.5
Social complexity risk factors, %[a]				
Parent domestic violence	4.5	4.4	5.4	5.4
Parent death	0.4	2.1	0.3	2.4
Parent mental illness	31.1	32.7	36.8	40.3
Parent criminal justice involvement	44.0	40.4	50.2	45.6
Child abuse/neglect	27.7	34.5	32.1	41.6
Homelessness	17.0	17.0	20.4	20.7
Poverty	26.8	23.4	34.3	30.8
Limited English proficiency	25.7	18.5	28.9	20.4
Child mental illness	n/a	18.4	n/a	24.1
Child substance abuse	n/a	1.9	n/a	3.7
Child juvenile or criminal justice involvement	n/a	3.0	n/a	5.3
Social complexity risk factors				
0 factors, %	21.2	19.8	13.9	12.3
1 factor, %	30.4	26.8	28.2	23.3
2 factors, %	20.2	20.7	22.2	21.3
3 factors, %	13.5	14.7	16.3	17.1
4 factors, %	9.0	9.8	11.4	13.0
≥5 factors, %	5.8	8.2	7.9	13.0
Mean (SD), No.	1.8 (1.5)	2.0 (1.6)	2.1 (1.5)	2.4 (1.7)
Outcomes				
Emergency department visits, mean (SD), No.	0.7 (1.3)	0.3 (0.8)	1.9 (1.4)	1.6 (1.2)

n/a = not applicable.

[a] Assessable factors from Table 1. A total of 8 factors were assessed in children aged <5 years and 11 factors were assessed in children aged 5-17 years, Supplemental Appendix, http://www.annfammed.org/content/16/1/62/suppl/DC1/.

Children Aged Younger Than 5 Years

Among children aged younger than 5 years, 35% (n = 62,512) had 1 or more ED visits during the measurement year. Of the 8 social complexity risk factors assessed in this age-group, severe poverty had the strongest association with a higher rate of ED use (IRR =1.25; 95% CI, 1.23-1.28) (Table 3). Five other risk factors were also associated with elevated rates of use. The rate of ED use in this cohort increased as the number of risk factors increased, reaching nearly twice the rate for children having 5 or more risk factors compared with those having none (IRR = 1.92; 95% CI, 1.85-2.00). When the number of risk factors was entered as a continuous predictor, we detected a significant positive association with a higher rate of ED use, supporting a dose-response relationship (IRR = 1.13; 95% CI, 1.12-1.14; results not shown).

Children Aged 5 to 17 Years

Among children aged 5 to 17 years, 21% (n = 69,015) had at least 1 ED visit during the measurement year (Table 2). Of the 11 individual social complexity risk factors studied in this age-group, child juvenile or criminal justice involvement (IRR = 1.40; 95% CI, 1.33-1.46) and child substance abuse (IRR = 1.37; 95% CI, 1.29-1.45) had the strongest associations with higher rates of ED use (Table 4). Five other risk factors were also associated with elevated rates. The rate of ED use increased as the number of risk factors increased, reaching more than twice the rate for children having 5 or more risk factors compared with peers having none (IRR = 2.06; 95% CI, 1.99-2.14). When the number of risk factors was entered as a continuous predictor, we detected a significant positive association with a higher rate of ED use, supporting a dose-response relationship in this age-group as well (IRR = 1.13; 95% CI, 1.13-1.14; results not shown).

Table 3. Adjusted Analysis Predicting the Number of Emergency Department Visits for Children Aged Younger Than 5 Years

Predictor	Model 1: Incidence Rate Ratio (95% Wald CI)	Model 2: Incidence Rate Ratio (95% Wald CI)
Social complexity risk factor		
Parent domestic violence	0.96 (0.92-1.00)	–
Parent death	0.85 (0.74-0.98)	–
Parent mental illness	1.21 (1.19-1.24)[a]	–
Parent criminal justice involvement	1.11 (1.09-1.13)[a]	–
Child abuse/neglect	1.08 (1.06-1.10)[a]	–
Homelessness	1.05 (1.03-1.08)[a]	–
Poverty	1.25 (1.23-1.28)[a]	–
Limited English proficiency	1.17 (1.14-1.19)[a]	–
Number of social complexity risk factors		
1 factor	–	1.24 (1.21-1.28)[a]
2 factors	–	1.48 (1.43-1.52)[a]
3 factors	–	1.62 (1.57-1.67)[a]
4 factors	–	1.76 (1.70-1.83)[a]
≥5 factors	–	1.92 (1.85-2.00)[a]

Note: Adjusted for child sex, race/ethnicity, age, level of medical complexity, and length of Medicaid coverage (months).

[a] Significant at $P < .0001$ level.

DISCUSSION

We found that it was feasible to use administrative data from the Washington State DSHS Integrated Client Database to identify several social complexity risk factors by linking children and their biologic parents. Social complexity risk factors frequently co-occurred, with approximately one-half of this population having at least 2 risk factors. The magnitude of the association with the rate of ED use was small for individual risk factors, but the rate increased as the number of risk factors increased independent of medical complexity. Our findings supported a dose-response pattern, which suggests greater need for support or services in children with multiple risk factors. Approximately one-quarter of the population was severely impoverished, as measured by receipt of Temporary Assistance for Needy Families (TANF), and severe poverty had one of the strongest associations with ED use in both cohorts. In contrast, child substance abuse and child juvenile or criminal justice involvement were infrequent, but given their effect size, they may be important indicators of health risk behaviors and family-level risk.

