

Children in Harm's Way: a Global Issue as Important as Climate Change

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Abstract

Considerable evidence points to the importance of early development from the time of conception in causal pathways to life-long health and wellbeing. A consistent theme is evolving regarding the interplay between psychological and social factors and biological mechanisms, such as genetic predisposition and stress-related neuroendocrine functioning. The focus of interest is the developing child and the emerging capacity for emotional, attentional, and social regulation. Of substantial importance is the possibility that the experience of multiple stressful life-events within the family, school and community directly and indirectly influences these regulatory processes. Evidence suggests that the experience of life-stress modifies the child's biology through the central mediator of stress responsiveness, the hypothalamic-pituitary-adrenal (HPA) axis.

Children in both developing and developed countries are at risk of poor health and developmental outcomes across the lifespan. Terrorism, civil unrest, youth crime and violence, high rates of mental health problems in both children and adults, high rates of substance abuse, promiscuous sexual behaviour, and high rates of starvation as well as obesity are all symptoms of the underlying problem. While the causes are complex and involve an interplay between individual, family and community characteristics, there is increasing evidence that supportive public policy across a range of portfolios is key to reversing this disturbing situation. Failure to act now, both nationally and globally, poses a dire risk for future human habitation arguably greater than the impact of unabated climate change.

Introduction

There is extensive evidence demonstrating that the health and wellbeing of many of the world's children is at risk. In a comprehensive report just released by the World Health Organisation's (WHO) Commission on the Social Determinants of Health titled "Closing the Gap in a Generation", the increasingly steep social gradient in children's health outcomes is highlighted by the fact that worldwide, 10 million children die each year before their fifth birthday (Commission on the Social Determinants of Health [CSDH] 2008). While the vast majority of these deaths occur among children born in low or middle-income countries, infant mortality is also higher among disadvantaged households and communities in high income countries such as the United Kingdom (UK) and Australia (CSDH 2008, Australian Research Alliance for Children and Youth 2008). The social gradient affecting children is not restricted to health

outcomes alone. It is estimated that more than 200 million children are not achieving their full developmental potential (CSDH 2008), in terms of emotional, attentional and social regulation, literacy and numeracy, and subsequent learning. The gravity of the issue and the importance of remediation are underscored by a great deal of evidence that suggests early child development lays the foundation for lifelong health and wellbeing (Maggi et al. 2005). Because children who become healthy adults can be expected to make a positive contribution to society, both socially and economically, social gradients in children's development affect the health and wellbeing of entire populations.

Substance abuse is an important issue that is highly illustrative of the interplay between social, psychological and biological mechanisms that give rise to social gradients in children's health and development. Substance abuse is both a cause and effect of disordered early development. Cigarette smoking, alcohol use and illicit drug use during pregnancy all contribute to poor outcomes (Knopik 2009, Guerri et al. 2009, Shankaran et al. 2007). Meanwhile, substance abuse in the adolescent years is much more common among young people with mental health problems and poor school performance (Squeglia et al. 2009, Lamps et al. 2008, Sussman et al. 2008). In the year 2000, Toumbourou et al. (2007) estimated that the use of alcohol and illicit drugs contributed to 23.3% of the disease burden for adolescents and youth aged between 15 and 29 years in developed countries and it accounted for 9.8% of the total global burden of disease for the same age group. The prevalence of substance abuse is already high in the Western world, especially amongst indigenous populations, and it is increasing in many developing nations (United Nations Office on Drugs and Crime 2008, Leslie 2008, Nessa et al. 2008, Nguyen and Scannapieco, 2008, WHO, 2006). It is one of a number of issues within families and communities that must be addressed if the trend toward even greater health inequities is to be arrested. As with many social issues, children and young people are often the worst affected (Nessa et al. 2008).

This paper is a brief summary of research-based knowledge and understanding of social gradients in children's health and development. It will first outline some seminal research in the field and key publications that have effectively synthesised research findings from a wide variety of academic disciplines. Second, it will present a theoretical perspective that has played a

significant role in unifying this somewhat disparate body of knowledge and illuminating important causal pathways and potential points of intervention. Thirdly, it will identify biological mechanisms that are known to be influenced by psychological and social factors, focusing on stress responsiveness and the hypothalamic pituitary adrenal (HPA) axis. Fourthly, it will present evidence for the link between stressful experiences in childhood and poor health and developmental outcomes. Fifth and lastly, it will make a case for all nations of the world to make far greater investments in succeeding generations through supportive public policy across a range of portfolios.

