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Preconception and Prenatal Predictors of Early Experiences of Risk and Protection Among Alaska Children

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Abstract

Objectives Our objective was to identify preconception and prenatal predictors of early experiences of co-occurring risk and protective factors to help target prevention efforts to the highest-need families prior to the birth of the child.

Methods Data were from the Alaska Longitudinal Child Abuse and Neglect Linkage project and the 2012–2014 Alaska Child Understanding Behaviors Survey. We used latent class analysis and Vermunt's three-step approach to examine predictors of latent classes of risk and protective factors among Alaska children.

Results Among children of Alaska Native/American Indian mothers, financial (OR 2.02, 95% CI 1.04, 3.90) and partner stress (OR 2.06, 95% CI 1.02, 4.10) prior to childbirth, maternal education < 12 years (OR 2.29, 95% CI 1.05, 4.96), and maternal substance use (OR 2.52, 95% CI 1.30, 4.89) were associated with a higher likelihood of membership in a high risk/moderate protection class as compared to a low socioeconomic status/high protection class. Among children of non-Native mothers, partner stress prior to childbirth (OR 3.92, 95% CI 1.08, 14.19), maternal education < 12 years (OR 2.69, 95% CI 1.24, 5.81), maternal substance use (OR 2.69, 95% CI 1.24, 5.81), younger maternal age (OR 0.87, 95% CI 0.80, 0.95), and a greater number of children (OR 1.62, 95% CI 1.09, 2.41) were associated with a higher likelihood of membership in a moderate risk/high protection class as compared to a low risk/moderate protection class.

Conclusions Results can inform eligibility criteria for prenatal home visiting programs and prenatal screening in Alaska to ensure prevention programming and referrals are directed to families most in need of additional support.

Keywords Risk factors · Protective factors · Early childhood · Alaska Native/American Indian

Significance

What is already known on this subject? Previous research identifies preconception and prenatal predictors of children's early experiences of risk and protective factors. However,

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most studies examined associations between predictors and individual risk or protective factors. Prior research suggests that risk and protective factors do not occur in isolation, but cluster to form distinct patterns of experience. *What this study adds?* We identified common and distinct predictors of heterogeneous classes of risk and protective factors among children of Alaska Native/American Indian and non-Native mothers. Results can inform targets for screening during prenatal visits and eligibility criteria for home visiting programs.

Introduction

Early childhood is a period of both potential and vulnerability given the rapid growth and change that occurs during this time (Shonkoff and Phillips 2000). In early childhood, development is influenced by risk factors, such as maltreatment and poverty, that increase the probability of poor outcomes and protective factors, such as the child having a relationship with a caring adult, that increase the probability of healthy outcomes (Elder 1998; Shonkoff and Phillips 2000). Importantly, the social, emotional, and physical capabilities that develop during the early years provide the foundation for subsequent development across the life course (Elder 1998; Shonkoff and Phillips 2000). Thus, there is a need for effective strategies that mitigate exposure to risk and enhance exposure to protection during early childhood.

From a life course perspective, to effectively mitigate risk and enhance protection during childhood, early identification of families who may benefit from services is important. The preconception and prenatal periods represent an opportune time to identify families and deliver prevention efforts to improve future child and family wellbeing. The prenatal period, in particular, is often a time of frequent engagement with the health care and other service systems. This period offers multiple opportunities for screening, referral, and service provision within the context of existing interactions. However, more information is needed regarding the social, environmental, and clinical factors present during the preconception and prenatal periods that are predictive of later child exposures to refine early prevention efforts and target them to the highest-need families.

