



## Review

Developmental and mental health disorders: Two sides of the same coin<sup>☆</sup>Valsamma Eapen<sup>a,b,\*</sup><sup>a</sup>Academic Unit of Child Psychiatry, South West Sydney Mental Health Centre Level 1, Locked Bag 7103, Liverpool BC, NSW 1871, Australia<sup>b</sup>School of Psychiatry, Faculty of Medicine University of New South Wales, Sydney, NSW 2052, Australia

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## ABSTRACT

Children with developmental disorders (DD) are at substantially greater risk of developing mental health problems compared to typically developing children. However, the mental health co-morbidity is often missed or hidden in the context of DD leading to reduced quality of life and increased burden of care. Mental health problems in the context of DD also result in less optimal school and post-school outcomes with reduced opportunities for employment and community participation. There is also considerable overlap in the risk factors for both conditions, and these follow a cumulative risk model. Although awareness among clinicians and the public is improving, there is paucity of theoretical models, early identification frameworks as well as care pathways for interventions. This paper presents a framework for evaluating developmental vulnerability that highlights common risk factors for developmental and mental health disorders.

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## 1. Introduction

## 1.1. Disorders of development and mental health

The interactions between developmental disorders (DD) and mental health (MH) problems are complex and not unidirectional.

Around 10% of children experience DD which are evident in early childhood (Eapen et al., 2006) and these rates are higher in children from vulnerable populations (Bouras, 2011). Disorders of development include those occurring in cognitive (e.g. intellectual delay), physical (e.g. cerebral palsy), self-help, language, social (e.g. autism), emotional or behavioural spheres. Individuals with DD are at fivefold risk for future mental health (MH) problems compared to controls (Bouras, 2011; Cooper and Smiley, 2007; Einfeld et al., 2006; Matson and Shoemaker, 2011; Morgan et al., 2008; Whitehouse et al., 2009a,b) with 40–50% experiencing such problems (Einfeld et al., 2006) including depression, anxiety, substance abuse, disruptive behaviours and psychosis. This added complexity compounds the psychosocial trajectory and can lead to family distress, poor community participation, unemployment and forensic involvement. It is often the MH co-morbidity that

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adversely affects the overall outcomes and quality of life in individuals with DD and their families. The long term support of those with DD places a considerable burden on families/carers (Bourke et al., 2008; Laurvick et al., 2006; Miodrag and Hodapp, 2010; Seltzer et al., 2011) and mothers, in particular, are at increased risk of MH problems (Abbeduto et al., 2004; Gray et al., 2011; Herring et al., 2006; Petalas et al., 2009; Rao and Beidel, 2009).

The key short- and long-term outcomes of DD for sufferers and carers are mediated, at least in part via MH. For example, it has been shown that the MH of parents of children with DD is more dependent on the child’s MH than on the child’s developmental level (Herring et al., 2006). MH problems associated with DD are also a major cause of failure in transition to school programmes and in the post-school period, with reduced opportunities for work, recreation and independent living (Einfeld et al., 2006). Robust evidence indicates that a lack of early detection and intervention has significant implications for the future academic, behavioural and social functioning of children with DD (Bouras, 2011). For example, children receiving early intervention for Autism have been shown to have an increase in their mean IQ score of 10 points over 12 months in a community setting (Eapen et al., 2013) and 18 points over two years in a clinic setting (Dawson et al., 2010). It is also known that families experiencing additional life stress prior to having children are more likely to have children with DD (Eapen et al., 1998). This is particularly the case with respect to Indigenous families, those from culturally and linguistically diverse (CALD) backgrounds, and those with a parent who has DD or a mental illness (Leonard et al., 2005, 2011; To et al., 2004). Hence, a vicious cycle of the development of DD and MH problems can be seen at an individual level or in population groups experiencing adversity (Whitehouse et al., 2009a,b). This confluence of factors generates a significant health burden for individuals, families, and communities, as well as inequity in child health resulting in significant health and economic impacts on the nation

(Woolfenden et al., 2013). Also these factors present opportunities for prevention and early intervention frameworks (Eapen and Jairam, 2009). However, studying these frameworks will require longitudinal study designs that follow up children and their environments over time with careful evaluation from pregnancy through to adolescence, and involving measures of biological and environmental risk factors (Golding, 2009a,b).

