

Annual Research Review: Resilience – clinical implications

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Background: It is a universal finding that there is huge heterogeneity in people's responses to all kinds of stress and adversity. Resilience is an interactive phenomenon that is inferred from findings indicating that some individuals have a relatively good outcome despite having experienced serious adversities. **Methods:** Resilience can only be inferred if there has been testing of environmental mediation of risks and quantification of the degree of risk. The use of 'natural experiments' to test environmental mediation is briefly discussed. The literature is then reviewed on features associated with resilience in terms of (a) those that are neutral or risky in the absence of the risk experience (such as adoption); (b) brief exposure to risks and inoculation effects; (c) mental features (such as planning, self-regulation or a sense of personal agency); (d) features that foster those mental features; (e) turning point effects; (f) gene-environment interactions; (g) social relationships and promotive effects; and (h) the biology of resilience. **Results:** Clinical implications are considered with respect to (a) conceptual implications; (b) prevention; and (c) treatment. **Conclusion:** Resilience findings do not translate into a clear programme of prevention and treatment, but they do provide numerous leads that focus on the dynamic view of what may be involved in overcoming seriously adverse experiences. **Key words:** Stress inoculation, planning, school experiences, self-control, self-reflection, turning points, gene-environment interactions, social relationships.

Introduction

Resilience is an interactive phenomenon that is inferred from findings indicating that some individuals have a relatively good outcome despite having experienced serious stresses or adversities – their outcome being better than that of other individuals who suffered the same experiences. **Werner and Smith (1982) were pioneers, not only in highlighting the importance of resilience, but also in showing the role of social support and the crucial importance of a lifespan approach.** Before discussing clinical implications, it is necessary therefore to summarise briefly what is known on environmentally mediated psychopathological effects of serious stresses or adversities. The concept of resilience does not negate the need to assess risk and protective influences; to the contrary, resilience has to be considered on the basis of evidence on risk and protection. What is crucial, however, is to focus on the mediating mechanisms for risk and protective processes.

Testing for environmental mediation

The requirement that environmental mediation should be tested rather than assumed applies to risk and protective factors research as much as resilience research, but it is only with resilience research that there has been much systematic testing.

Identification of key risk element

The first need is to determine whether each broad-based risk factor does actually constitute a risk for whatever maladapted outcome is being investigated.

'Broken homes' or 'family breakup' provides a good example for some of the possible research strategies (British Academy Working Group Report, 2009). Clearly, if family break-up constitutes a true element in the causal process, it must have occurred during the child's lifetime. Analyses in an adoption study showed that the risk for delinquency associated with parental divorce before the child was born did not differ from that in families in which no divorce occurred. In contrast, there was a substantial increase in risk associated with divorce after the child's birth (Burt, Barnes, McGue, & Iacono, 2008). Using a national birth cohort longitudinal study, Cherlin et al. (1991) tested whether the risk effect was a function of parental psychopathology or conflict that preceded the divorce. The findings when the children were aged 11 years indicated that predivorce conflict largely accounted for the supposed risk effect from the later occurring divorce. A further follow-up when the children were adult showed that, although predivorce family conflict accounted for part of the divorce risk effect, a significant divorce effect remained (Cherlin, Chase-Lansdale, & McRae, 1998).

Of course, divorce is rather a broad-based variable, and the next question was whether the risk stemmed from the parental break-up as such, or rather from the family conflict that was associated

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with the divorce (and may have predisposed to it). Rutter (1971) tackled the question by contrasting the risk effects of divorce and bereavement, and of unhappy versus happy separations. The findings were that the risks for antisocial behaviour in children were far greater in the case of divorce or unhappy separations than bereavement or happy separations. Fergusson, Horwood, and Lynskey (1992) used the Christchurch longitudinal study data set to contrast the risk effects on antisocial behaviour of family break-up, as against discord/conflict. Multivariate analyses showed a significant effect of discord after controlling for variations in family separations or break-up, but not for separations after controlling for discord. Most crucially, there was an effect of discord even in the absence of break-up (whereas the reverse was not the case).

Harris, Brown, and Bifulco (1986) undertook somewhat similar comparisons with respect to the risks for disorder in the children that followed break-up of the parental marriage. They asked whether the risks for the children arose only because the break-up led to poor parenting. They found that break-up did not lead to risk effects in the absence of poor parenting, but that poor parenting was associated with substantial risk even when there had been no break-up. Buchanan, Maccoby, and Dornsbusch (1991) asked whether the risks associated with divorce were largely a function of parental discord and conflict after the divorce. They found that that was the case.

The results of other research gave rise to much the same conclusions. That is, the major risks for the children derived from parental discord and conflict, and not from family separations or break-up as such. Of course, that is not to argue that bereavement is not stressful and never creates a risk for mental disorders in the children. However, it is to argue that whether or not parental loss operates as a risk factor depends on the particular circumstances of the individual case. Separation as such is not a major risk in most cases, whereas serious parental discord/conflict is usually a substantial risk factor.

The next question is whether or not the risks to the children are environmentally mediated. Three possible alternatives are genetic mediation, reverse causation (i.e. effects of the children on their parents, rather than the other way around) and selection effects (i.e. the characteristics of those who divorce rather than the divorce as such). Genetic mediation has been tested for using adoptee (Burt, McGue, Iacono, & Krueger, 2006) multivariate twin (Kendler & Prescott, 2006; Narusyte et al., 2008), discordant twin (Burt et al., 2006; Caspi et al., 2004) and Children of Twin (CoT) designs (D'Onofrio et al., 2006, 2007; Silberg & Eaves, 2012; Silberg, Maes, & Eaves, 2010). The focus in these various studies has included parental negativity, negative expressed emotion and family conflict, as well as parental divorce and parental discord. The findings are clear-

cut in showing environmentally mediated risk effects, but, also, they showed some genetic mediation. The overall body of evidence shows that almost all variables that describe environments include a complex mixture of genetic and environmental mediation.