Previous research has identified various preconception and prenatal predictors of children's later exposure to risk and protective factors influencing early development. For example, in a birth cohort study in California, maternal and infant characteristics captured on the birth certificate including low birth weight; birth abnormalities; late prenatal care; maternal birth place, race/ethnicity, age, education, abortion history, and insurance type; number of children; and missing paternity were predictive of child contact with child protective services (CPS) for suspected maltreatment prior to age five years (Putnam-Hornstein and Needell 2011). Data from the Pregnancy Risk Assessment Monitoring System (PRAMS) showed that the prevalence of postpartum depressive symptoms was highest among women who were younger in age and had lower education at childbirth and who experienced three or more stressful life events prior to childbirth (Ko et al. 2017). In the Family Life Project, maternal marital status during pregnancy was associated with the quality of the caregiving environment post-delivery, including positive parenting practices (Lanza et al. 2011). These results suggest that it may be possible to predict aspects of children's early experiences of risk and protection and to subsequently target prevention efforts based on preconception and prenatal indicators.

A limitation of the existing literature is that most studies examined associations between potential preconception and prenatal predictors and an individual risk or protective factor experienced during early childhood. Prior research suggests risk and protective factors do not occur in isolation, but rather cluster among children to form distinct patterns of experience (Bowen et al. 2007; Copeland-Linder et al. 2010; Murdock and Bolch 2005; Salas-Wright et al. 2014; Solberg et al. 2007). Focusing on associations of preconception and prenatal predictors with an individual risk or protective factor fails to account for children's larger experiences of multiple co-occurring risk and protective factors. Predicting patterns of risk and protective factors may improve our ability to better understand family needs and to effectively target multifaceted prevention efforts at the population level.

In a previous study, (Austin et al., in press) we conducted latent class analysis (LCA) to identify classes of seven risk and four protective factors in child social and emotional development experienced by children of AN/AI and non-Native mothers from birth until age 3 years. Examining patterns of risk and protective factors stratified by AN/AI and non-Native status is important as experiences of collective trauma among the AN/AI population, including forced assimilation and separation of families, may contribute to differences in the prevalence and co-occurrence of risk and protective factors between populations (Evans-Campbell 2008; Sarche et al. 2011; Services 2018). We identified two classes among children of AN/AI and children of non-Native mothers (Online Resource 2), with a test of invariance indicating that the nature of the classes differed by AN/AI and non-Native status (Austin et al., in press). Among children of AN/AI mothers, a high risk/moderate protection class (29.1%) was characterized by moderate to high probabilities of multiple risk factors (low socioeconomic status (SES), CPS contact for alleged maltreatment, maternal depressive symptoms, parental incarceration, child exposure to violence) and three protective factors (father figure involvement and family meals 7 days per week, regular interactions with peers) (Austin et al., in press). A low SES/high protection

class (70.9%) was characterized by a high probability of low SES and all protective factors (father figure, reading by an adult, and family meals 7 days per week, regular interactions with peers) (Austin et al., in press). Among children of non-Native mothers, a moderate risk/high protection class (32.9%) was characterized by moderate to high probabilities of low SES, maternal depressive symptoms, and all protective factors (Austin et al., in press). A low risk/high protection class (67.1%) was characterized by a high probability of all protective factors (Austin et al., in press).

The aim of the present study was to examine preconception and prenatal factors as predictors of the previously identified latent classes.

Methods

Data Sources

We used data from the Alaska Longitudinal Child Abuse and Neglect Linkage (ALCANLink) Project, a population-representative data source linking 2009–2011 Alaska Pregnancy Risk Assessment Monitoring System (PRAMS; N = 3549) data with administrative data sources. Alaska PRAMS is a population-based survey that collects self-reported information on maternal behaviors and experiences before, during, and after delivery of a live-born infant. Alaska PRAMS samples nearly one in six live births annually from the state's birth certificate file, with stratification by maternal AN/AI and non-Native status and birth weight (< 2500 g vs. ≥ 2500 g). In ALCANLink, Alaska PRAMS respondents were linked to administrative data sources via birth certificates. Administrative data sources for this study included data from the Alaska Office of Children's Services (OCS; Alaska's child protective services agency), Child Death Review, and death certificates. Additional details on data sources and linkage are provided elsewhere (Parrish et al. 2017).

