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Editorial

Rik Crutzen

Editor

Emely de Vet

Editor

Dear Readers,

Welcome to the conference issue of the European Health Psychologist (EHP), which most of you will be reading in Prague, Czech Republic during the 26th European Health Psychology Conference. This year's conference focuses on resilience and health. Pauline Boss (2006) defines resilience as "the ability to stretch (like elastic) or flex (like a suspension bridge) in response to the pressures and strains of life". Promotion of resilience has significant rewards: a healthy, well-educated and cohesive population, and a widespread readiness to adapt to the unexpected (Casteden, McKee, Murray, and Leonardi, 2011), which stresses the importance of this year's conference theme.

We are particularly pleased with the contribution of all four keynote speakers in this issue. First, Professor Kavita Vedhara (University of Nottingham, UK) provides insight into the many faces of stress and the associated psychological processes that are highly relevant to our understanding of health and disease. Second, Professor Johan Denollet (Tilburg University, the Netherlands) discusses the health effect of Type D and other psychosocial risk factors. Third, Professor Charles Abraham and colleagues (University of Exeter, UK) plead that funding research on the basis of impact potential should be welcomed by health psychologists who want to create change that counts. Last, Professor Carol Ryff (University of Wisconsin - Madison, US) discusses the varieties of resilience and their biological underpinnings. These contributions clearly reflect the diversity of work in health psychology.

Last but not least, we would like to ask all potential authors to continue to submit appropriate contributions the EHP. We look forward to receiving and publishing inspiring pieces in the (near) future and are happy to discuss any ideas in this respect.

On behalf of the editorial board of the EHP, we wish you a fruitful conference and wonderful stay in Prague!

Rik Crutzen and Emely de Vet, Editors

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President's message

Paul Norman

EHPS president

Dear EHPS members and colleagues,

Welcome to the 26th annual conference of the European Health Psychology Society which is being held in the historic city of Prague. This year's conference takes place prior to the International Congress of Behavioral Medicine in Budapest. We were all saddened by the unexpected death of Maria Kopp earlier this year. Maria Kopp was actively involved in the organisation of the congress and it is hard to come to terms with the fact that she will not be there to welcome us. She was an influential figure in the development of health psychology both in Eastern Europe and actively involved in EHPS, attending many conferences as well as serving on the EC for four years. She was elected as an EHPS Fellow in 2007 in recognition of exceptional contribution to health psychology in Europe. She will be greatly missed by her friends, family and colleagues.

The EHPS conference in Prague will be a "flagship event" that will provide researchers with the opportunity to present, and learn about, some of the very best research in European health psychology. This year's conference is likely to be one or our largest to date as it will be attended by over 800 delegates. As ever, we are indebted to the hard work of the local organisers who have ensured that preparations for the conference have run so smoothly. The success of the conference depends on many people, but special thanks are due to the Conference President, Vladimir Kezba, who has been ably supported by Lenka Kloudova from the Czech-In conference agency and Ralf Schwarzer who was our conference liaison officer. In addition, the Chair of the Scientific Committee, Aleksandra Luszczynska, deserves a special mention for her work in processing almost 1,000 abstracts. Together with the Scientific Committee and the Track Chairs she has produced a high quality scientific programme which includes keynote presentations from Carol Ryff, Kavita Vedhara, Charles Abraham and Johan Denollet. I would also like to acknowledge the work of Create and Synergy who have organised three-day pre-conference workshops again this year. The Create workshop, facilitated by Kerry Chamberlain, is on *Qualitative Research in Perspective*, and the Synergy workshop, facilitated by Rachel Shaw and Paul Flowers, is on *Mixed Methodology in Health Psychology*. The Synergy workshop is the 10th workshop that they have organised, and this occasion will be celebrated at the conference after the Thursday poster sessions.

This year's conference marks the end of the term of the current Executive Committee of the EHPS. I would like to take this opportunity to thank all members of the EC for their valuable contributions to the work of the society over the past two years. A number of members will be stepping down from the EC in Prague and I would like to acknowledge their impact on the society. First, the Past-President, Irina Todorova, has been the driving force behind many of the recent initiatives undertaken by the EC, most notably our recent association with the UN. In addition, she has been an invaluable source of support during my time as President and an exemplary model of how to provide calm leadership. Second, Holger Schmid has been Education and Training Officer for the past four years and has a played a key role in the development and administration of the full range of grants that EHPS offers its members. Third, Manja Vollmann has been a central figure in the EC for six years, both as Treasurer/Membership Officer and as an Ordinary Member. Her work in building up the membership base of the society as well as ensuring the smooth administration of the society's finances cannot be underestimated.

The society is in a strong position and has seen a number of areas of growth over the past two years. First, the membership of the society reached 500 for the first time last year. This is a notable achievement and points to the relevance of EHPS as a home for researchers in health psychology both within Europe and beyond. The increased size of the membership has enabled us to invest in a wide range of initiatives to support our members. In addition to the annual conference and workshop grants, we also fund research visit grants for early career researchers (tandem, visiting scholar) as well as a Networking Grant to support colleagues from different European countries to meet to develop research ideas. The EC always welcomes suggestions from members for ways in which we can invest in other activities. For example, in response to a request from the National Delegates, the EC convened and supported a committee to consider the provision of Health Psychology Masters programmes in Europe. The increased size of the membership has also increased the administrative burden on the EC. In response to this, the EC has made a number of changes to the way in which membership applications and renewals are processed so that as many procedures as possible are automated. In addition, we have introduced electronic voting for the elections for the first time this year.