Much the same applies to the study of reverse causation. As Bell (1968) posed the question of whether supposed socialisation effects might reflect the influences of children on parents rather than parents on children, numerous studies using a range of different designs have shown the reality of bidirectional effects (Bell & Harper, 1977). For example, Anderson, Lytton, and Romney (1986) used an ingenious experimental design involving a 'clear-up toys' task with mothers interacting with a normal child or with a conduct disorder child, in each case the child being either their own or someone else's. Clear evidence of child effects on mothers was found, but also some evidence of parental effects. Similar bidirectional effects were found by Kerr and Stattin (2000; Kerr, Stattin, & Pakalnskiene, 2008) in studying supervision and monitoring of children's behaviour as a possible protective influence against antisocial behaviour. Other research has also shown bidirectional effects.

Studies of other risk factors have also given rise to some surprising findings. For example, because parental depression involves a substantial genetic liability, there has been a tendency to assume that the intergenerational risk effects on the children are likely to be largely genetically mediated. However, CoT designs have shown a more nuanced or complicated picture (Silberg & Eaves, 2012 & Silberg et al., 2010). The effects of parental depression on child depression seem to be largely environmentally mediated, but the effects on children's conduct problems involves an admixture of genetic and environmental mediation.

Much (but not all) research has shown that corporal punishment constitutes a risk factor for psychopathology in the children, but does it serve as an environmentally mediated cause? Jaffee et al. (2004) set out to answer the question by contrasting physical punishment with physical abuse, using a twin design. The findings for the two were strikingly different. There were major risk effects associated with physical abuse, and these were largely environmentally mediated. In contrast, the risk effects associated with corporal punishment were largely genetically mediated, presumably through the effects of the children's behaviour in eliciting the punishment. Nevertheless, frequent recourse to physical punishment tended to escalate into abuse.

Jaffee, Moffitt, Caspi, and Taylor (2003) asked a similarly incisive question with respect to the supposed beneficial effects of fathers' involvement in child rearing. The research set out to determine whether the findings differed according to the qualities of the fathers. The results showed that the

involvement of seriously antisocial fathers had a significantly negative effect, whereas the involvement of fathers who were not antisocial or only somewhat antisocial, was significantly beneficial.

Numerous studies have shown that maternal cigarette smoking during the pregnancy is associated with a range of behavioural and cognitive problems postnatally. As there is experimental evidence that there are causal effects on birth weight (with a substantial lowering), it was widely assumed that the behavioural sequelae (especially antisocial and hyperkinetic behaviour) were also due to some form of prenatal programming effect. However, it is notoriously difficult to control for all possible confounders (see Academy of Medical Sciences, 2007) and three different types of natural experiment (see Rutter, 2007) have all negated the prenatal effect on behaviour, but have confirmed that on birth weight. These strategies were a comparison of pairs of siblings, one of whom had been exposed to maternal smoking in the pregnancy, one of whom had not (Obel et al., 2011); a CoT design (D'Onofrio et al., 2008); and a comparison of offspring born through assisted reproductive technologies using the mother's ovum and donated sperm (where there would be a genetic link between mother and child) and those using other techniques, such as egg donation, where there would be no genetic link (Rice et al., 2009; Thapar & Rutter, 2009). It is evident that causal inferences from statistical associations in nonexperimental designs can be quite misleading.

The last example deals with the somewhat different problem of assuming that risk and protective effects apply universally without the need to pay attention to social context or developmental stage. Nonmaternal care findings and claims illustrate this point. Thus, poor quality day care has been found to be associated with a very slightly increased risk of negative outcomes with respect to both scholastic achievement and disruptive behaviour (Vandell, Belsky, Burchina, Steinberg, & Vandergrift, 2010). However, five points are striking. First, in most studies, the effects have been rather small. Second, the main effects have concerned group day care in the first year of life. Third, there have also been cognitive benefits. Fourth, the risks and benefits are influenced by the quality of care provided. Fifth, although not studied in a resilience style, there appear to be marked individual differences in children's responses.

The importance of social context has been shown in both Canadian and Norwegian studies. In Canada, nonmaternal care has been most used by socially disadvantaged groups and the children in these families fared better if they received nonmaternal care – presumably because of the less good care provided by the biological mothers (Côté, Borge, Geoffroy, Rutter, & Tremblay, 2008; Geoffroy et al., 2007). In Norway, in contrast, almost no families made use of nonmaternal care in the year after the

child was born because of the generous state funding of maternal leave. After that, it was well-educated families who made most use of nonmaternal care – presumably because of a wish to resume their careers and a confidence in the generally high quality of group care in Norway (Bekkhuis, Borge, Maughan, & Rutter, 2011). In this situation, nonmaternal care carried no major risks or benefits.

An even more striking example is provided by the effects of marriage in preventing relationship breakdown. Within the UK, partnerships between unmarried couples tend to be more likely to break down than those of married couples. This is been widely, but misleadingly, interpreted as meaning that marriage protects against breakdown. It is misleading because unmarried cohabitations are hugely heterogeneous and because of the evidence that the difference largely reflects the characteristics of those who choose to marry or not marry (Crawford, Goodman, Greaves, & Joyce, 2011). International comparisons show that the breakdown rate of marriage in the USA is far higher than that of unmarried couples in Scandinavia (Cherlin, 2009). It makes no sense to see marriage as always a risk factor or a protective factor against relationship breakdown.