We also used data from the 2012 to 2014 Alaska Childhood Understanding Behaviors Survey (CUBS; N = 1699). CUBS is a follow-up survey to Alaska PRAMS conducted shortly after the child's third birthday that collects self-reported information from mothers about their child's health status and experiences. Alaska PRAMS respondents living in Alaska at the time of CUBS administration are eligible to participate (Alaska Department of Health and Social Services 2015).

Measures

Alaska Native/American Indian Versus Non-Native Status

We categorized AN/AI (N = 593) or non-Native (1018) status based on maternal self-reported race on the birth certificate. For 2009–2011 births in Alaska, mothers did not have the option to report multiple races.

Preconception and Prenatal Predictors

We derived eight preconception and prenatal predictors from the birth certificate and Alaska PRAMS data available in ALCANLink (Online Resource 1). Factors derived from the birth certificate included maternal age, maternal education, and number of living children at childbirth. Maternal substance use was obtained from the birth certificate and Alaska PRAMS and included use of alcohol or cigarettes during pregnancy and marijuana use during pregnancy or in the 12 months prior to pregnancy. Stressful life events in the 12 months prior to childbirth were collected on Alaska PRAMS and included financial stress (the mother or her partner lost a job or the mother had a lot of bills she could not pay), emotional stress (a family member had to go into the hospital or someone close to the mother died), traumatic stress (the mother was homeless or in a physical fight, the mother or her partner went to jail, or someone close to the mother had a problem with drinking or drugs) and partner stress (the mother got separated or divorced, the mother argued with her partner more than usual, or the mother's partner said he didn't want her to be pregnant) (Ahluwalia et al. 2001).

Statistical Analysis

We used Vermunt's three step approach (Asparouhov and Muthén 2014; Vermunt 2010) to examine preconception and prenatal predictors of the previously identified latent classes among children of AN/AI and non-Native mothers (Austin et al., in press). In LCA, class membership is probabilistic, and there is an uncertainty rate associated with assigning individuals to a particular latent class (Collins and Lanza 2013). Vermunt's three step approach is a preferred method for examining predictors of latent classes because it accounts for the uncertainty associated with class membership (Asparouhov and Muthén 2014; Vermunt 2010). We used Vermunt's three-step approach to generate odds ratios (OR) and 95% confidence intervals (CI) estimating the odds of membership in the high risk/moderate protection class compared to low SES/high protection class among children of AN/AI mothers and the moderate risk/high protection class compared to low risk/high protection class among children of non-Native mothers for the predictors of interest.

We conducted data management in SAS 9.4 and statistical analyses in Mplus 8. All analyses accounted for the complex sampling design of CUBS. This study was reviewed and approved by the Institutional Review Board (IRB) at the University of North Carolina at Chapel Hill. Alaska PRAMS and CUBS are reviewed by the IRB at the University of

Alaska Anchorage, and PRAMS is reviewed by the IRB at the Centers for Disease Control and Prevention.

Results

The preconception and prenatal predictors examined are presented in Table 1. A significantly higher percent of AN/AI mothers compared to non-Native mothers experienced traumatic (36.6% vs. 18.4%) and partner stress (31.2% vs. 24.4%) in the 12 months prior to childbirth, used substances during pregnancy (52.0% vs. 27.9%), and had < 12 years of education (21.8% vs. 7.3%). AN/AI compared to non-Native mothers also had a significantly greater number of children at childbirth (1.4 vs. 0.99).

Among children of AN/AI mothers, maternal experiences of financial (OR 2.02, 95% CI 1.04, 3.90) and partner stress (OR 2.06, 95% CI 1.02, 4.10) in the 12 months prior to childbirth, maternal education < 12 years (ref: 12 years; OR 2.29, 95% CI 1.05, 4.96), and maternal substance use (OR 2.52, 95% CI 1.30, 4.89) were associated with a higher likelihood of membership in the high risk/moderate protection class compared to the low SES/high protection class (Table 2). Among non-Native children, maternal experiences of partner stress in the 12 months prior to childbirth (OR 3.92, 95% CI 1.08, 14.19), maternal education < 12 years (ref: 12 years; OR 2.69, 95% CI 1.24, 5.81), maternal substance use (OR 2.69, 95% CI 1.24, 5.81), younger maternal age at childbirth (OR 0.87, 95% CI 0.80, 0.95), and a greater number of living children at childbirth (OR 1.62, 95% CI 1.09, 2.41) were associated with a higher likelihood of membership in the moderate risk/high protection class compared to the low risk/high protection class. Maternal education > 12 years was associated with lower likelihood of membership in the moderate risk/high protection class compared to the low risk/high protection class (OR 0.32, 95% CI 0.15, 0.70).