Second, the society has developed strong links with other organisations over the past two years in order to promote health psychology in Europe. First, EHPS is now associated, for an initial period of two years, with the Division of Public Information/NGO Section of the United Nations. I would like to thank our Past-President, Irina Todorova, for all her work and persistence in ensuring that our application was successful. EHPS members have already attended briefing events at the UN and the 64th Annual UN/NGO Conference in Bonn last year. Irina Todorova has formed a UN sub-committee which will be looking at ways in which we can strengthen our association. Further details of our UN association are now on our website. In addition, we have also strengthened our links with the European Federation of Psychologists' Associations (EFPA). Given the close links between EFPA and the EU, this will strengthen the voice of European health psychologists and their influence on policy. For example, last year EFPA organised a conference at the European Parliament on *Psychology for Europe* which sought to highlight the importance of psychology to EU policy-making in various areas including education, work, community, transport and health. European health psychology had a strong presence at the meeting with one of our Past-Presidents, Susan Michie, presenting on the psychological principles of behaviour change and implications for policy. EFPA have organized a follow-on expert conference on *Psychology for Health – Contributions for Policy Making* in September 2012, in which health psychology will represent a core focus. Our Founding President, Stan Maes, is the Conference President. In addition, a number of EHPS members sit on the EFPA Standing Committee on Psychology and Health.

Third, the society's official journals, *Psychology & Health* and *Health Psychology Review*, have both performed strongly over the past two years. Mark Conner and Daryl O'Connor started their term as the new Editors-in-Chief of *Psychology & Health* last year. One of their key short-term goals was to reduce the size of the publication backlog. They negotiated an increase in the number of articles published in each journal which, combined with an increase in the rejection rate, has resulted in a significant reduction in the publication lag. This means that authors' papers are now published more quickly. The Editors' longer-term goal was to increase the impact factor of the journal and increase the relative standing of the journal. We were very pleased to receive the news that the latest impact factor (2011) for *Psychology & Health* has increased to 2.126. This is the first time in the journal's history that the impact factor has been above 2.00—congratulations to the Editors for achieving this. *Health Psychology Review*, under the excellent stewardship of Martin Hagger, has quickly established itself as a key journal in the field. The journal is now included in the Social Science Citation Index and this year received its first impact factor of 2.062. This is an outstanding achievement for such a young journal and augurs well for the future. Finally, I would like to thank the current editors of *The European Health Psychologist*, Rik Crutzen and Emely de Vet, for their continued work on this publication. As a society, we are fortunate to have such a well-produced and innovative publication that provides an outlet for societal news as well as a forum for scientific discussion.

To end on a personal note, it has been an honour to be entrusted with the Presidency of the EHPS. I will have many positive memories of the past two years; the initiatives that have come to fruition as well as the warm friendships that I have developed with members of the EC. It has been a pleasure working with such a dedicated and enthusiastic team. The results of the EC election will be announced at the Members Meeting in Prague, when the new EC will start their term of office. I wish the incoming President, Falko Sniehotta, and the new EC all the best for a productive and enjoyable two years and I look forward to working with them in my new role as Past-President.

Finally, I would like to encourage all members to attend the *EHPS Members' Meeting in Prague on Thursday 23rd August at 12.40*—your input is valued. I look forward to seeing you there.

Best Wishes,
Paul Norman
EHPS President

keynote article

The many faces of stress

Kavita Vedhara
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Ecclesiastes tells us that 'there is nothing new under the sun' and it is certainly true that the notion that the mind and body may be connected has been around for a long time. But a chance discovery in the 1970's completely revolutionised our understanding of this area. At that time, Robert Ader and Nicholas Cohen were engaged in behavioural conditioning research (Ader & Cohen, 1975). They were examining whether the pairing of saccharine (their conditioned stimulus) with a substance known to produce nausea and vomiting: cyclophosphamide (the unconditioned stimulus) would result in a conditioned taste aversion response i.e., that the animals would avoid the saccharine even when presented on its own because they had been conditioned to associate it with the unpleasant side effects of cyclophosphamide. However, in their early trials they noticed an unexpected effect of their experimental manipulation. In addition to the expected taste aversion response, they found a significantly higher mortality rate in the animals exposed to the unpaired saccharine. This finding was both concerning and perplexing, until they realised that their unconditioned stimulus, cyclophosphamide, had immunosuppressant properties. This led them to speculate that, rather than simply conditioning a taste aversion response, they may have inadvertently conditioned their animals to suppress their immune systems.

This seemingly absurd proposal was tested by conducting a further conditioning experiment in which they measured antibody levels in order to capture the effects of the conditioning paradigm on the immune system. Ader and Cohen reported that, even after a single exposure to the saccharine (their conditioned stimulus) these animals displayed evidence of significant immune suppression. Suddenly, behaviourally conditioned immune suppression was a reality, and tangible proof that the mind and body are connected was presented to the scientific world.

Ader and Cohen's findings generated, in equal measure, both enthusiasm and scepticism, but the net effect was a new area of enquiry which, today, is variously referred to as psychoneuroendocrinology, psychoneuroimmunology, etc. Whatever nomenclature is used, the area is concerned with the exquisite and dynamic interplay between the mind and body; it is inherently multidisciplinary in nature and has, in my view, psychology at its heart.