Social gradients in health

Published in the UK in 1980, the Black Report presented comprehensive evidence of differences in health outcomes between groups based on occupational class. Black and his colleagues reviewed national and international health census data collected in the 1970s. Occupational classes among men varied from professional (Class I) to unskilled (Class V). Married women and children were classified by their husband's/father's occupation and women of other marital statuses were attributed to their own occupational class. It was found that mortality rose inversely with falling occupational rank or status, for both sexes and at all ages, including infancy and early childhood. Occupational class differences were also found for self-reported morbidity, the use of various health services, and hospitalization (Townsend and Davidson 1988). A number of possible explanations have been offered for these findings. One explanation viewed occupation as a marker of income, and the apparent inequalities would have been due to factors associated with poverty, such as poor housing and occupational hazards. It was also proposed that cultural and individual differences in behaviour, and lifestyle factors, such as smoking and diet, may explain the differences in health found between the occupational groups. It was concluded that no single explanation was wholly satisfactory (Townsend and Davidson 1988).

In 1986, Butler and Golding published a book about the Child Health and Education Study, a national longitudinal study of British children born in one week in April, 1970 (Butler and Golding 1986). As with even earlier British studies, such as the Thousand Families in Newcastle upon Tyne Study (Spence et al. 1954), the concept of "social class" based on the classification of the occupation of the male head of the household was used as a parameter of children's health

and development. A number of positive associations were found between low social class and a number of adverse child outcomes (Butler and Golding 1986).

In 1984, Marmot and his colleagues published the results of the first Whitehall study, following the health of 17,000 British civil servants, men who all lived in a relatively affluent locality and worked in stable office jobs. Employment grades ranged from office support to clerical, professional/executive, and administrative type of work. The results were striking in that position in the hierarchy was strongly correlated with mortality risk (Marmot 1999). Furthermore, employment grade, on its own, proved to be a more powerful predictor of premature heart disease than the combination of classic risk factors including smoking, serum cholesterol, and blood pressure (Brunner and Marmot 1999). It was concluded that social inequality, rather than poverty per se, was responsible for the health differential found.

Meanwhile, in the United States (US) Brooks-Gunn, whose work dates back over many years, has sought to identify “proximal” processes within the family and the community that mediate between socioeconomic factors and various health and developmental outcomes. Key elements of this approach have been the attention given to development through the early childhood years and the attention given to effective early intervention. Brooks-Gunn has utilised existing large national data collections, such as the Panel Study of Income Dynamics, the National Longitudinal Study of Youth, and data from current observational studies and intervention initiatives, such as the Early Head Start Research and Evaluation Project and the Panel Study of Income Dynamics Child Development Supplement (Brooks-Gunn et al. 2000).

In the late 1990s, as several initiatives were implemented to address the need for greater synthesis and integration across scientific disciplines, social gradients have been identified in many childhood health and developmental outcomes ranging from birth weight to school achievement. Notably, the Canadian Institute for Advanced Research, under the leadership of Fraser Mustard (Keating and Hertzman 1999), and the United States, National Research Council and Institute of Medicine, led by Shonkoff and Phillips (2000) have both published integrated accounts of the study of early childhood development. The growing body of evidence suggests that in developed countries “income is related to health not so much through its role as a determinant of material

living standards, but rather as a marker for social status” (Wilkinson 1999, 258). More egalitarian societies tend to have better health and increased longevity. Furthermore, as Wilkinson has pointed out, work in animal studies “indicates important psychosocial pathways linking the chronic anxiety of subordinate social status to raised basal cortisol levels and attenuated responses to acute stress, increased atherosclerosis, worse HDL : LDL ratios, central obesity, depression, and poor immune function” (1999, 260). Sapolsky’s recent review (2005) has demonstrated how the stressful characteristics of social rank have harmful effects on adrenocortical, cardiovascular, reproductive, immunological, and neurobiological systems.

Bioecological Theory

The belief that features outside the child’s immediate environment can, and frequently do, impact on the child’s development was popularised by developmental psychologist Urie Bronfenbrenner. Bronfenbrenner (1979) conceived of development as occurring within nested settings beginning with the developing person, the “microsystem”, and extending out to the immediate social settings of home, school and neighborhood, the “mesosystem”, and settings that do not involve the developing person as an active participant such as the parent’s workplace, the “exosystem”, and the wider society and culture, the “macrosystem”.

