



Early Adversity Scale for Schizophrenia (Short Form) (EAS-Sz (SF))

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To the Editor

We have developed the Early Adversity Scale for Schizophrenia (EAS-Sz) (Di Prinzio et al., 2023) which is a weighted combination of 42 childhood adversity exposures up to age 10 that can be measured from cross-linked electronic health and social services registers. Five subscales corresponding to (1) discontinuity in parenting (Morgan et al., 2007), (2) family functioning (Read, van Os, Morrison, & Ross, 2005), (3) family structure (Haukka, Suvisaari, & Lonnqvist, 2004), (4) area-level socioeconomic/demographic environment (Haukka et al., 2004; Veling, Susser, Selten, & Hoek, 2015), and (5) family-level socio-demographic status (Wicks, Hjern, Gunnell, Lewis, & Dalman, 2005) were also developed. See Table 1 for the variables included in each domain. Using routinely collected register data, we believe EAS-Sz has potential to help untangle contributions of genetic and environmental liability to schizophrenia risk. However, to increase the accessibility of EAS-Sz, we have now derived a shortened version of it and its subscales using simplified calculations, while maintaining useful levels of discrimination.

The calculation of the original EAS-Sz is a weighted combination of its five subscale scores. Each of these is in turn a weighted combination of its domain-specific adversity exposures. To simplify EAS-Sz, we used the original development dataset from which it was developed and identified cut-points in each distribution of subscale scores, some of which arose naturally because of the tendency for adversity exposures to cluster. We then explained and distinguished these groups by efficient checklists of exposures. For example, the distinct group of children with the highest scores in discontinuity in parenting had all experienced at least three adverse exposures, regardless of which three. The resulting five categorical scales (each a simplification of its original full domain continuous scale) were then combined through multivariable cox regression of time to schizophrenia diagnosis. Weights derived from regression coefficients were then assigned to each categorical level of each domain. A careful study of the regression coefficients showed that some category weightings within a domain could be assumed equal. This allowed for further simplification such that, when all domain scales were used to contribute to the overall scale, they could be explained by either two or three categories each. Refined regression-derived weightings for 13 categories were rounded and the summed rounded weightings within domains mapped to a domain-contribution to total score. See Table 1 for the steps involved in calculating this simplified version of EAS-Sz: Early Adversity Scale for Schizophrenia (Simplified Form) – EAS-Sz (SF).

This modified scale has a potential range from 0 to 10. Harrell's Concordance (Harrell, Califf, Pryor, Lee, & Rosati, 1982) values for predicting time to schizophrenia outcome were determined from the two original validation samples ($C = 0.63$ (95% CI 0.60–0.66) and $C = 0.65$ (95% CI 0.62–0.68)) which were consistent with those calculated for the original scale. Four category approximations for individual domains displayed concordance values which varied between validation samples and ranged between a minimum of $C = 0.55$ (95% CI 0.52–0.58) for Domain 4 to a maximum of $C = 0.60$ (95% CI 0.58–0.63) for Domain 3. Category level concordances were equivalent to those for their respective full scales for all domains. Calibration graphs (Royston, 2015) for EAS-Sz (SF) displayed good agreement between predicted time to schizophrenia diagnosis curves and 95% CI bands of observed Kaplan–Meier (Kaplan & Meier, 1958) curves.

For those 5% of children assigned an EAS-Sz (SF) score of five or greater, we estimated an average hazard rate of schizophrenia diagnosis at least four times higher than the rate estimated for the 63% of children assigned a score of zero or one.

EAS-Sz has been developed to help untangle contributions of genetic and environmental liability to schizophrenia risk. Initial validations show discrimination capacity well above chance. To increase the accessibility of EAS-Sz, we developed a simplified version, EAS-Sz (SF), derived through simplified calculations applied to a checklist. Concordance values for EAS-Sz (SF) from validation samples were equivalent to those for EAS-Sz. Results showed the concordance values for five domain sub-scales, each simplified to a four-category measure, were equivalent to the concordance values for the respective full sub-scales.