Discussion

The purpose of the present study was to add to the extant research literature by examining preconception and prenatal predictors of previously identified patterns of risk and protective factors among young children in Alaska. While prior research has examined associations of preconception

Table 1 Prevalence of preconception and prenatal predictors among Alaska children (N = 1699)

	Children of Alaska Native/American Indian mothers (N = 593)		Children of non-Native mothers (N = 1018)		
	N or mean	%[a] (95% CI)	N or mean	%[a] (95% CI)	χ^2 p value
Emotional stress 12 months prior to childbirth					0.6258
No	471	80.7 (77.3, 84.1)	809	79.5 (76.3, 82.8)	
Yes	109	19.3 (15.9, 22.7)	205	20.5 (17.2, 23.7)	
Traumatic stress 12 months prior to childbirth					< 0.0001
No	364	63.4 (59.3, 67.5)	841	81.6 (78.3, 84.8)	
Yes	216	36.6 (32.5, 40.7)	173	18.4 (15.2, 21.7)	
Partner stress 12 months prior to childbirth					0.0160
No	297	68.8 (64.8, 72.7)	788	75.6 (72.0, 79.2)	
Yes	183	31.2 (27.3, 35.2)	226	24.4 (20.8, 28.0)	
Financial stress 12 months prior to childbirth					0.6347
No	294	51.7 (47.4, 55.9)	531	50.2 (46.2, 54.3)	
Yes	286	48.3 (44.1, 52.6)	483	49.8 (45.7, 53.8)	
Maternal education at childbirth (years)					< 0.0001
< 12	122	21.8 (18.2, 25.3)	63	7.3 (4.9, 9.7)	
12	586	55.1 (50.9, 59.3)	246	31.7 (27.7, 35.6)	
> 12	147	23.1 (19.6, 26.6)	681	61.0 (56.9, 65.1)	
Maternal substance use					< 0.0001
No	271	48.0 (43.8, 52.3)	732	72.1 (68.4, 75.9)	
Yes	310	52.0 (47.7, 56.2)	258	27.9 (24.1, 31.6)	
Number of living children at childbirth	1.4	(1.2, 1.5)	0.99	(0.90, 1.07)	< 0.0001
Maternal age at childbirth	25.7	(25.2, 26.2)	28.0	(27.6, 28.5)	< 0.0001

[a]All percentages are weighted to account for the complex sampling design of the Alaska Childhood Understanding Behaviors Survey

Table 2 Preconception and prenatal predictors of latent classes of risk and protective factors among Alaska children (N = 1699)

	Children of Alaska Native/American Indian mothers (N = 593)	Children of non-Native mothers (N = 1018)
	High risk/moderate protection class versus low SES/high protection class	Moderate risk/high protection class versus low risk/high protection class
	OR (95% CI)	OR (95% CI)
Emotional stress		
No	1.00	1.00
Yes	0.85 (0.35, 2.06)	1.53 (0.59, 3.99)
Traumatic stress		
No	1.00	1.00
Yes	1.98 (0.93, 4.19)	2.68 (0.92, 7.80)
Partner stress		
No	1.00	1.00
Yes	2.06 (1.04, 4.10)	3.92 (1.08, 14.19)
Financial stress		
No	1.00	1.00
Yes	2.02 (1.04, 3.90)	1.17 (0.49, 2.76)
Maternal education (years)		
12	1.00	1.00
< 12	2.29 (1.05, 4.96)	3.29 (1.46, 7.44)
> 12	0.55 (0.22, 1.35)	0.32 (0.15, 0.70)
Maternal substance use		
No	1.00	1.00
Yes	2.52 (1.30, 4.89)	2.69 (1.24, 5.81)
Maternal age at childbirth	0.95 (0.88, 1.04)	0.87 (0.80, 0.95)
Number of living children at childbirth	0.96 (0.72, 1.29)	1.62 (1.09, 2.41)