A rather different example concerns profound institutional deprivation. Adoption into well-functioning adoptive families is undoubtedly protective (see Rutter & Sonuga-Barke, 2010). Nevertheless, there are issues with respect to how the transition should be handled. Bateson et al. (2004) have emphasised that biology means that individuals adapt to the early environments in which they are reared. Too rapid a provision of normal experiences could provide risk if the example of subnutrition is thought to provide a model (see Barker, 1997, 1999, 2007).

The clinical implications of resilience must take account of these varied environmental mediation findings. Resilience cannot be studied without assessing which features constitute environmentally mediated risk or protection. Equally, neither prevention nor treatment can be planned without attention to these findings. There would be no point, for example, in seeking to reduce the adverse effects of a divorce without appreciating the important risk role of discord, conflict and poor parenting. Divorce constitutes a distal risk factor (because it is associated with discord and because it may bring about poor parenting), but usually it has only a minor proximal causal role. Equally, nonmaternal care may constitute either a risk or protective factor depending on individual circumstances. Prenatal exposure to maternal smoking does have a definite risk factor with respect to low birth weight, but not with respect to antisocial behaviour or ADHD. The main clinical implication is the requirement to assess individual needs in relation with particular circumstances, rather than assume that all risk and protective factors have similar effects in all conditions in all people.

The best established risk factors are abuse and neglect, which appear to have a substantial environmentally mediated risk effect on psychopathology in all societies that have been studied. Probably, the same applies to serious family discord and unresolved conflict, although the research findings are less robust; also the mediation is partially genetic. In contrast, family structure and disciplinary style are less solid risk influences. Parental mental disorder does have an environmentally mediating risk effect, in addition to a genetic influence, but the particular mix of mediating mechanisms varies with the psychopathological outcome being studied. There are risk effects associated with multiple negative life events, but this seems to be partially because they index chronic psychosocial adversities, which have a stronger risk effect. Poverty and social disadvantage undoubtedly have robust risk effects but they seem to operate more distally, with rather a limited proximal causal effect on young people. Deviant peer groups have a potentiating effect on antisocial behaviour (Dodge, Dishion, & Lansford, 2006), but the mechanisms involved have been surprisingly little studied up to now. Much the same applies to living in disorganised high crime areas.

The implication is that maltreatment (both physical and sexual) and neglect, together with serious family discord and unresolved conflict constitute well established partially environmentally mediated causal effects on psychopathology. On the other hand, there needs to be much more caution in using disciplinary style or family structure as indices of risk. Poverty and social disadvantage are important distal risk factors (and hence play an important role in causal pathways) but, despite a large number of studies, uncertainty remains on the mediating mechanisms as they operate at an individual level.

Features associated with resilience

The overall findings on resilience are more fully discussed elsewhere (Rutter, 2012), but the main conclusions may be summarised briefly as follows.

Features that are neutral or risky in the absence of a risk experience

First, resilience may stem from features that are not positive in the absence of environmental risk; they may be either neutral or even risky in their effects. The best known medical example is heterozygote sickle cell status, which provides a substantial protective effect against malaria, despite the fact that homozygote status leads to a very serious disease. A possible psychological equivalent may be adoption or long-term stable fostering. As being adopted is atypical, it may constitute a very slight psychopathological risk in the absence of serious risk experiences, but the adoption of a child who has been reared in an institutional environment or has

been removed from parental care because of serious abuse or neglect, exerts a substantial protective effect (Rutter & Sonuga-Barke, 2010; Nelson et al., 2007; Duyme, Dumaret, & Tomkiewicz, 1999). This has been shown both by group comparisons (e.g. children left in an institution versus those provided with good quality fostering – see Fox, Almas, Degnan, Nelson, and Zeanah (2011), and by within-individual change over time in children who leave institutional care to move to an adoptive home. Another example is nonmaternal care. There is no reason to suppose that such care provides a generally strongly beneficial effect if the care provided by the mother is good. However, it is associated with benefits in children from disadvantaged families (Côté et al., 2008; ; Geoffroy et al., 2007). The question to be asked each time is, not whether some supposedly atypical environment is a general health-promoting experience, but rather whether it improves on what the child would have had in the risky environment.

Brief exposure to risks: inoculation and coping

Second, resilience may stem from the effects of repeated brief exposure to negative experiences in circumstances that allow the individual to cope successfully with the experience. The obvious medical example is the acquisition of immunity from particular infectious agents, either as a result of natural exposure or inoculation of a modified form of the pathogen. Resistance to infections does not come from avoiding all contact with the pathogens; such avoidance is likely to increase vulnerability rather than promote resistance. In addition, there is extensive evidence that exposure to mycobacterial agents is protective against some forms of atopic disease, particularly asthma. Children reared on farms are less likely to get asthma because of the endotoxins to which they are exposed, and marked hygiene increases the risk (Martinez, 2008; von Mutius, 2007; Obihara & Bardin, 2008; Strachan, 1989).

The most compelling psychosocial equivalent comes from Lyons and colleagues' (Lyons & Parker, 2007; Lyons, Parker, Katz, & Schatzberg, 2009; Lyons et al., 2010) experiments with squirrel monkeys, building on the earlier study of Levine and Mody (2003). Young monkeys were removed from their colony for one hour's separation once per week before returning to their usual rearing conditions. The effects were a 'steeling' effect of reduced sensitivity to later stress experiences, accompanied by measurable effects on the neuroendocrine system. It is tempting to see this as a direct equivalent of inoculation-induced immunity, but in the absence of a better understanding of the mediating mechanisms that could be misleading. A possible human example may be seen in the observation by Stacey, Dearden, Pill, and Robinson (1970) that children who experienced brief happy separations from their parents

(such as sleepovers or staying with relatives) were able to cope with the more complicated multiple stresses of hospital admission. The evidence is based on limited data of a nonexperimental kind, but exposure in positive circumstances did seem to be helpful. The evidence from studies of the treatment of fears and phobias is also consistent with respect to the finding that the avoidance of the feared object makes persistence of the fear more likely.