We have presented EAS-Sz (SF) and five domain-based four-category subscales. These are simplified versions of our original EAS-Sz and corresponding five domain scales and they

Table 1. Calculation of EAS-Sz (SF) and simplified domain-level subscales

EAS-Sz domains and domain-specific exposures	If given exposure has occurred, add listed value to domain total	If domain total is:	Simplified domain sub-scale value	Add listed value to EAS-Sz (SF) score
Domain 1 – Exposure to <i>Discontinuity in parenting</i>	Mother hospitalized ≥ 8 days when child aged 1 year <5 years	1		
	Mother hospitalized ≥ 8 days when child aged 5 years <10 years	1	$T = 0$	1
	Child hospitalized ≥ 8 days when child aged 15 days <1 year	1	$1 \leq T \leq 1.5$	2
	Child hospitalized ≥ 8 days when child aged 1 year <5 years	1	$2 \leq T \leq 2.5$	3
	Child hospitalized ≥ 8 days when child aged 5 years <10 years	1	$3 \leq T \leq 13$	4
	Father hospitalized ≥ 8 days when child aged 1 year <5 years	1		
	Father hospitalized ≥ 8 days when child aged 5 years <10 years	1		
	Any placement in foster care before child aged <10 years	3		
	Any incarcerations for father when child aged 1 year <5 years	1.5		
	Any incarcerations for father when child aged 5 years <10 years	1.5		
Domain 2 – Exposure to <i>family functioning</i>	Child protection contact before child aged 10 years:			
	Child or maternal sibling subject of ≥ 1 unsubstantiated notification, no substantiated abuse	1	$T = 0$	1
	Child or maternal sibling victim of ≥ 1 substantiated abuse	2	$T = 1$	2
	No notification for any child or maternal sibling within family	0	$T = 2$	3
Any parental corrective services contact before child aged 10 years	1	$T = 3$	4	
Domain 3 – Exposure to <i>family structure</i>	Maternal family size at child's 10 th birthday:			
	One, three or four children	1	$T = 0$	1
	Two children	0	$T = 1$	2
	Five or more children	2	$1.1 \leq T \leq 2.2$	3
	Father age <25 years or ≥ 45 years at child's birth	1.1	$3.1 \leq T \leq 4.2$	4
Mother not partnered at time of child's birth	1.1			
Domain 4 – Exposure to <i>ecological environment</i> ^a	Value of index of socio-economic disadvantage of residence at birth in lowest quintile	1.1		
	Area of residence at birth has:			
	High ethnic heterogeneity	1.1	$T = 0$	1
	Percentage of persons never married $\geq 50\%$	1.1	$1 \leq T \leq 2$	2
	Percentage of one parent families $\geq 20\%$	1	$2.1 \leq T \leq 3.3$	3
	Percentage of persons living in residences that are flats $\geq 5\%$	1	$4.1 \leq T \leq 5.3$	4
Percentage of persons who do not speak English well between 1 and 2%	1			
Domain 5 – Exposure to <i>family level sociodemographic status</i>	Father unknown/not registered at child's birth	1.1	$T = 0$	1
	Father is known and has occupation in lower skill level or unemployed at time of child's birth	1.1	$1 \leq T < 1.1$	2
	Mother born in low income country or in Western Australia	1	$1.1 \leq T \leq 2.1$	3
	Child of Aboriginal or Torres Strait Islander descent	3	$3 \leq T \leq 5.1$	4

^aIn area of mother's residence at child's birth, at 2001 census.

display equivalent discriminative capacity. These new tools provide a computationally simplified method for researchers to simultaneously account for many early childhood adversity exposures when modeling the role of cumulative adversity in schizophrenia

risk, including its interplay with genetic liability. While the greatest discrimination capacity is achieved when contributions across five domains are included, individual domain scales also provide some discrimination capacity above chance.

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