and prenatal indicators with individual risk or protective factors, this is the first study, to the best of our knowledge, to examine preconception and prenatal predictors of multiple co-occurring risk and protective factors in early childhood. We found both common and distinct predictors of membership in the "higher risk" class for children of AN/AI and non-Native mothers, with subsequent implications for the development and delivery of early screening and prevention efforts.

Common predictors of membership in the high risk/moderate protection class among children of AN/AI mothers and the moderate risk/high protection class among children of non-Native mothers included partner stress in the 12 months prior to childbirth and maternal substance use. Among children of AN/AI mothers, these stressors were predictive of experiences of multiple co-occurring risk factors during early childhood including low SES, CPS contact for alleged maltreatment, maternal depressive symptoms, parental incarceration, and child exposure to violence. Among children of non-Native mothers, these factors were predictive of exposure to low SES and maternal depressive symptoms during early childhood.

Partner stress and maternal substance use may each be a proxy for underlying household dysfunction. For example, among both AN/AI and non-Native mothers, arguing with a partner more than usual was the most commonly reported indicator of partner stress (25.6% and 19.2%, respectively). Increased conflict during pregnancy may reflect underlying social or financial stress associated with the transition to parenthood (Kluwer 2010). Maternal substance use may represent an unmet need for treatment services, or it may function as a mechanism for coping with underlying stressors (Latuskie et al. 2018). During prenatal visits or in home visiting programs in Alaska, universally assessing for partner conflict and screening for substance use with evidence-based tools (Wright et al. 2016) may help to identify those most in need of additional support. Ascertaining potential reasons for partner conflict and prenatal substance use may facilitate referrals to the most appropriate services to meet family needs.

An additional predictor of membership in the high risk/moderate protection class among children of AN/AI mothers and the moderate risk/high protection class among children of non-Native mothers was maternal education < 12 years

at childbirth. Prenatal home visiting programs delivered in Alaska include the Nurse Family Partnership, offered through the Alaska Maternal, Infant, and Early Childhood Home Visiting (MIECHV) Program and the Tribal Home Visiting Program, and Parents as Teachers, offered through the Tribal Home Visiting Program. All AN/AI parents of young children in specified geographic regions are eligible for Parents as Teachers (U.S. Department of Health and Human Services 2019). However, the Nurse Family Partnership specifically targets first-time, low income mothers (Olds 2006). While lower maternal education may translate to low income, some women with lower education may not meet income thresholds for program eligibility. Previous research suggests targeting early home visiting programs to mothers with lower levels of education in addition to low income and first-time mothers as maternal education has been found to be an important predictor of child development (Chittleborough et al. 2011; Hobcraft and Kiernan 2010). Our results align with this research and suggest that expanding prenatal home visiting program eligibility to include mothers with lower levels of education may be beneficial in terms of future child exposures.

Among children of AN/AI mothers, financial stress in the 12 months prior to childbirth was also a significant predictor of membership in the high risk/moderate protection class. The most commonly reported indicator of financial stress was the family having a lot of bills that they could not pay (20.7%). Among AN/AI mothers, assessing for difficulties with housing, utility, medical, and other bills during prenatal visits or in home visiting programs and referring mothers to agencies that can assist in meeting these basic needs may be important to promoting overall stability (Gershoff et al. 2007; Manuel et al. 2012) during the prenatal and postnatal periods. It will also be important to consider societal-level factors, such as discrimination, racial bias, and historical trauma (Evans-Campbell 2008), that undermine financial wellbeing and contribute to early childhood exposure to multiple risk factors among the AN/AI population.