It is contended here that modern Western societies are obsessed with individual, personal explanations for child development, and health and wellbeing generally. The concept of “agency”, the notion that individuals have the capacity to act independently and to make their own free choices, is enshrined in law and enacted in all aspects of life, including the study of psychology. Bronfenbrenner’s ecological theory challenges this view by drawing attention to the proximal contexts of family, school and community and the distal “structural” components of society, culture, economic influence and politics that are largely outside the sphere of the child’s and family’s influence. "Structure" refers to those factors such as socioeconomic status, social class, religion, gender, ethnicity, customs and institutions (such as education, law enforcement, health, welfare, political systems) which seem to limit or influence the opportunities that individuals have.

The discovery that social gradients are pervasive in both health and child development has fuelled speculation among population health researchers that poor outcomes result from common biological, psychological, and social processes (Hertzman 1999). Accumulating evidence from developmental neuroscience and developmental psychopathology of the complex functioning of the human central nervous system offers considerable support for this proposition (Cicchetti and Walker 2003). Consequently, many researchers in the study of human development now share the belief that they should investigate functioning through the assessment of genetic, physiological and neurocognitive aspects of ontogenesis and socioemotional, environmental and cultural influences on behavior (Cicchetti and Cohen 1995).

Theory has particular relevance here, because the knowledge base of child development comes from a wide variety of academic disciplines, a wide range of theoretical perspectives, and a vast assortment of facts derived from research. Biological, psychological, and social processes are all important, however the focus of interest is the interplay between characteristics at all levels. Complimentary rather than competing explanations must ultimately be sought. Knowledge of the relative contribution of components at each level of the human system, and the way in which those components act together, is fundamental to greater understanding and more effective intervention. This approach has become known as the bioecological perspective.

Biological Embedding

Of particular relevance to social inequality research is the prospect that socioeconomic and psychosocial circumstances very early in life have a strong effect later in life, independent of intervening experience, a “latency” model. Conversely, a “pathways” model stresses the cumulative effect of life events and the ongoing importance of socioeconomic and psychosocial conditions throughout the lifecycle (Hertzman and Frank 2006). These two models are not mutually exclusive. Time-frame is important. It is plausible, for example, that development throughout early childhood is cumulative, a pathways effect, and that this early childhood experience then has a strong effect in adolescence and later life, a latency effect.

The process, whereby early experience affects health and wellbeing across the life course, Hertzman has called “biological embedding”. “Because the central nervous system, which is the centre of human consciousness, ‘talks to’ the immune, hormone, and clotting systems, systematic

differences in the experiences of life will increase or decrease levels of resistance to disease. This will change the long-term function of vital organs of the body and lead to socioeconomic differentials in morbidity and mortality” (Hertzman 1999, 31). Clearly, psychoneuroendocrine and psychoneuroimmune pathways are key links between socioeconomic and psychosocial circumstances and health. A great deal of research has focused on stress response and the role of the sympatho-adrenal medulla (SAM) pathway and the HPA axis. This research will be outlined briefly in the following section. A number of associated biological mechanisms have also been implicated in causal pathways to disordered early development and poor health across the lifespan. These mechanisms include: gene-environment interaction, the process of “neural sculpting”, intrauterine growth restriction, nutrition, and environmental exposure to toxic substances, ranging from metals and air pollutants to alcohol, cigarettes and illicit drugs during pregnancy. These mechanisms all involve early life social conditions and help to explain the social gradients seen in so many health and developmental outcomes.

Stress Response

The SAM pathway and the HPA axis are stress-sensitive biological systems that are hypothesized to be involved in the connection between socioeconomic and psychosocial circumstances and health. The SAM pathway, involving the instantaneous release of adrenaline from the adrenal medulla and noradrenalin from sympathetic nerve endings, is controlled by the brain and can be switched on and off rapidly. The combined effects of centrally and peripherally acting catecholamines in response to stress are “... psychological arousal and energy mobilization, and inhibition of functions which are irrelevant to immediate survival, such as digestion and growth” (Brunner and Marmot 1999, 22). The second, slower component of the stress response, the HPA axis, results in cortisol release into the bloodstream. “Cortisol and other related glucocorticoid hormones have both metabolic and psychological effects via receptor binding in many central and peripheral tissues. Glucocorticoids play a key role in the maintenance and control of resting and stress-induced metabolic functions. As antagonists of the hormone insulin, they mobilize energy reserves by raising blood glucose and promoting fatty acid release from fat tissues ... The brain is also a target for glucocorticoids, which promote vigilance in the short term” (Brunner and Marmot 1999, 25). Subsequently, but as important, stress-induced cortisol will dampen its enhanced secretion from the adrenal cortex through direct negative feedback action on the HPA

axis. This stress regulatory event is protective against the damaging effect of overexposure to high circulating cortisol (De Kloet et al. 2005).