In the years that followed, replications of Ader and Cohen's work were conducted and investigators began to broaden their examination of the psychological parameters that appeared to affect our biology. This included over a decade of high quality research which demonstrated time and again that the experience of psychological stress, both acute and chronic appeared to modulate the activity of the immune system. Much of this early research was, however, conducted in vitro. So the clinical relevance of these observations for health was unknown. This all changed with the groundbreaking work of Sheldon Cohen and colleagues (Cohen, Tyrell & Smith, 1991). The authors assessed stress in a large group of healthy volunteers and then exposed their participants to respiratory viruses. This was followed by a period when the participants were quarantined and monitored for the development of respiratory symptoms and clinical colds. Cohen et al. reported that stress at study entry was significantly and positively associated with both respiratory symptoms and clinical colds, such that the greater the level of stress at baseline, the greater the incidence of both respiratory symptoms and clinical colds over the follow-up period. Psychological stress, it would appear, could significantly increase our vulnerability to infectious disease.

So stress might increase disease risk in young healthy people. But does that really matter? The young and healthy can, and do, recover quickly from minor illnesses such as the common cold. What happens in populations who are more vulnerable to ill health and for whom even minor respiratory illnesses can be fatal, such as in the elderly? This issue was examined by ourselves and colleagues in the US a few years later (Kiecolt-Glaser, Glaser, Gravenstein, Malarkey & Sheridan, 1996; Vedhara, Cox, Wilcock, et al., 1999). Both groups recruited a group of chronically stressed older adults (spousal carers of patients with dementia) and a non-caregiving control group. All participants were given an influenza vaccine and were followed up to examine the proportion of people in each group able to generate an antibody response denoting that they were protected against flu (i.e., a 4 fold increase in antibody). Both groups observed that the rate of vaccine failure was significantly higher in the chronically stressed group of caregivers, compared with the control group. In the US study, the authors observed that only 38% of their chronically stressed carers were protected against flu, compared with 68% of the control group; while our UK study demonstrated even higher rates of vaccine failure with only 16% of chronically stressed carers producing protective levels of antibody following vaccination. Perhaps the most striking feature of these results is that they suggest that, at least in the elderly, the effects of chronic stress on the immune system appear to be so insidious that even vaccinations appear unable to protect a chronically stressed individual from the threat of disease.

The effects of stress on health are not, however, restricted to disease vulnerability. In the last two decades there has been considerable research effort devoted to exploring the effects of psychological stress on chronic disease outcomes including disease progression and disease activity. A multitude of chronic diseases have been the subject of investigation including HIV, cancers, autoimmune conditions, etc. One of the emerging areas of enquiry, concerns the effects of psychological factors on the healing of wounds. Early work in this field focused on the healing of experimental wounds in non-clinical groups; and a recent meta-analysis provided compelling evidence in support of psychological stress resulting in delayed wound healing (Walburn, Vedhara, Hankins, Rixon & Weinman, 2009). This review also noted, however, that the clinical relevance of this association is unclear as limited research had been conducted in the context of non-experimental wounds, such as chronic wounds. We recently addressed this issue in a large prospective study of patients with diabetic foot ulcers (Vedhara, Miles, Wetherell, et al., 2010). These ulcers are a common and costly complication of diabetes, accounting for approximately a third of the direct healthcare costs associated with diabetes (Driver, Fabbi, Lavery & Gibbons, 2010). The wounds are slow to heal, with 70% of ulcers remaining unhealed after 5 months. We examined the effects of psychological distress and related psychosocial processes on the healing of these ulcers over a 6 month period. Our results showed that, even after controlling for clinical and demographic determinants of healing, patients' coping styles predicted whether or not these wounds healed over a 6 month period (patients with confrontational styles were perhaps surprisingly found to be less likely to heal); and levels of depression predicted the rate at which these wounds healed. Psychological distress and related processes would appear, therefore, to influence a range of chronic disease outcomes, including the healing of wounds.

It is clear then that persuasive associations have been documented between concurrent psychological functioning and both disease vulnerability and progression. However, the effects of the mind on the body appear to persist beyond the here and now. In particular, research has shown that the experiences of mothers during pregnancy can programme the physiology of their offspring in ways which can increase the offspring's risk of a range of chronic conditions such as hypertension, diabetes, etc. (Barker, 1995). How does this happen? It appears that adverse exposures in pregnancy and early in life may programme the biological pathways involved in our responses to stress i.e., the neuroendocrine system; and that these in turn may influence later vulnerability to disease. A range of adverse exposures have been examined in this context including maternal distress, nutrition, smoking, illness, etc. with research suggesting long-term programming of the neuroendocrine system following these exposures. For example, we have shown that maternal anxiety and depression during pregnancy can program the offspring's blood pressure and cortisol responses to stressors encountered approximately 16 years later (Vedhara, Metcalfe, Brant et al., 2012). Similarly, childhood illness in the first 5 years of life has been shown to predict cortisol levels in adulthood (Vedhara, Miles, Crown et al., 2007). Further mechanistic research in longitudinal cohorts is required to delineate how these programming effects occur, but this area of enquiry may help us to understand enduring inequalities in health.