These psychological examples might perhaps be viewed as ‘inoculation’ equivalents, but this is not so obvious in the case of Elder’s (1974) finding that adolescents who had to take on additional family responsibilities during the great Economic Depression of the 1930s, and who coped successfully, seemed to be strengthened by their experiences. In contrast, this beneficial effect was not evident with younger children – perhaps because they were less able to cope with what was demanded of them. Responsibilities are not easily viewed as pathogenic stress experiences, and perhaps the focus should be on the coping – either physiological as in the animal experiments or psychological as in the human naturalistic studies. However, even in the animal studies, psychological coping is implied by the evidence that adverse effects stem from uncontrollable, but not controllable, stress experiences (Maier, Amat, Baratta, Paul, & Watkins, 2006).

Mental features

Third, both the quantitative and qualitative studies have emphasised the importance of mental features such as a ‘planning’ tendency (Clausen, 1991, 1993; Quinton & Rutter, 1988), a style of self-reflection to assess what has worked or not worked for them and a sense of agency or determination to deal with challenges and self-confidence in being able to do so successfully (Hauser, Allen, & Golden, 2006). These are not equivalent to a particular coping strategy; the ‘planning’ benefits concerned a propensity to plan at all in relation to key life decisions, rather than skill in such planning. What was lacking in the institution-reared girls in Quinton and Rutter’s (1988) follow-up study was any sense of having control over what happened to them. They lacked both planning and a sense of agency. The outcomes were strikingly better for the minority who did show these mental features.

Experiences that fostered these mental features

The Quinton and Rutter (1988) findings indicated that the main positive effect on planning came from successes in some activity at school (the one other operative environment for young people reared in institutions). Very few of the girls had gained any kind of scholastic accomplishment, but they had successes in terms of achieving positions of responsibility within the school, or successes in music or sport, or some other activity. The implication was that,

possibly, the experience of success and the ability to exert control in one arena had enabled them to develop a more positive self-concept and a cognitive set that they could and would deal with life experiences.

A key mental feature concerns self-control. Moffitt et al. (2011) in the Dunedin longitudinal study showed that poor self-control in childhood was associated with a wide range of physical, psychological and social outcomes. The effects, moreover, were independent of IQ and social class, and operated across a population-wide dimension. The last feature provides the reason for considering interventions to improve self-control under the heading of prevention rather than treatment. The Dunedin study did not include any intervention to improve self-control, but the finding that improvements over time in self-control were associated with better outcomes suggests that there might be benefits from interventions to raise self-control. Findings on the efficacy of such preventive interventions are sparse, but they are encouraging (Greenberg, 2006). Accordingly, this is another example of a resilience finding that points to a possible preventive measure.

Turning point effects

Although researchers and clinicians have mainly considered childhood as the period when resilience develops, there is now good evidence of turning point effects in adult life. Two naturalistic examples illustrate what has been found. Sampson and Laub (1993; Laub & Sampson, 2003; Laub, Nagin, & Sampson, 1998) in their quantitative analysis of the data from their long-term follow-up of the Gluecks’ sample of incarcerated delinquents found that those men (the sample was exclusively male) who had married had a better outcome. This held up after taking account of the range of plausible background confounders. They went on to argue that if a supportive marriage truly was a protective influence, this should be evident in changes in their crime involvement during the time periods when they were married (Sampson, Laub, & Wimer, 2006) – capitalising on the rather high rate of marriage breakdown and remarrying in American society. They created a propensity score based on the 20 variables that predicted getting married. This was then used to create, in effect, groups matched on their propensity to marry. The overall changes in crime rate according to age was then put into the model. The findings showed an overall reduction of 36–43% in crime involvement during periods of marriage – confirming that there was a protective effect of being married.

The next question was, what was it about marriage that brought about this effect? John Laub conducted a systematic qualitative interviewing of a purposive sample of 52 of the men to get leads on this important matter. He found that marriage had many facets. Of course, it was likely that a loving supportive relationship was an important feature, but marriage

involved many other potentially relevant elements. These included the regulating function of the wives with respect to employment and family activities. This, in turn, was associated with a major change in both peer group and kinship group. Qualitative data cannot be used to test which of these mattered most, but they provided invaluable leads on what might be influential. The crucial features seemed to include the combination of 'knifing off' with respect to the past, and the opening up of opportunities for the future (see Maruna & Roy, 2007). That is, the turning point involves a discontinuity with the past that removes disadvantageous past options and provides new options for constructive change.

A second example is provided by service in the Armed Forces for individuals from a severely socially disadvantaged background at the time of the Great Economic Depression (Elder, 1986, 1987; Sampson & Laub, 1996). Findings showed that such early Armed Service experiences were associated with significantly better outcomes compared with individuals with a similar background who did not serve in the Armed Forces. Again, as with marriage, this constituted a multifaceted experience. There were two key consequences of service that probably mattered. First, most of the young male subjects had dropped out of school and lacked scholastic qualifications. Education in the more 'adult' arena of the Armed Forces reengaged many with the advantages of both learning and qualifications. The G.I. (Government Issue) Bill also provided funding for a later college education. The second feature involved postponement of marriage. This had two advantages. On the one hand, it meant that marriage could take place after, rather than before, a career was established. On the other hand, it also opened up the pool of potential partners beyond the group of similarly disadvantaged, often delinquent, peers. Again, the findings could not test whether these were the crucial elements, but they did point to a likely dynamic chain of events and experiences that involved both a 'knifing off' of the past and an opening up of new opportunities.