It is envisaged that exposure to undesirable stressful influences in a child's environment influence the development of the SAM and HPA axes and their level of long term functioning may be "locked in" at a very early age (Hertzman and Frank 2006). Among others, prenatal alcohol intake and smoking are well studied examples known to affect fetal development and growth. Alcohol in the maternal circulation is able to disrupt a hormonal balance required for optimal fetal development and maturation. Alcohol, like glucocorticoids, can also easily cross the placenta and directly affect the highly vulnerable fetal HPA axis with long lasting consequences for neurological development and brain function and behavior after birth, referred to as fetal alcohol syndrome (Weinberg et al. 2008, Guerri et al. 2009). Similarly, smoking can enhance maternal HPA activity and has frequently been associated with impaired fetal growth and reduced birth weight with known adverse implications for health later in life (Justus et al. 2005, Horta et al. 1997, Chan et al. 2008). Moreover, parents who abuse alcohol and other substances are much more likely to experience significant life-stress in association with their life style and neglect their children (Dunn et al. 2002, Osterling and Austin 2008). The magnitude of these effects depends on the duration and intensity of early exposures to adverse conditions, which affect early experience, consequent stress responsiveness and subsequent life trajectories of mental and physical health (De Kloet et al. 2007, Seckl and Holmes 2007). Adverse conditions of a chronic nature modify the child's physiology through the HPA axis, the central mediator of the stress response. Both consistent hyper and hypo activity of the HPA axis have been associated with adverse outcomes. To distinguish between good (excitement) and bad (chronic fatigue, worry, frustration, inability to cope) stress, the concept of allostatic load has been proposed (McEwen 2005). This represents the wear and tear on physiological systems (the nervous, endocrine and immune systems). Certain physiological mediators of these interlinked systems (catecholamines, cortisol and cytokines) maintain functional stability (homeostasis) through simultaneous actions that mediate short-term adaptive responses to an acute challenge. However, long term elevated or inefficiently managed levels of these mediators contribute to the damaging effect of chronic stress on desensitization of the target receptor for these mediators and tissue damage, referred to as allostatic load.

Predisposition by experience before and after birth through biological embedding appears to contribute to individual differences and social gradients in resilience, morbidity and mortality. But genetic predisposition to cortisol sensitivity through individual variation in the gene sequence of cortisol binding receptors cannot be excluded either (De Kloet et al. 1998, De Kloet and DeRijk 2004, DeRijk and De Kloet 2008). Perinatal gene-environment interactions are therefore important determinants of health and well-being in the context of genetic and early life moderators of life-stress in the family and community environments. A deeper understanding of the proximal, psychosocial processes in families and communities that interact with biological processes to affect health and development during childhood may better explain how early life influences and maintains inequalities in health along a socioeconomic gradient (Hertzman and Frank 2006).

Life-stress and Child and Adolescent Health and Development

Convincing evidence for the link between early life experiences and changes in stress responsiveness and the ability to cope comes from research conducted using laboratory animals. Rat pups and nonhuman primate infants born to mothers who have been exposed to a variety of stressors during pregnancy show delays in neuromotor development, increased emotionality, decreased exploratory behavior, and impaired adaptation to conditions of conflict (Huizink, Mulder, and Buitelaar 2004). Physiological changes include overreaction to stress and impaired negative feedback regulation of the HPA axis after stress (Huizink, Mulder, and Buitelaar 2004). While rats that genuinely exhibit extreme differences in stress reactive physiology and behavior have been successfully bred, similar results have been obtained by experimental manipulation based on maternal deprivation in early postnatal life (De Kloet et al. 1998, Meaney 2001). Brief daily handling and separation of mother and pup leads to a form of adaptation reflected in reduced emotionality, reduced adrenocortical reactivity and a lower stress-induced corticosterone level. However, the opposite effect is seen when pups are removed from their mother for three or more hours per day. This specific manipulation results in higher corticosterone production and poor performance in spatial learning tests later in life (De Kloet et al. 1998). Interestingly, the outcome is due to the absence of licking or stroking by the mother rather than the absence of feeding (De Kloet et al. 1998). It is concluded that genotype and early life experience appear to

interact in programming individual variation in stress responsiveness in later life (De Kloet et al. 1998, Meaney 2001, Seckl and Holmes 2007; De Kloet et al. 2007)