Observational evidence of the sort described above has done much to illuminate the relationship between the mind and the body and to hint at potential clinical relevance. But the holy-grail is, of course, to explore whether we can develop interventions which harness the mind, and in so doing, affect the body in ways which not only enhance emotional well-being, but also prolong life and/or reduce symptom burden. The results from some early intervention studies offer considerable hope and promise. For example, stress management in women positive for human papillomaviruses (viruses associated with an increased risk of cervical cancer) has been shown to significantly reduce the risk of developing cervical neoplasia (Antoni, Pereira, Marion, et al., 2008). Similarly, stress management has been shown to boost the effectiveness of influenza vaccinations in chronically stressed older individuals (Vedhara, Bennett, Clark, et al., 2003). The development of effective and cost-effective psychological interventions which can reduce our vulnerability to new diseases and moderate the progression of existing conditions is clearly the next frontier.

So in summary, it would seem that psychological stress, and associated psychological processes are highly relevant to our understanding of health and disease. In the coming decades, we will see advances in our understanding of the clinical relevance of these relationships; the mechanisms that underlie them and the development of interventions which exploit these powerful effects of the mind on the body. Enquiry into the connections between the mind and body takes many guises; but also positions health psychology as being central to our understanding of health and the management of disease. ■

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keynote article

Type D or not type D: that's the question

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Acceptance by others is a central human concern, and the threat of negative reactions from others is a main source of psychosocial stress. People who are high in social inhibition have a tendency to inhibit emotion and behaviour in social situations because of their increased vulnerability to social-evaluative threats. However, surprisingly little is known about this trait in the context of cardiovascular disease. About fifteen years ago, the distressed or Type D personality construct—defined by high scores on social inhibition and negative affectivity—was introduced to study more chronic, covert forms of psychosocial stress. Evidence shows that Type D may have an adverse impact on cardiac prognosis, self-management, adherence to treatment and patient-reported outcomes, but also that its effect may recede in older patients with heart failure and somatic comorbidities. These observations clearly indicate the need to take a more differentiated look at the health effect of Type D and other psychosocial risk factors.

Stress and the heart

Patients' psychosocial characteristics have long been known to be associated with the course and prognosis of cardiovascular disease (CVD). However, in contrast to the popular view that stress is bad for the heart, there is still much debate in the scientific community regarding the exact nature and role of psychosocial stress in the onset and progression of heart disease.

Traditionally, psychosocial studies on CVD have focused on specific negative emotions such as depression or anxiety, and have investigated the effect of a single factor rather than multivariable combinations of factors. This approach seems to ignore the fact that people differ in their susceptibility for chronic stress, and that attempts to integrate psychosocial and cardiovascular care should account for individual differences in personality that may help to explain these variations in cardiovascular risk (Denollet & Pedersen, 2009). Assessment of personality could help health professionals better understand how to interact with different kinds of patients, and could improve our understanding of psychosocial stress as a risk factor for CVD. Global personality traits refer to relatively stable dispositions that underlie consistencies in emotion and behaviour. Extraversion and neuroticism are well-known examples of these traits that may be relevant for health.

Lately, interest in personality traits and CVD has shifted from extraversion and neuroticism to social inhibition and negative affectivity. The threat of negative evaluations by others is a central human concern (Smith, Birmingham & Uchino, 2012), and is a main source of stress in everyday life. However, socially inhibited individuals have a cognitive interpretation bias toward social threat (Grynberg, Gidron, Denollet & Luminet, 2012) and a specific brain response to perceived social threat (Kret, Denollet, Grèzes & de Gelder, 2011) that may explain why they are more likely to expect negative reactions from others and have a greater cardiovascular stress response than non-inhibited individuals. Social inhibition refers to the tendency to inhibit emotion and behaviour in social interactions (Denollet, Pedersen, Ong, Erdman, Serruys & van Domburg, 2006). Hence, this personality trait includes more elements of social anxiety and shyness than does introversion. Research on social inhibition is largely limited to animal stress models or developmental studies in young children but surprisingly little is known about this trait in adult human life.

Critically, social inhibition may also interact with negative affectivity, another global personality trait, to predict greater stress reactivity of the cardiovascular system. This latter trait is closely related to neuroticism, but the label negative affectivity will be used here because this trait is centrally defined by the tendency to experience aversive emotional states across time and situations. Almost 30 years ago, Ruberman and colleagues (1984) already reported that the combination of social isolation and high psychosocial stress was associated with a significantly increased mortality risk in cardiac patients. In 1996, we introduced the distressed or Type D personality construct to identify a general propensity to psychosocial stress, as defined by elevated scores on both social inhibition and negative affectivity (Denollet, Sys, Stroobant, Rombouts, Gillebert & Brutsaert, 1996). This personality construct was designed to study more chronic and covert forms of psychosocial stress that may be associated with adverse physical and mental health outcomes.

The Type D (distressed) personality construct

While variable-centred models of personality focus on the co-variation of traits in groups of people, person-centred models such as the Type D personality construct focus on the configuration of traits within an individual (Denollet, 2005; Denollet, Schiffer & Spek, 2010). Two basic assumptions guided the development of the Type D construct. First, the Type D construct assumes that psychosocial risk factors tend to cluster together within individuals (Denollet & Pedersen, 2009). Second, the Type D construct does not focus on one variable at a time but accounts for the way social inhibition may modulate the association of negative emotions with CVD (Denollet et al., 2006).