In summary, there is good evidence of the reality of turning point effects in adult life and consistency on the types of circumstances that brought them about. What are more speculative are the precise elements that were crucial and the mechanisms by which they operated. It can be assumed that any experiences that bring about major changes will necessarily involve some form of altered biology, but just what these are with respect to turning point effects remains unknown. What has been shown, however, is that experiences in adult life can bring about changes in the brain (Keating, 2011).

Gene-environment interactions (G × E)

There is now good evidence of the reality of G × E – (with respect to individual genes and measured

environments) – as shown by epidemiological/longitudinal studies, human experimental studies (using imaging to assess neural changes) and animal models (Caspi, Hariri, Holmes, Uher, & Moffitt, 2011; Caspi & Moffitt, 2006; Rutter, Thapar, & Pickles, 2009; Uher & McGuffin, 2010). There have been attempts to deny the reality of G × E (Risch et al., 2009) or to deny its practical importance (Zammit, Owen, & Lewis, 2010), but none has validity. Rather than seek to review G × E as a whole, the findings and issues may be better considered by focussing on just one environmental adversity – child maltreatment – and just two genes, – the MAOA gene and the serotonin transporter promoter gene (5HTTLPR), using the Dunedin studies as a starting point (Caspi et al., 2002, 2003). In the case of depression, the G × E concerned the short allele polymorphism of 5HTTLPR and either recurrent negative life events (LE) in the year before the onset of a depressive episode, or maltreatment in early childhood. In relation with antisocial behaviour, the G × E concerned the polymorphism associated with high MAOA activity and maltreatment. Both types of G × E were relatively specific; that is the 5HTTLPR G × E applied only to depression and not to antisocial behaviour and vice-versa with the MAOA gene. A large-scale meta-analysis (Karg, Burmeister, Shedden, & Sen, 2011) putting together different sorts of stresses showed only a marginally significant G × E effect for LE, but a strong and highly significant one for maltreatment. The finding is important because it connects early childhood experiences with psychopathology in later adolescence/early adult life. Uher et al. (2011) further showed that the G × E applied more to chronic or recurrent depression than to single acute episodes. Both sets of findings underline that the G × E applies to liability to disorder and not just to the provocation of the onset of an episode. The human brain imaging studies of Weinberger, Hariri and Meyer-Lindenberg (Hariri, Mattay, Tessitore, et al., 2002; Meyer-Lindenberg & Weinberger, 2006) further showed that both types of G × E (i.e. with the two different genes) operated in individuals without psychopathology. Although the biological pathway is involved in the genesis of (or protection from) psychopathology, the pathway operates in the total population and not just in patients with a mental disorder.

With respect to resilience, the key message is that genetic factors are involved in protection against both depression and antisocial behaviour. The precise mediating mechanisms have not yet been identified, but the implication of G × E is that it represents either a coming together of two closely related causal pathways or the sharing of one common pathway to a particular group of psychopathologies. As the G × E is relatively outcome specific, it also reinforces the view that resilience cannot be viewed as a fixed domain-general individual trait. Rather, resilience reflects a dynamic process.

At first sight, the $G \times E$ findings might seem to be relevant only to the identification of children who are unusually vulnerable to the psychopathological risks stemming from adverse experiences. However, evolutionary considerations suggest that this may be misleading (Belsky, 1997, 2005; Boyce & Ellis, 2005; Boyce et al., 1995; Ellis, Essex, & Boyce, 2005; Pluess & Belsky, 2009). Rather, it is more likely that the genes influence responsivity to most environments – both good and bad. Empirical findings supporting this suggestion are steadily growing (Ellis, Boyce, Belsky, Bakermans-Kranenburg, & van Ijzendoorn, 2011). On the other hand, there is evidence suggesting that, to some extent, there may be a degree of domain-specificity (see Essex, Armstrong, Burk, Hill Goldsmith, & Boyce, 2011; Obradaovic, Bush, & Boyce, 2011). It also remains uncertain whether the differential susceptibility resides in genomic, epigenomic, neural, neuroendocrine, or behavioural mechanisms. However, in terms of clinical implications, the bottom line message is that the genetic polymorphisms that are associated with vulnerability to adverse environments may also be associated with greater responsivity to positive environments brought about through therapeutic interventions.

Social relationships and promotive effects

As humans are social beings, it may be expected that commitment to social relationships would be protective. Indeed, the Hauser et al. (2006) qualitative study found that it was one of the three main features associated with long-term resilience following a mental disorder that had led to inpatient care. Bowes, Maughan, Caspi, Moffitt, and Arseneault (2010) used the Environmental Risk (E-Risk) prospective longitudinal study of a national sample of twins to study the possibly protective effects of family warmth in buffering the damaging effects of bullying victimisation (shown to be environmentally mediated). Linear regression models showed that maternal warmth, sibling warmth and a positive atmosphere in the family, as assessed between 5 and 10 years, was significantly protective against the

effects of bullying on emotional and behavioural disturbance at 10–12 years. The benefits were evident in both bullied and nonbullied children, but a significant interaction showed that effects were greater in the case of bullied children. A discordant MZ twin strategy was used to test whether the maternal warmth exerted an environmentally mediated protective effect; finding that it did in the case of behavioural problems. Within MZ pairs, the twin who received more maternal warmth had fewer behavioural problems.