1.2. Developmental vulnerability and determinants of mental health problems in DD

Available evidence from the literature suggests that most of the variance in developmental vulnerability is associated with the social determinants of health and their interaction with an individual’s innate biological sensitivity to adversity (Guralnick, 1997; King et al., 1992; Patrianakos-Hoobler et al., 2009; Zeanah et al., 1997). Further, the cumulative exposure to risk factors over time without any protective factors particularly during the sensitive periods of neural development can result in changes in the neuronal circuitry with long term consequences. There is also emerging evidence that there is a transactional relationship between genes and the environment (Sameroff, 2009) with differential genetic sensitivity to social environment (GDSE) model positing that individuals with certain genetic makeups are more sensitive to favourable and unfavourable environmental influences than those without these genetic makeups (Mitchell et al., 2013). In this regard, four major mechanisms have been described: genes can influence an individual’s response to environmental stress, genes may enhance an individual’s sensitivity to both favourable and adverse environments, inherited characteristics may better fit with some environments than with others, and inherited capabilities may only become manifest in challenging or responsive environments (Reiss et al., 2013). It has been suggested that the human genome may have evolved specific “social programs” to adapt molecular physiology to the changing patterns of threat and

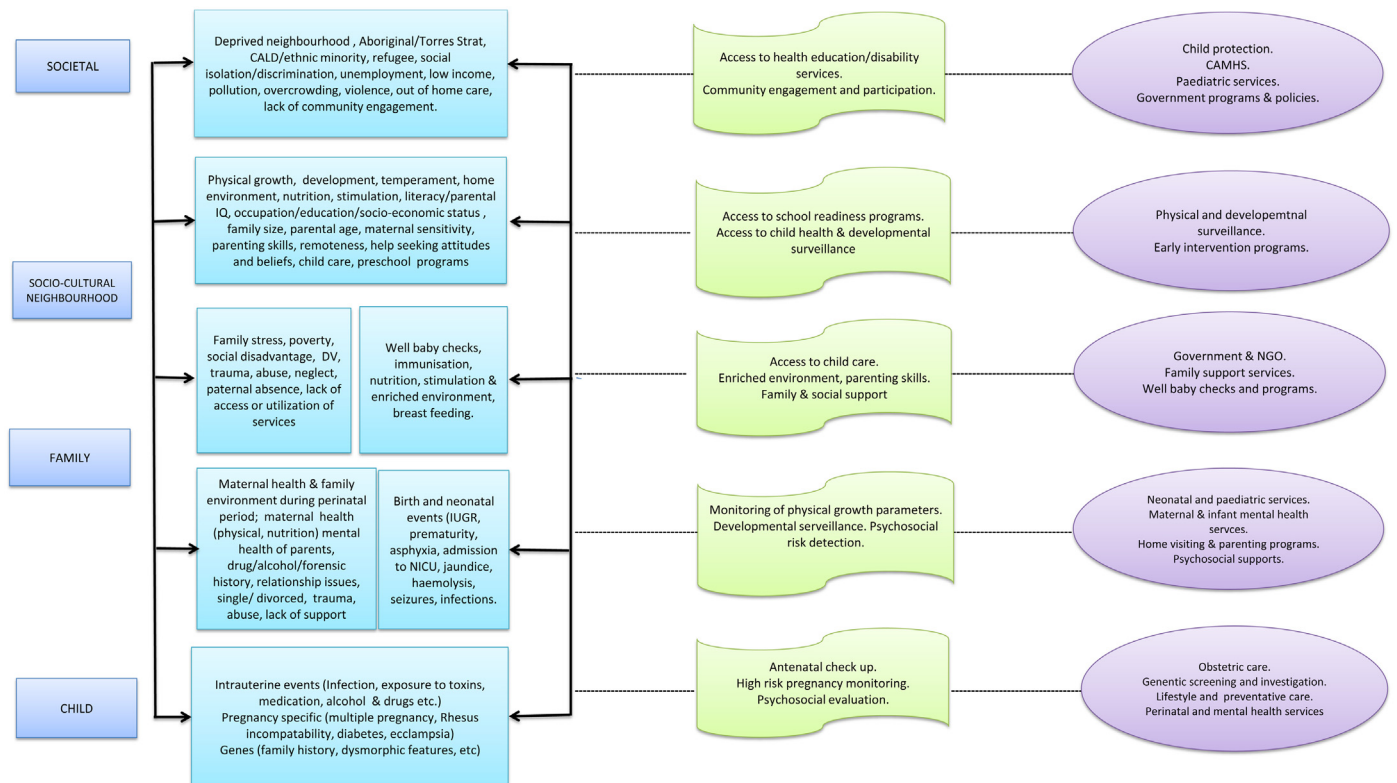


Fig. 1. Developmental vulnerability index.

opportunity ancestrally associated with changing social conditions (Cole, 2013).