Type D personality and its two components can be reliably assessed with the 14-item DS14 self-report scale (Denollet, 2005). The 14 items of the DS14 are rated on a 5-point Likert scale, ranging from 0 (false) to 4 (true) and are divided into social inhibtion and negative affectivity subscales of 7 items each. The 7 social inhibition items cover social discomfort, reticence, and lack of social poise; the 7 negative affectivity items cover the tendency to experience feelings of dysphoria, anxiety and irritability. These personality measures have good internal consistency and are stable over time. Completing the DS14 takes only a few minutes and comprises little burden to patients, and the scale has been validated in multiple languages, making it widely applicable. In a large international study of 6222 patients with ischemic heart disease, cross-cultural measurement equivalence was demonstrated for the DS14 scale in 21 different countries (Kupper, Pedersen, Höfer, Saner, Oldridge & Denollet, in press). The classification of patients as having a a Type D profile is determined by a cut-off score ≥ 10 on both the social inhbiton and negative affectivity subsclaes of the DS14 (Denollet, 2005). Typically, the prevalence of Type D personality among patients with established CVD ranges between 25 and 35%.

Meta-analytic reviews have reported that Type D personality was associated with a 2 to 3-fold increased risk of cardiac death and heart attack in patients with established CVD

(Denollet, Schiffer & Spek, 2010; O'Dell, Masters, Spielmans & Maisto, 2011). In another study, Type D personality was associated with an increased risk of mortality in patients treated with an implantable cardioverter defibrillator because of life-threatening cardiac arrhythmias (Pedersen, van den Broek, Erdman, Jordaens & Theuns, 2010). Importantly, Type D predicts adverse cardiovascular outcomes above and beyond the effect of depression (Denollet et al., 2010). For example, Type D remained independently associated with high levels of cortisol (Molloy, Perkins-Porras, Strike & Steptoe, 2008) and with an increased risk of adverse clinical events (Martens, Mols, Burg & Denollet, 2010) in patients with coronary heart disease, after adjustment for depression.

Type D personality has also been associated with a poor perceived health status in patients with CVD. Meta-analysis of prospective studies confirmed that Type D personality was associated with a 2-fold increased odds for impaired physical health status and a 2.5-fold increased odds for impaired mental health status as reported by patients with CVD (Versteeg, Spek, Pedersen & Denollet, 2012). In a German study, Type D was associated with the persistence of depressive symptoms in cardiac patients (Romppel, Herrmann-Lingen, Vesper, & Grande, 2012). Type D patients also have more dysfunctional illness perceptions and are more likely to believe that their cardiac condition will be less responsive to treatment than non-Type D patients (Williams, O'Connor, Grubb & O'Carroll, 2011a).

There are a number of behavioural pathways that may explain the relationship between Type D personality and adverse health outcomes, including unhealthy behaviours such as smoking and physical inactivity (Hausteiner, Klupsch, Emeny, Baumert & Ladwig, 2010; Kupper et al., in press; Williams, O'Connor, Howard, et al., 2008). In the medical care for cardiac patients, Type D has been associated with poor adherence to medical treatment (Williams, O'Connor, Grubb, O'Carroll, 2011b) and with reluctance to consult clinical staff for cardiovascular symptoms (Schiffer, Denollet, Widdershoven, Hendriks & Smith, 2007). Biological mechanisms of disease associated with Type D include cardiovascular stress-reactivity (Habra, Linden, Anderson & Weinberg, 2003; Williams, O'Carroll & O'Connor, 2009), elevated levels of the stress hormone cortisol (Molloy et al., 2008), and elevated biomarkers of inflammation (Conraads, Denollet, De Clerck, Stevens, Bridts & Vrints, 2006).

Re-examining the Type D construct

In recent years, a number of research reports have indicated the need to re-examine the prognostic validity of the Type D personality construct, in an attempt to further investigate the robustness of this personality model. In 2010, we were the first to publish a null study that found no association between Type D and prognosis in patients with heart failure (Pelle, Pedersen, Schiffer, Szabó, Widdershoven & Denollet, 2010). In 2011, another study in patients with heart failure (Coyne, Jaarsma, Luttik, van Sonderen, van Veldhuisen & Sanderman, 2011) and a study in a mixed sample of patients with substantial comorbid medical conditions (Grande, Romppel, Vesper, Schubmann, Glaesmer & Herrmann-Lingen, 2011) also found no association between Type D and mortality. However, anxiety and depression also failed to predict prognosis in all of these null studies (Coyne et al. 2011; Grande et al. 2011; Pelle et al., 2010). Hence, it appears that it was not just the Type D personality construct but rather psychological distress in general that failed to predict prognosis in these null studies.

In addition, more research is needed to examine the conceptually unique prediction of the Type D personality model that it is the synergistic interaction of social inhibition and negative affectivity that places patients with CVD at increased risk, and not only the separate effect of one of these personality traits (Smith, 2011). In a number of previous studies, we have reported that the combined effect of both social inhibition and negative affectivity was independently associated with a significantly increased risk of adverse events (Denollet et al., 1996 & 2006), but more research is needed to examine the prognostic validity of this model. Recently, other research groups also showed that Type D personality was independently associated with a two-fold increased risk of 5-year cerebrovascular events following after cardiac surgery (Cserép, Balog, Székely J, et al., 2010), and with a history of previous coronary events in the general population (Beutel, Wiltink, Till, et al., 2012).