The findings are important in three different respects. First, they show the role of family relationships in bringing about resilience and, second, they showed that this effect is strongest in the case of bullied children. Third, however, to a lesser degree, the effect also applied to nonbullied children. Many influences on resilience are of a kind that do not apply in the absence of the environmental hazard but, in the case of warm family relationships, they serve as promoters of good functioning in the absence of adversity, as well as fostering resilience in the presence of adversity. As indicated, there are very fundamental differences between additive concepts of risk/protection (i.e. that risk effects tend to be broadly similar in everyone with outcomes dependent on the summative effects of risk and protective features) and the interactive concept of resilience (in which the focus is on the heterogeneity of outcomes reflecting a dynamic process that requires the presence of risk to trigger its occurrence), but that does not mean that sometimes the same influence cannot operate in both.

In summary of the dynamic processes that underlie resilience, a distinction may be drawn between those that operate before the experience of stress/adversity to increase resilience to the effects of such experiences (as indicated in Figure 1), and those that operate after such an experience to foster restoration of good functioning (as indicated in Figure 2). In addition, but not included in the figures, are the important role of $G \times E$, and the value of promotive factors (such as represented by warm family relationships).

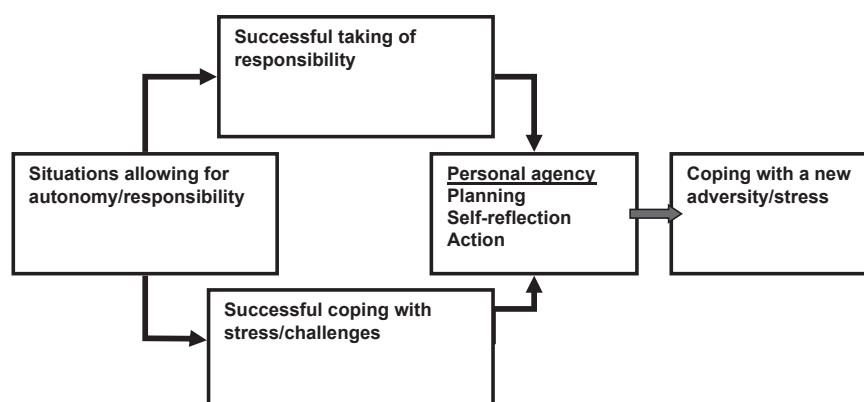


Figure 1 Resilience promoters operating prior to adversity/stress experiences

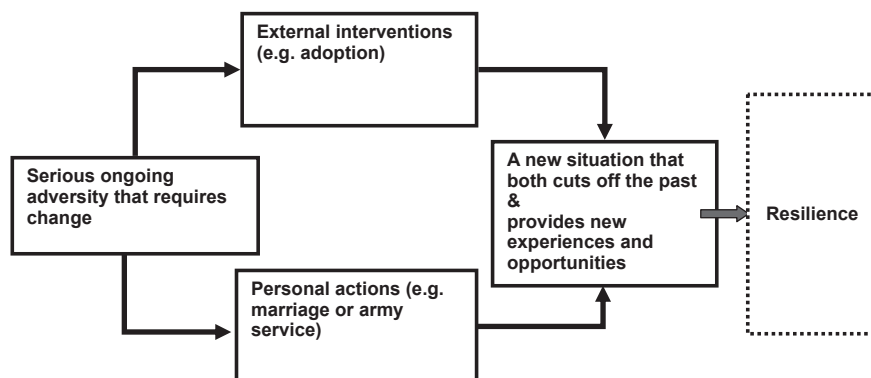


Figure 2 Resilience promoters operating after adversity/stress experiences

Biology of resilience

It may be assumed that all mental phenomena will have biological correlates (Rutter, 2011) and an understanding of the biological features would be likely to provide leads on how better to foster resilience. Unfortunately, key questions on the biology have yet to be addressed. Thus, quite a lot is known on the effects of abuse and neglect on the neuroendocrine system (hypothalamic-pituitary-adrenal - HPA-axis) (Gunnar & Quevedo, 2008), but evidence is lacking on whether or not these effects differ in those who overcome adversity. Indeed, uncertainty remains on whether the HPA features mediate the negative effects of adversity on psychological functioning, let alone resilience. The reality of epigenetic effects of experiences has been well shown by animal studies (Meaney, 2010) and it is to be expected that the same mechanisms apply in humans; indeed, there is some evidence that they do. However, as with the HPA findings, the query is whether or not epigenetic findings account for individual differences in children's responses to adversity – i.e. whether they account for resilience. There is then the further query of the connections between the epigenetics and the HPA findings. Thus, it is possible that epigenetic alterations are needed for the HPA findings to develop. For any of this to be clinically useful, a much better understanding of the mechanism is required.

A somewhat different issue concerns brain plasticity (Huttenlocher, 2002; Lenroot & Giedd, 2011; Nelson, 2011). The term refers to the ability of the brain to change as a result of experiences – sometimes (but not always) as a result of sensory input during a sensitive phase of development. The best-known example stems from Hubel and Wiesel (2005) Nobel Prize winning research into the role of binocular visual input in allowing normal development of the visual cortex. More recently, there has been a revival of interest in the topic as a result of the evidence that active physical experiences aid people's recovery from severe brain injuries (Taub, 2000). Of course, these observations apply to the sequelae of severe brain damage and the benefits of physical

activity, but it is possible that the principles could apply also in the psychosocial arena. If so, it might suggest novel approaches to the fostering of resilience. However, uncertainty remains on the relative benefits of intensive training of the damaged function and compensatory training of alternative processes (see Bryck & Fisher, 2012).