Gunnar and colleagues' (2001) work with children adopted from Romanian orphanages is, perhaps, the best example of research conducted with children. For those who are not familiar with this humanitarian disaster, Romanian Dictator Nicolae Ceaușescu's 1998 program for population growth resulted in more than 65,000 abandoned children being reared in state-run institutions under the most bleak and deprived conditions imaginable (Gunnar et al. 2001). The experience of these children included a lack of sensory and motor stimulation and a life devoid of social and emotional relationships (Gunnar et al. 2001). When they were 6 to 12 years age, Gunnar et al. (2001) compared the salivary cortisol levels of these Romanian children who had since been adopted, with children raised in their family of origin in British Columbia, Canada. They found that the children reared in orphanages for more than 8 months in their first year of life had markedly higher cortisol levels than children reared in orphanages for four months or less and Canadian born children. Furthermore, the longer beyond 8 months that the Romanian orphanage children remained institutionalized the higher their cortisol levels (Gunnar et al., 2001). Previous research has shown that 30% of these Romanian orphans had multiple serious developmental problems and a much greater proportion had a low IQ (Morison and Ellwood 2000). Later research has shown that poor cognitive functioning has persisted into adolescence despite significant educational opportunities being afforded (Beckett et al. 2006).

Recent research using data for 2000 children and families participating in the Western Australian Pregnancy Cohort (Raine) Study has revealed that exposure to stressful life-events (SLE) in the family, such as economic hardship, employment difficulties and dysfunctional relationships, even before birth, can impact on problematic behavior at two and five years of age (Robinson et al. 2008) and the mental health of children at eight to nine years of age (Kendall, Zubrick and Blair 2004). Children whose family experienced just one period of life stress in the pregnancy and birth period, were at increased risk of a clinically significant mental health problem. The risk almost doubled for children whose family experienced life stress in the pregnancy and birth period and also the infancy and toddlerhood period and then the risk of a mental health problem at eight increased in almost perfect linear fashion according to the number of periods the family

experienced life stress. These results suggest that latency and pathway effects operate simultaneously, that timing and accumulated burden are both important determinants of risk.

In the recently completed Western Australian Aboriginal Child Health Survey over 1 in 5 (22%) Aboriginal children aged 0–17 years were found to be living in families where 7–14 major SLE had occurred over the preceding 12 months (Silburn et al. 2006). The same survey, Zubrick et al. (2005) found an estimated 26% of Aboriginal children aged 4 to 11 years were at high risk of clinically significant emotional or behavioural difficulties, compared with 17% of non-Aboriginal children in the same age group. Whether the children experienced emotional and behavioural difficulties or not, having 7 or more SLE is equivalent to the stress of living in a war zone. The health and developmental consequences are likely to be far reaching (Silburn et al. 2006).

The Peel Child Health Study has recently received funding from the Australian Research Council and a number of Commonwealth and State Government Departments to establish and study a new pregnancy cohort. The first phase involves the recruitment of over 1,600 families with a first trimester pregnancy who are living in the Mandurah/Peel region between 2009 and 2011, and their follow-up during pregnancy and the first three years of the birth child's life. The study is measuring: community services, facilities, resources and patterns of access and utilization; norms of reciprocity, trust and connectedness; interagency collaboration and community partnerships; and Indigenous participation. Within the family the study is measuring sociodemographic and psychosocial characteristics, parental health and functioning, environmental exposure to toxins, fetal growth and newborn and sibling's health and development using validated and reliable instruments currently employed in other local, national and international studies. Supplementary pregnancy, birth, and health data is obtained for participants through linkage to the Hospital Morbidity Data System. Physiological and biochemical measures include: fetal anthropometry; uterine and umbilical blood flow; maternal, paternal and child basal cortisol and cortisol circadian rhythm; maternal, paternal, and child functional genetic polymorphisms related to cortisol sensitivity and resistance; and placental morphology and stress-sensitive gene-regulatory control. Instruments measuring stress include: stressful life events, state anxiety, trait anxiety, parental mental health, parental relationships, family functioning, experience of discrimination, financial strain, and parental consumption of cigarettes alcohol, and illicit drugs.