An important question is the feasibility of integrating data from multiple agencies to identify social complexity risk factors, given the challenges of linking data pertaining to a particular client across agencies, protecting privacy, updating data across multiple systems, and standardizing definitions of variables (eg, race/ethnicity) across agencies.[40-42] The Washington State DSHS Integrated Client Database is unique and facilitated this study. Other states, notably South Carolina and Illinois, have demonstrated that data integration is feasible, however.[41-43] We also successfully integrated administrative data for the Minnesota Medicaid population without using a preexisting database and identified several of the social complexity risk factors examined in the present study.[11]

Table 4. Adjusted Analysis Predicting the Number of Emergency Department Visits for Children Aged 5 to 17 Years

Predictor	Model 1: Incidence Rate Ratio (95% Wald CI)	Model 2: Incidence Rate Ratio (95% Wald CI)
Social complexity risk factor		
Parent domestic violence	1.01 (0.97-1.05)	–
Parent death	1.03 (0.97-1.10)	–
Parent mental illness	1.17 (1.15-1.20)[a]	–
Parent criminal justice involvement	1.02 (1.00-1.04)[a]	–
Child abuse/neglect	1.13 (1.11-1.15)[a]	–
Homelessness	1.09 (1.06-1.11)[a]	–
Poverty	1.25 (1.23-1.28)[a]	–
Limited English proficiency	1.04 (1.01-1.07)[a]	–
Child mental illness	1.10 (1.08-1.13)[a]	–
Child substance abuse	1.37 (1.29-1.45)[a]	–
Child juvenile or criminal justice involvement	1.40 (1.33-1.46)[a]	–
Number of social complexity risk factors		
1 factor	–	1.21 (1.18-1.25)[a]
2 factors	–	1.37 (1.32-1.41)[a]
3 factors	–	1.52 (1.47-1.57)[a]
4 factors	–	1.71 (1.65-1.77)[a]
≥5 factors	–	2.06 (1.99-2.14)[a]

Note: Adjusted for child sex, race/ethnicity, age, level of medical complexity, and length of Medicaid coverage (months).

[a] Significant at $P < .0001$ level.

After identifying children with social complexity risk factors, state agencies could potentially provide primary care clinicians with a social complexity flag or score without disclosing the specific risk factors so that they could consider in-person screening or taking a more detailed social history. The primary care team could then document the screening results or social history in the electronic health record and plan next steps, such as referrals, care coordination, or outreach (eg, support from a community health worker).[44] Team-based approaches involving professionals such as nurses, social workers, and community health workers could help identify risk and protective factors and coordinate the response, outreach, or both in order to reduce the burden on primary care clinicians.[5]

In the context of addressing social determinants of health, team-based care and coordination involve maintaining an inventory of community resources, developing partnerships with community-based services, and establishing a reliable follow-up system.[45] For example, a social worker might be able to help address concrete needs related to poverty, such as hunger, by connecting the family to a food bank or the Special Supplemental Nutrition Program for Women, Infants, and Children. For transportation and access issues, which are a barrier for low-income families,[46] bus or cab vouchers could facilitate daytime access to the primary care medical home to reduce evening ED use by a family with only 1 car. A nurse could provide education about how to access care advice by telephone or at an affiliated health care site during evening hours. If screening identifies parent or child mental health concerns, the primary care clinician could take steps to manage mental illness or make a referral to specialty care. Considering that a comprehensive and tailored approach is needed to address social complexity at the family level, the primary care team in a medical home is uniquely positioned to develop a thoughtful plan, harness needed community resources, and follow up to ensure both parents and children receive needed support.

This study has several limitations. Our method would be harder to replicate in states that lack the ability to link and integrate individual-level data across different agencies. We could not identify all social complexity risk factors associated with use patterns in prior studies.[12,19,23-25,27,29-31] To be included in the initial cohort, children had to have an identifiable biologic parent and at least 1 month of Medicaid coverage during the study period, resulting in the exclusion of 13% of otherwise eligible children. In assessing the child's exposure to social risk in the context of their family and environment, we were limited to biologic parents. We could not identify risk factors of other caregivers in the household or determine the time period in which the biologic parent lived with the child. Some variables have broad definitions that do not differentiate between levels of frequency or severity (eg, criminal justice involvement). Categorizing children as having social complexity risk factors when they have less serious forms of adversity may have resulted in underestimating the association with ED use. Future research using narrower definitions of the social complexity risk factors, specifying levels of frequency or severity, or examining specific combinations of risk factors could provide greater understanding of their relative importance. Future research should also include uninsured children and those who are covered by commercial health plans.

In conclusion, state administrative data can be used to identify social complexity risk factors that are associated with a higher rate of ED use for visits that may

be nonurgent, thereby potentially indicating a need for better access to services, community resources, or both. Providing a social complexity flag or score to primary care clinicians could facilitate targeted screening of families who are likely to have social risk, thereby making the best use of limited time and resources in primary care.

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Key words: adverse childhood experiences; social determinants of health; health care quality, access, and evaluation; primary care; vulnerable populations

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