A third issue concerns the role of development in bringing about adaptation of the organism in relation with the environmental conditions prevailing during sensitive periods of development (Bateson et al., 2004). The somatic medical example is provided by the human evidence that poor growth in the prenatal and early post natal period predisposes to an increased risk of cardiovascular disease in adult life – i.e. the opposite of risk stemming from being overweight in middle age (Barker, 1999, 2007). The suggestion is that the biological programming is of a kind that provides adaptation to under nutrition, and this may be damaging if over nutrition is experienced. The implication might be that too rapid a provision of active stimulating experiences might be damaging in the case of children who had suffered gross pervasive deprivation during an institutional rearing, and that resilience might be fostered by a slower restoration of normal experiences. It is all too clear that all of this is at the stage of speculation. The issues are noted because once the biology is better understood, there are likely to be important implications for resilience.

Clinical implications

The review so far has implicitly drawn attention to some of the important clinical implications of resilience findings, but hereon, they are made explicit.

Conceptual implications

To begin with, there are several important conceptual implications. First, simply because a variable describes some environmental feature, it does not necessarily mean that the psychopathological risks are environmentally mediated. At least part of the effects may be genetically mediated and some may

represent reverse causation or bidirectional effects, or reflect the origins of the risk factor.

Second, whenever a feature is broadly defined (as with 'broken homes' or 'poverty'), it is crucial to determine which particular aspect of the feature contributes to causation. There are many historical examples of mis-identification of the key risk element.

Third, many influences are relatively context-specific, making it mandatory to consider individual circumstances more closely. Research findings on contextual effects (see e.g. Rutter, 1999) are sparse, but when available they should be used to consider the likely impact in each individual case. The examples given on nonmaternal care and on marriage well illustrate the role of social context.

Fourth, as shown by the $G \times E$ findings, resilience influences may operate over a considerable time span (as with the effect of maltreatment in childhood on psychopathology in late adolescence or early adult life). Resilience is a process and not a static feature. Moreover, resilience should not be thought of as achieving superior functioning. Rather, it means that the individual has been able to continue on a normal life trajectory despite the adversity.

Fifth, resilience may be fostered by exposure to manageable challenges or small doses of a stress experience, rather than by avoidance of the environmental hazard. The promotion of competence implies that outcomes are determined by a balance between risk and protective factors, but resilience findings show that neglects the very important finding that some risk factors may actually be quite 'steeling' or strengthening if they occur in a way and at a time when the individual can cope successfully (coping being both physiological and psychological).

Sixth, resilience may be brought about by experiences that are either neutral or slightly risky in the absence of the environmental hazard. The example of adoption well illustrates this point.

Seventh, resilience operates on a lifetime basis, so that experiences long after the initial adversity may bring about a restorative effect (as shown by the turning point findings).

Finally, the mediating mechanisms involved in resilience may involve the biology and not just mental operations. Nevertheless, mental features appear prominent in resilience findings (as shown by the effects of personal agency and of planning). It should not be assumed that these are outside the biology; to the contrary, they are part of it even if our understanding of brain-mind interconnections remains rather rudimentary at the moment.

Prevention

The first prevention implication is that resilience may stem from features that are not intrinsically positive in the absence of risk. Adoption is the obvious example because it carries no benefits in the absence of adversity, but it is protective when

remaining in a risk environment is the alternative. The relevant adversity is the occurrence of child abuse or neglect or serious parental problems that lead the child to be removed from parental care. An all too common occurrence is a series of short-term foster home placements without any decision or action on long-term plans. It would be unreasonable (and probably unethical) to decide that the parents could never provide acceptable care, without steps being taken first to determine whether, through remedial intervention, parental care could be brought up to an acceptable standard.

The same issue arises, even more forcefully, in the case of newborn babies removed at birth on the basis of the mother's drug and alcohol problems. A novel initiation was set up, with the support of the Coram Foundation, in which remedial intervention could be provided for a 6-month period at which point a decision had to be made (Harwin et al., 2011). Either there had been sufficient progress to justify leaving the child in parental care with whatever continuing intervention was needed or, recognising that adequate care was unlikely to be possible, adoption should be made available without further procrastination. This presupposes that, if parental care is unreasonably withheld, there can be adoption without their consent. That is allowable in English law, but not in many other jurisdictions.

The second prevention implication arises from the observation of the role of mental features such as planning, self-reflection, and active personal agency in resilience processes. Two possible steps have to be considered. First, these could be taught through experiential teaching (rather than didactic instruction), as shown by the success in the field of self-efficacy (Bandura, 1995). This would be reasonable, but it is unlikely that such personal teaching could be provided on a community-wide basis and it is uncertain what proportion of children suffering abuse and neglect would welcome such interventions. Accordingly, in addition, attention needs to be paid to the provision of universal experiences of a kind that serve to foster the beneficial mental features. As noted above, the experience of success in some domain of activity at school seems to be important. For this to foster resilience, it seems likely that the children must be able to take responsibility, exercise a degree of autonomy and have the opportunity of learning from their own mistakes. Studies of effective schools (Rutter & Maughan, 2002; Rutter, Maughan, Mortimore, Ouston, & Smith, 1979) showed that schools varied greatly in the extent to which they provided opportunities for taking responsibility and exercising autonomy, but those that did so (in rather varied ways) tended to have better pupil outcomes.

The third prevention implication derives from the resilience finding of the protective effects of being exposed to and coping successfully with, challenges and stressors. This resonates with the general

recognition that coping with challenges constitutes an essential, and generally positive, aspect of normal development (Rutter & Rutter, 1993).

In whatever preventative approaches are used, there needs to be sensitivity to the danger of inadvertently deskillling the participants (whether they be young people or their parents) because professionals drive the whole enterprise, not just in strategic planning (which they need to do), but in the details of tactics as well. Of course, there is a fine line to be drawn between leaving everyone to their own devices (which is not likely to be a good option) and so regulating everything that there is no scope for participants to try out their own ideas and to learn from their own mistakes. This has implications for interventions with families, but it has even more applicability in what is needed in schools and in community projects.