Supportive Public Policy

Traditionally the province of pediatricians, psychiatrists, psychologists, and educationalists, the field has more recently attracted the attention of molecular biologists, neuroscientists, epidemiologists, sociologists, and economists. Unfortunately, much of the work undertaken in each of these specialist disciplines has been conducted independent of research in other fields, and much of the knowledge gained has only now been effectively synthesized. A “silo” approach to research coupled with a lack of coordination, or even cooperation, between rival health, education, welfare and economic agencies has limited the scope and penetration of many intervention strategies to date (McCain and Mustard 1999, Keating and Hertzman 1999, Shonkoff and Phillips 2000).

However, the social policy mandate is much broader than simply offering antenatal care and parenting programs, increasing counseling for adolescents, or building more parks and playgrounds. Clinical, targeted and universal interventions are warranted, but as Willms (2002) has proposed, we need to envisage a *family-enabling society*, and renew social policy such that families and communities receive the support they need to raise their children. Syme (2003) has suggested we should move away from a focus on diseases and risk factors and begin to think about the community and social forces, involve the community as an empowered partner and focus on the underpinnings of vulnerability to risk and disease. To illustrate his point he outlines a project funded by the United States Centers for Disease Control to study fifth grade children in a low-income community near Berkeley, California. The focus of the grant was on cigarette smoking and other drug use, violence, poor school performance, and sexual behavior. However, he and his colleagues decided not to study any of those things. They decided instead to focus on one the fundamental issues underlying all of these problems. They decided to focus on hope. They took the view that if these children, mostly from minority groups and very poor families, had no hope for the future, what difference would it make if they smoked or used drugs or missed school or engaged in violent behavior (Syme 2003).

This paper began by drawing attention to the very recent WHO report titled “Closing the Gap in a Generation” and this is where it will finish. Readers are strongly urged to study this

comprehensive report if they have not already done so. The Commission makes the point that economic growth is without question important, but growth by itself without appropriate social policies to ensure reasonable fairness in the way its benefits are distributed, is wasted. In a recent book, Wilkinson and Pickett (2009) have summarised the extensive research evidence that supports this view. Further, the high burden of illness responsible for appalling premature loss of life arises in large part because of the conditions in which people are born, grow, live, work and age. “In their turn, poor and unequal living conditions are the consequence of poor social policies and programmes, unfair economic arrangements, and bad politics. Action on the social determinants of health must involve the whole of government, civil society and local communities, business, global fora, and international agencies” (CSDH 2008, 1). Policies and programs must embrace all the key sectors of society.

Conclusion

The movement to address the environmental concerns now labelled “climate change” began many years ago. The movement began as a popular one in which ordinary people joined together to fight government policies they believed to be foolish and unjust with regard to environmental degradation in its many forms. For quite some time these people were viewed as outcasts by the majority and they were often treated with scorn and derision (Hutton and Connors 1999). Over time, however, science has caught up with popular belief and these people with their extreme views have now been thoroughly vindicated. Scientists and environmentalists have joined forces to put unprecedented pressure on governments the world over to act to preserve the physical environment (Gough and Shackely 2001).

There is ample evidence that the global social environment is under serious threat (CSDH 2008). Terrorism, civil unrest, youth crime and violence, high rates of mental health problems in both children and adults, high rates of substance abuse, promiscuous sexual behaviour, and high rates of starvation as well as obesity are all symptoms of the underlying problem. Millions of people the world over are already engaged in the protest movement (People’s Health Movement 2000). For example, many people give their time and resources to try to make a difference in their local community, many people support international aid agencies, and countless others belong to both religious and non-religious groups that voice concern about these issues. The scientific evidence

is mounting rapidly, the biological, psychological and social mechanisms that mediate and moderate peoples' social, economic and psychosocial circumstances and health are already fairly well understood (Hertzman and Frank 2006, Wilkinson and Pickett 2009). Isn't it time scientists and social environmentalists joined forces to put unprecedented pressure on governments the world over to also act to preserve the social environment? Failure to act now, both nationally and globally, will have dire consequences for future human habitation equal if not greater than the impact of unabated climate change.

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