The gene–environment interaction is a dynamic process that offers both vulnerability and resilience and three different types of interactions have been described. First, the reactive interaction refers to how the individual's innate characteristics influence the way he/she reacts with the environmental situation. For example, when a parent reprimands two siblings, one may react with extreme emotional outburst while the other may not show any concern. Evocative interaction on the other hand refers to how two children evoke different sets of responses from the parents or care takers. For example a child who smiles and shows positive affect when the caretaker interacts with him/her would evoke more warmth and positive nurturing as opposed to a child with difficult temperament who does not show any positive affect when the caretaker interacts with him. Pro-active interaction refers to how children as they grow older create their own environments. For example a shy child who is anxious about attending social gatherings will choose not to go and find an excuse to miss a birthday party while another child who is an extrovert and likes social gatherings will choose to attend. Thus we are active agents and participants in this process of how the innate biological makeup interacts with the social environment to determine the outcome. Similarly the environment can also modify how our genes are expressed (Meaney, 2010) with evidence that parental risk factors in early childhood are predictive of different patterns of DNA methylation in adolescents at follow up (Essex et al., 2013). Due to this transactional and inter-dependent relationship between different risk and resilience factors, developmental vulnerability will need to be understood, measured and intervened with due consideration given to the cumulative impact of multiple dependent and independent factors involving the individual child, the family and parental factors, psychosocial and neighbourhood factors as well as service systems and policy factors (Fig. 1). While it is critical to understand the adverse impact of risk factors on the developmental trajectory, the balancing effects of protective factors and the interplay between the two at multiple levels of the child's environment are all important in determining the outcomes.

The occurrence of mental health co-morbidity in children with DD and the nature and type of such co-morbidity are shaped by the interplay between the biological and environmental risk and resilience factors and its expression mediated by the life course issues as to when these factors are in operation in the child's life.

Therefore when assessing a child for developmental and mental health risk, it is essential that all these factors are given due weighting with the overall risk increasing as the number of risk factors that the child is exposed to increases. Similarly for intervention to be effective, interagency involvement becomes critical when risk factors in a number of risk categories are involved. For example a child with history of birth asphyxia, maternal depression, difficult temperament and speech delay will be at considerably increased risk for developing behavioural problems than another child exposed to only a single risk factor such as birth asphyxia. The first child will also need a trans-disciplinary approach involving paediatric, psychiatry and allied health professionals to achieve a comprehensive assessment followed by primary, secondary or tertiary level of intervention as deemed appropriate. Such a transactional relationship (Sameroff, 2009) between the child, the innate biological architecture as well as the environmental influences could best be conceptualised using a bioecological model. Such a model takes into account the amount of risk and protection factors that are in operation as well as the “dose” of co-occurring factors that are in the immediate environment and directly impact on the child (*proximal factors*) as well as those that exert an influence indirectly (*distal factors*) (Walker et al., 2011). For example, maternal depression does not have a direct impact on the child's development but it operates less directly through parenting behaviour that has a direct effect on the child's development (Linver, 1999). A cumulative risk index of potential risk factors (that is the sum of individual risk factors) is a robust way of conceptualising how risk factors interact together in the bioecological model, where risk variables across levels are dichotomised (present/absent) and then grouped into a single score and their effect analysed (Sameroff and Seifer, 1983). While it is difficult to capture the true interdependent and compounding nature of such risk factors, an example of how these factors can be accounted for in a Developmental Risk Index using the *micro-, meso-, exo- and macro-systems* model by Bronfenbrenner (1986) is given in Table 1. A score of 1 is given to the biological determinants of the developing child while the *microsystem* of the child's most immediate or proximal environment and the *mesosystem* involving the reciprocal relationship and interconnections between a developing child's different *microsystems* is given a score of 0.5 while the more distal *exosystem* that indirectly impacts on the child and their family and the *macrosystem* of societal, cultural and service or policy factors are given a score of 0.25.