Personality traits are often not considered in the assessment and treatment of patients with CVD, perhaps due to the implicit assumption that the risk associated with personality traits cannot be changed. In contrast, the approach taken by the Type D personality construct may be directly relevant for the emerging need for a shift towards more personalized medicine. This approach may improve our understanding of individual differences in cardiovascular risk, patient-reported outcomes, and relevant health behaviours. Elsewhere, we have argued that behavioural intervention may be useful to improve coping strategies and to reduce psychological distress in Type D patients (Pelle, van den Broek & Denollet, 2012). In addition, the initial findings from a recent randomized controlled trial showed that behavioural intervention may also reduce the trait levels of social inhibition and negative affectivity in individuals with a Type D personality profile (Nyklícek, van Beugen & Denollet, 2012).

Finally, research on the Type D personality construct may also generate new insights that may be immediately relevant for patients with other chronic medical conditions, or for public health in the general population. For example, Type D personality has been associated with impaired quality of life and poor mental health in patients with diabetes (Nefs, Pouwer, Pop & Denollet, 2012) and in cancer survivors (Mols, Thong, van de Poll-Franse, Roukema & Denollet, 2012). In the general population, Type D personality has been related to an increased risk for clinically significant depression, panic disorder and alcohol abuse (Michal, Wiltink, Grande, Beutel & Brähler, 2011). Overall, these findings indicate that individual differences in Type D personality may be of high relevance for health care. ■

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keynote article

Creating change that counts: Evidence-led co-creation as a pathway to impact

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> "impactful... *a non-existent word coined.... to make... work sound more useful, exciting and beneficial to humanity than it really is."*
> Urban Dictionary
> (http://www.urbandictionary.com/define.php?term=impactful)

In the UK, many applications for research funding require an explanation of how the proposed research will produce "impact" in a "pathways to impact statement". Moreover, in a forthcoming competition for UK government funding and recognition, "impact case studies" will account for 20% of annual funding allocated to universities. What is meant by "impact"? UK research funding councils distinguish between "academic impact" such as increased understanding, improved methods, and application of theory, and "economic and societal impacts" such as enhanced effectiveness of public policy and services, and increased health and quality of life. While academic impact, indexed, for example, by citation indices is undoubtedly important to scientific progress, we will focus on economic and societal impact. Allocation of research funding based partly on impact assessments prompts a variety of responses. Researchers who believe their work reveals fundamental causal process regulating natural, intrapersonal, interpersonal or societal process but cannot specify policy, products or services that a better understanding of such processes may generate, may feel undervalued. Applied researchers may welcome the opportunity to emphasise how their findings could revolutionise policy and service provision but may also be disappointed if they fail to persuade others of the impact potential of their work. Applied researchers may also be disappointed if impact assessments are, in practice, less important to funding decisions than they hope. These responses may result in despondent, cynical or overstated approaches to describing pathways to impact, such as "promise world peace within the funding period!" Here we will argue that best practice in understanding mechanism and in developing and evaluating interventions also optimises pathways to impact. We will focus on the application of behavioural science to health problems and, in particular the design and evaluation of behaviour change interventions. We will illustrate this argument by reference to ongoing research. Considerable effort has been devoted to the measurement of impact and the development of assessment procedures that allow replicable comparisons and weighting of research impact and potential impact. For example, Project DESCRIBE involving the Exeter and Brunel universities is designed to review and assess of current standards relating to the evidence of research impact and will make recommendations on best practice across academic disciplines (http://www.exeter.ac.uk/research/rkt/refandimpact/describeproject/). We will not focus on methods of assessing potential research impact but on research design pathways by which impact can be optimised. We will assume that it is possible to assess the likely impact of planned research on, for example, enhanced effectiveness of public policy and services and increased health and quality of life.

Planning pathways to impact during the research design process is not equivalent to promising or guaranteeing impact because well-designed research may reveal that a particular approach to understanding the world should be abandoned. For example, a trial may show that an intervention should not be implemented. The challenge is to assess whether proposed research could have economic and societal impact and describe how that would unfold. This does not, necessarily prejudice research selection in favour of applied research. Mendeleev's construction of the periodic table in 1869 is an archetypical example of fundamental research but it is easy to imagine how one could make a case that identifying the basic elements of which matter is constructed and their irreducible properties was likely to generate impact; not just academic impact, but economic and societal impact in terms of increased capacity to create pure and novel products consisting of single elements or compounds with known properties.

Intervention mapping (Bartholomew et al., 2011), Re-AIM (Glasgow et al., 2002), and the UK Medical Research Council's Guidance on development and evaluation of complex interventions (Craig et al., 2008) provide influential frameworks within which to develop and evaluate health promotion research. Combining these with models used to understand innovation management, adoption and diffusion (e.g., Abraham & Hayward, 1985; Bessant & Maher, 2009) suggests a series of research design principles which may simultaneously optimise research reliability, validity and impact. These could include the following: Research design should...