The fourth implication is that a lifespan approach is essential because of the reality of turning point effects in adult life. Preventive interventions in early/middle childhood are needed - not because development is determined and fixed during that period (it is not) - but rather because it comes first and, because of that, it may partially shape later experiences. On the other hand, major turning point effects in adult life occur naturally and the key question is how that knowledge can influence our planning of preventive interventions. Obviously, we cannot 'prescribe' harmonious marriages, but we can, and should, consider how any type of adult experience may provide a major discontinuity with the disadvantaged, deviant past and open-up fresh opportunities for success and good relationships. Mentorship of others constitutes one possible way forward. For example, using individuals who have dealt successfully with their own substance abuse or have come out of a career of crime may be particularly valuable in helping others to do the same. Providing such mentoring is likely to strengthen their own personal development, but it also may be helpful for others just because they share certain experiences.

Fifth, the evidence on $G \times E$ points to the need to pay attention to the possible biological pathways involved. Amongst other things, the suggestive evidence that the same genetic polymorphism associated a high vulnerability with abuse/neglect may also be associated with an increased responsiveness to positive environments. In other words, the $G \times E$ may be an indicator that, far from predestining a bad outcome, may actually predispose to a good outcome from the beneficial environments that have been provided as part of the preventive intervention. Once the biological pathways are better understood, there are likely to be more specific pointers to improve methods of intervening, but so far that is a hope for the future rather than a goal achieved (Ellis et al., 2011).

Finally, there is the evidence from the bullying studies that maternal warmth and a positive family

atmosphere can serve to buffer children from the negative outcomes associated with bullying victimisation. This promotive effect fostering good development applied even in nonvictimized children, but the benefits were more marked in those exposed to bullying. The message is that interventions need to serve the provision of good social relationships and not just the focussed learning of specific coping skills or particular cognitive strategies. It is probably not most useful to consider social relationships as a taught skill; rather they are best acquired through relevant experiences that are guided but not instructed.

Treatment

The first indication of resilience findings concerns what is needed in any clinical assessment. In addition to diagnosis, assessment has to include an analysis of possible causal influences and the mechanisms by which they may operate. In addition, there should be an appraisal of features in the child, family and social circumstances that could guide the planning of treatment (Rutter & Taylor, 2008). In that connection, resilience findings indicate the need to consider the social context of possible influences - recognising that the context may alter their meaning and their impact (Rutter, 1999). In the identification of possible causal influences, there are two key messages. First, attention needs to be focussed on those for which there is good evidence of environmental mediation. Second, some influences may have operated many years earlier, but nevertheless, have a continuing impact on psychopathological liability. Acute life events may provoke the onset of an episode, but the persisting effects of chronic adversity on ongoing liability matter more.

As resilience means attention to escape from adversities, clinical assessment needs to incorporate a search for clues on possibly relevant features in each individual case. This should focus more on dynamic features than static traits and it should incorporate a consideration of how the child (and family) had dealt with past crises and challenges, as successes then may be relevant now. Have there been any turning point experiences? Sibling comparisons may also be informative in providing clues on possible coping strategies.

The more general resilience implications is that the planning of treatment should include the possibility of changing circumstances so that there might be some experience that both 'knifed off' the past and provided new opportunities for success and good relationships. For example, are there youth groups that could build on the individual's strengths? Could the school provide appropriate opportunities? Would it be helpful to seek the involvement of other family members?

As noted already, resilience findings highlight the importance of mental phenomena - ideas, attributions,

self-reflection and planning. The implication is that any adequate clinical assessment should assess these with a particular interest in which might have potential for overcoming adversity. A key message is that no causal influences in multifactorial disorders are fully determinative. Even when the dice seem loaded against the individual, successful coping may still be attainable and the onus is on the clinician to identify and foster the processes that might lead to success.

There is one more general message. Whatever treatment is implemented, whether psychological or pharmacological, there will still be a need to consider whether it is provided in a manner that encourages the patient to feel that they can 'act' to improve their situation, rather than feel that all benefits derive from what the clinician does. The goal of any treatment must be to pass the initiative back to the patient, and not to encourage a dependent reliance on the therapist. In addition, however, there needs to be attention paid to both the child's ongoing relationships and the use made of them. Successful coping needs to encompass the social, as well as the psychological, dimension.

As for the specifics of interventions, resilience findings do not point to any particular treatments other than those discussed in relation to prevention. Thus, the likely value of fostering the development of self-control and the protective effect of a warm parent-child relationship and a positive family atmosphere have been noted. One possible addition stems from the brain plasticity findings that neural rehabilitation may be aided by massed practice of the

affected limb (see Nelson, 2011; also Taub, 2000 and Taub, Ramey, DeLuca, & Echols, 2004). This provides a direct possibility for clinics dealing with neuropsychiatric disorders, but it raises the much more speculative possibility that there might be a psychosocial equivalent of the neural effects of non-use of a function and the possible benefits of ensuring deliberate practice of that function.

Conclusion

Resilience findings do not translate into a clear programme of prevention and treatment, but they do provide numerous leads on clinical approaches that focus on the dynamic view of what may be involved in overcoming seriously adverse experiences.

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Key points

- Resilience may be fostered by controlled exposure to manageable challenges or stresses, rather than through their avoidance.
- Protection may also derive from experiences, such as adoption, that are neutral or even slightly risky in the absence of risk.
- Benefits may depend on mental features, such as planning, self-reflection and personal agency and success in areas outside the family (such as schools) may foster these features.
- Late recovery from early adversities may stem from turning point experiences that 'knife off' the past and provide new opportunities.
- Individual differences in response with adversity may reflect biological pathways influenced by genes.

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