**Table 1**  
Developmental risk index.

1.	<i>Biological factors</i> – biological vulnerability such as genetic (positive family history, physical/dysmorphic features etc.), temperament, etc.	1 point per positive item up to a maximum of 2
2.	<i>Individual child factors</i> – intrauterine environment (e.g. exposure to alcohol/drugs, toxins) perinatal (e.g. prematurity, IUGR, low Apgar), postnatal growth (developmental, social-emotional or behavioural problems), seizures, infections, chronic physical illness, stimulation (play, reading to child) and care (physical, nutrition, emotional), etc.	0.5 point per positive item up to a maximum of 2
3.	<i>Parental factors</i> – Younger or older age of parents, parental physical and mental health, drug/alcohol, criminality, maternal sensitivity/parenting skills, child exposed to DV, trauma, violence, abuse or neglect, single parent, family relationships, parental sensitivity and attitudes, poor literacy, low IQ, lack of social supports, out of home care, parents in prison, etc.	0.5 point per positive item up to a maximum of 3
4.	<i>Family and psychosocial factors</i> – family stress, poverty, food insecurity, social disadvantage, low socioeconomic status (income, education, occupation), housing stability and quality, large family size, overcrowding, family stability, mobility, refugee/minority groups, trauma, abuse, etc.	0.5 point per positive item up to a maximum of 2
5.	Socio-cultural and Service related factors – poor access to or utilisation of services (e.g. antenatal, early childhood, preschool), poor community participation, help seeking attitudes and beliefs, deprived or violent neighbourhood, pollution (e.g. lead), remoteness, social isolation/discrimination, etc.	0.25 point per item up to a maximum of 1

Scoring and referral suggestions<sup>a</sup>  
 Score of up to 0.5 on subscale and up to 3 on total score: monitoring at primary care level  
 Score of 0.5 to 1 on subscale and up to 6 on total score: referral to specialist services  
 Score of >1 on subscale and >6 on total score: referral to tertiary services

<sup>a</sup> See Fig. 1 for relevant services for referral.

### 1.3. Science barriers and research translational gaps

Currently research and implementation of evidence into service and policy development are poorly coordinated internationally and the situation is more pronounced in middle and low income countries (Eapen and Jairam, 2009). Health, education and disability services are often poorly integrated and diagnosis of DD is inconsistent, thus compromising universal prevention and early intervention. Similarly, while MH problems occur in all age groups, research and service provision are often constrained by age and discipline boundaries. Together these obstacles have resulted in evidence gaps, service gaps and inconsistency in clinical research methods, approaches, quality and scope (Miller et al., 2008). Moreover, new knowledge has not been well integrated into health systems and between disciplines leading to each operating in their respective 'silos' across disciplines, DD types, age groups, and in different settings namely clinical services, research and policy. This has created missed opportunities for using existing evidence, generating important new evidence and effective evidence implementation (Patel et al., 2013). In this regard, the low levels of detection of child mental disorders, the lack of evidence on delivery of the treatments, and the shortage of skilled child mental health professionals have been identified as the major barriers (Patel et al., 2013).

To identify DD and MH problems early, and to address this risk, we need to understand the risk and resilience factors as well as ascertain the barriers and facilitators of accessing care. Similarly, to offer effective intervention in those with MH and DD we need to understand the effectiveness for the range of different DD and MH problems and adapt MH interventions for use in DD population. It is also essential to identify family members at risk of MH problems early, including siblings (Schuntermann, 2007). There is also an urgent need to determine the adequacy of existing policies and develop the best service pathways with responsive adaptations that are locally relevant. Implementation of such systems to identify those that are vulnerable coupled with effective intervention will reduce a significant burden on sufferers, families, communities, and governments. In the context of advances in healthcare having led to a higher likelihood of survival for those with severe DD (Freiling et al., 2010; The Royal Australian, 2011) but with increased rates of MH problems, there is escalating demand for evidence base on determinants and outcomes over the long term. Development is a dynamic process and as genetically mediated deficits interact with the environmental risk and resilience factors in the early formative years of a child's life, the developmental trajectory may also change (Eapen, 2012). This potential for change offers opportunities for implementing early intervention frameworks and best intervention strategies that would reduce the burden of MH problems and to inform allocation of funding and prioritisation of resources.

## 2. Conclusions

There is compelling evidence to suggest that, investments in early childhood services for vulnerable children are not only needed from a social justice perspective but also as a wise economic investment to promote developmental and mental health outcomes of our future generations. Such prevention and early intervention programmes provided to children at risk of DD and MH problems would have the potential to alter the course of development and/or prevent the progression of the clinical condition by exploiting the neuronal maturation and brain plasticity. Therefore, any opportunity to address the changing population risk factors in DD and to promote mental health care related policies will need to be seized and appropriate pathways developed for intervention targets across

the bio-psycho-social-ecological model to eliminate health inequities and to promote mental health and well being.

### Conflicts of interest

The author has no conflicts of interest to declare.

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