(1) start with a problem-solving approach to empirically-verified health needs, (2) be based on known regulatory mechanisms and/or change processes or be designed to elucidate these mechanisms and processes, (3) involve potential users or adopters in the development of research outputs, including interventions, (4) understand the reasons why adopters would select and employ products, including interventions, and "design-in" identified usability features, (5) assemble a team of experts with an adequate range of expertise, (6) develop products and interventions that can readily be implemented in everyday work/leisure environments and are sustainable over time within available resources, (7) integrate methodologically robust evaluations assessing outcomes of importance to users, (8) consider a range of potentially positive and negative outcomes taking account of social context, (9) include process evaluations which characterise how interventions are used in practice and which processes lead to any change in outcomes, (10) include time for pilot/implementation/feasibility data collection and re-design on the basis of findings, (11) develop detailed implementation manuals to ensure fidelity of replication.

The UK House of Lords (2011) report on behaviour change focused on government policy but many of the report's recommendations on evaluation apply to behaviour change intervention design. As in Intervention Mapping, the report emphasised that evaluation should be considered at the beginning of the policy design process, that pilot work should be undertaken and that external evaluation expertise should be sought, where necessary. While this advice relating to principles 6-8 above may appear obvious to researchers it is not always implemented when research proposals are developed.

In the UK the National Institute for Health Research (NIHR) has established "Collaborations for Leadership in Applied Health Research and Care" (CLAHRCs). These are partnerships between universities and the surrounding National Health Service organisations. They are designed to undertake research focused on the needs of patients and support the translation of research evidence into practice in the National Health Service (NHS). PenCLAHRC is a partnership between the NHS throughout Devon and Cornwall and the Universities of Exeter and Plymouth in the south west of England. Implementation of many of the research design principles listed above can be observed in PenCLAHRC research projects, in part because of the collaborative and multidisciplinary nature of the organisation.

Research question generation

PenCLAHRC has a mechanism for generating research questions from patients and professionals rather than from researchers. These questions inherently address real-world health problems but must be assessed in relation to what is already known about underlying processes and potential solutions. Not all real world problems warrant further research but when they do that research is likely to have impact.

Outcomes

Evaluating interventions in terms of outcomes that make a difference to funders, adopters and users is important to future impact. So measures of health, functional abilities, behaviour and economic evaluations are all important. While apparently obvious, this is not always evident in the design of psychological research. For example, when reflecting on the American Psychological Society's "Decade of Behavior", Baumeister, Vohs and Funder (2007), noted, worryingly, that:

"*although self-reports, reaction times, implicit associations, and the like are good methods, we believe that psychology has tilted towards examining precisely those topics for which these methods are appropriate and away from everything else*" (p.401).

If accurate, this does not augur well for the future impact of psychological research. Self-reports, reaction times and implicit associations are unlikely to convince commissioners to adopt products or interventions. To optimise impact, including adoption and diffusion of interventions, researchers must employ outcomes of value to commissioners, adopters and users.

Measurement and intervention design

This means that interventions, implementation procedures and evaluative tools often need to be developed and tested to correspond to the parameters of the problem—not just applied on the basis of previous reports. Paradigmatic, manualised science is important to developing reliable, replicable methods. However, when pressure on time and resources leads scientists to concentrate on cloning established measures and procedures, creative advances may be suppressed and impact limited.

Research teams

PenCLAHRC has a unit devoted to generating patient and public involvement in research design which recruits patients, carers and others to research design teams. PenCLAHRC teams also combine diverse groups of experts who co-create research in large group meetings. These may include clinicians, public health professionals, teachers, parents, psychologists, health economists, specialists in physical activity and dietary measurement, statisticians and trial management experts. This ensures a range of perspectives on problem solving which facilitates scrutiny of ideas and creative reworking of previous approaches. It also makes it less likely that research planning will neglect practical pitfalls or previous research. Such teams involve intervention adopters, such as professionals who know what will work in practice and what can be sustained given available resources. This makes it much more likely that, if an intervention is effective and cost effective, it will be adopted and embedded in health services.

Research team management

Management of multidisciplinary research groups involving users, practitioners and commissioners requires particular expertise and social skills. There is potential for the development of ingroup-outgroup oppositions (e.g., between disciplines) and for political in-fighting over resources. Meticulous inclusiveness, open accountability of decision-making, mutual respect of diverse and differing expertise, valuing of others' perspectives and of disagreement, recognition of differing needs and a dedication to fairness are important.

Three ongoing projects within PenCLAHRC illustrate this approach to problem-solving, service-relevant project development and design, namely, ReTrain, REACH-HF and HeLP.

ReTrain. "Action for Rehabilitation following Neurological Injury" (ARNI) was devised by a stroke survivor (Balchin, 2011) whose 487 page text describes this complex recovery programme. Six UK regions are funding ARNI-based programmes and preliminary evaluations indicate that the programme may be beneficial. For example, local audit data relating to 12 participants indicates NHS and social care resource savings of £5252 and a reduction in ambulance call outs saving of £7,200. A PenCLAHRC project, based on ARNI, generated ReTrain, a 12 week novel physical rehabilitation programme for stroke survivors who have completed NHS post-stroke rehabilitation. The programme was developed through an Intervention Mapping analysis of ARNI combined with video analysis fidelity-checking procedures to ensure replicability and sustainability of the intervention. ReTrain will incorporate 8 essential elements of ARNI and adheres to recommendations provided by a series of international guides to stroke rehabilitation. A bid to fund a multi-centre randomised controlled trial comparing Retrain plus usual care to usual care alone (which generally consists of nothing) for post-rehabilitation stroke survivors is under review. The planned intention to treat analysis will assess a primary objective outcome of Brunel Balance Assessment immediately following intervention and 9 months later. A variety of other moderators and mediators will be assessed. The process evaluation will relate attitudes to exercise, exercise motivation, self-efficacy, goal setting, intervention engagement and recovery optimism as well as secondary outcomes (including adherence).