Among children of non-Native mothers, younger maternal age and a greater number of living children at childbirth were also significant predictors of membership in the moderate risk/high protection class. As previously noted, many home visiting programs are targeted toward first-time mothers. This result suggests that targeting younger mothers and mothers with multiple children may be an effective strategy among non-Native families to address future child exposure to risk factors, particularly low SES and maternal depressive symptoms.

To mitigate risk and enhance protection at the population level, the results from this study suggest that multiple factors present during the preconception and prenatal period should be considered when determining eligibility criteria for prevention programs, such as prenatal home visiting, and for screening during prenatal visits. Our analysis highlights that these factors are predictive of child exposure to multiple risk factors during the first 3 years of life. However, the "higher risk" classes among children of AN/AI and non-Native mothers were also characterized by a high probability of multiple protective factors such as father figure involvement (Cabrera et al. 2007; McMunn et al. 2017; Sarkadi et al. 2008), family meals (Cprek et al. 2015), and interactions with peers (Criss et al. 2002; Masten 2007). Identifying those most in need of services and providing prevention programming to a highly targeted set of families must be carefully balanced against the risk of stigmatizing mothers and families as unfit or poor caregivers (Putnam-Hornstein and Needell 2011). The protective factors present in the "higher risk" classes highlight that risk does not occur in isolation and underscore the importance of acknowledging strengths as well as challenges in working with families to create environments supportive of healthy child development.

Limitations

Several limitations are worth note. First, data from Alaska PRAMS and CUBS are based on maternal self-report and thus are subject to social desirability, recall, and non-response bias. To address these issues, we combined data from multiple sources (e.g., Alaska PRAMS and the birth certificate) when possible. Second, we were limited in our ability to assess paternal characteristics around the time of pregnancy that may predict child exposure to risk and protective factors. Some data regarding paternal characteristics were available in the ALCANLink data, but a higher percent of these data were missing than for mothers. Thus, we chose to examine only maternal characteristics and experiences. In particular, we considered only maternal AN/AI status given that paternal race was missing for more than 15% of respondents. Third, we focused on predictors measured at one point in time. These factors may change over time, potentially altering the child's likelihood of experiencing various risk and protective factors. However, focusing on preconception and prenatal predictors allowed us to focus on a period of time when mothers are often in regular contact with various professionals and systems, providing opportunities for screening and assessment within existing interactions. Fourth, measures of discrimination and racial bias were not available from the data sources used. Such measures would provide additional insight and context for interpretation of results, particularly among the AN/AI population. Fifth, the 2012–2014 CUBS participation rate was 48% of 2009–2011 Alaska PRAMS respondents. CUBS non-participants were younger in age at childbirth (26.2 vs. 27.6 years) and had a higher prevalence of maternal education < 12 years (15.2% vs. 10.0%) and financial (52.9% vs. 47.8%) and partner (29.7% vs. 24.2%) stress in the 12 months prior to childbirth

compared to participants. However, participants and non-participants did not differ with respect to maternal substance use (35.0% vs. 32.8%), traumatic (22.7% vs. 21.8%) and emotional (19.8% vs. 20.0%) stress in the 12 months prior to child birth, maternal AN/AI status (25.8% vs. 25.3%), and number of living children at childbirth (1.2 vs. 1.1). Notably, most observed differences between CUBS participants and non-participants were small in magnitude.

Conclusions for Practice

Though it is unlikely that a one-size-fits-all approach will be effective for all families identified by the prenatal and preconception predictors examined in this study, the results can be used to help professionals make an informed determination of the families that may be most in need of services prior to the birth of the child. The prenatal and preconception predictors associated with the "higher risk" class among children of AN/AI and non-Native mothers can be used to inform and expand eligibility guidelines for prenatal home visiting programs and to highlight important screening questions to incorporate into prenatal visits such as questions assessing maternal substance use and family difficulties in meeting basic needs. Future research should examine the feasibility of targeting families for programs and referral based on the preconception and prenatal predictors identified in this study and whether such targeting is effective in impacting early childhood experiences of risk and protection.

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Compliance with ethical standards

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