REACH-HF. Heart failure (HF) is becoming more prevalent worldwide. Yet patients with heart failure as a primary diagnosis are excluded from most cardiac rehabilitation programmes in England, Wales and Northern Ireland (Dalal et al., 2012). A lack of resources and exclusion from local commissioning agreements are the main barriers to providing rehabilitation for patients with heart failure. The NIHR-funded Rehabilitation Enablement in Chronic Heart Failure (REACH-HF) programme is designed to improve UK HF rehabilitation services. The planned programme of work includes use of Intervention Mapping to develop an evidence-informed, home-based, self-help cardiac rehabilitation programme for people with heart failure and their caregivers. It builds on a qualitative meta-ethnography of key studies about self-management, which identified five stages through which patients progress in developing their own self-management strategies (Wingham et al., under review). These stages include disruption and sense-making followed by becoming a strategic avoider, a selective denier, a well intentioned manager, or an advanced self manager. Only later will they integrate self management into everyday life to maximise feelings of safety. This analysis highlights how intervention design needs to correspond to patients' complex, evolving representations of their illness. The REACH-HF manual will be developed in conjunction with patient and health professional stakeholder groups and the Heart Manual team who developed an effective manual for post-MI rehabilitation. The manual will incorporate a mechanism-based behaviour change model and relevant change techniques (Abraham, 2012). After conducting a feasibility trial, the effectiveness and cost effectiveness of the REACH-HF manual will be assessed in a randomised controlled trial comparing usual care to usual care and manual use. If effective, intervention has the potential to improve quality of life for systolic HF patients and their caregivers and reduce hospital admissions and caregiver stress. Moreover, it is hoped that evidence of effectiveness and cost effectiveness may lead to implementation on a national basis.

HeLP. One third of girls and boys aged 11-15 in the UK are either overweight or obese. Being overweight in childhood is associated with metabolic abnormalities, increased risk of Type II diabetes and musculo-skeletal and psychological problems and it has been predicted that by 2050 overweight and obesity prevalence will cost the UK £50 billion a year. There has been little success in reducing overweight and obesity prevalence in schools but a pilot study of a novel school-based Healthy Lifestyle Programme (HeLP) showed that after 2 years the proportion of overweight and obese children was 33% in the non-intervention, control schools compared to 22% in the intervention schools (Wyatt et al., 2011). HeLP is a multi-component school programme focusing on a healthy lifestyle message including maintenance of an energy balance. It is delivered across 4 school terms to 9-10 year old children and has been designed to change the whole-school environment. HeLP was developed using Intervention Mapping and the Information Motivation and Behavioural Skills model (Fisher & Fisher, 1992) to guide the choice of incorporated behaviour change techniques (Abraham & Michie, 2009; Abraham, 2012). HeLP was developed with teachers, parents, children, public health practitioners and clinicians to ensure that the intervention is feasible and acceptable for schools, children and their families. Three lifestyle changes are highlighted, namely, decreasing consumption of sweetened fizzy drinks, increasing the ratio of healthy to unhealthy snacks and a reduction in screen-based activities. HeLP also aims to nurture home and school environments supportive of healthy choices. The programme includes an innovative drama component built around four characters (Active Amy, Snacky Sam, Football Freddie and Disorganised Duncan). These are played by young actors, with whom the children can easily identify. During drama workshops children co-create scenes with the actors and provide their own ideas and solutions to problems faced by the characters. This drama-based delivery is engaging and allows individual message tailoring. Parents are invited into schools to work-in-progress workshops in which their children act out a range of scenarios. Manuals for delivery of the intervention and the training of those delivering it have been written. A NIHR-funded cluster randomised control trial is underway to assess the effectiveness of HeLP by comparing intervention and control schools on a range of anthropometric and behavioural measures. This trial will also assess cost and cost-effectiveness. A mixed-methods, process evaluation together with mediational analyses will elucidate change mechanisms including psychological change.

We conclude that funding research on the basis of impact potential should be welcomed by health psychologists who want to create change that counts. This emphasis can highlight health psychologists' research methods and intervention design skills which can be applied to embed evaluations which focus on health outcomes, quality of life and behaviour change as well as process evaluations which clarify mechanism underpinning change. Health psychologists and the professionals and patients they work with could benefit from increased weighting of impact assessment in research funding decision making. We recommend that other research funding bodies adopt and extend UK research councils' emphasis on impact. ■

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keynote article

Varieties of resilience and their biological underpinnings

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Resilience has been empirically studied for several decades, beginning with work in the 1970s and 1980s focused on children who grew up with mentally ill parents or lived in poverty. In the 1990s, scientists began examining resilience at the other end of the life cycle, with the goal of illuminating why some individuals negotiate the challenges of aging better than others. In both early and later life, the central issue of interest was that some individuals, when faced with hardship, loss, or adversity, do well. That is, they do not succumb to mental or physical illness when subjected to difficulties in life, but instead show profiles of healthy functioning. This article summarizes ongoing research on individuals from a national sample of U.S. adults who have been confronted with a variety of life challenges. The aim is to document that many are resilient, formulated as showing the capacity to maintain, or regain well-being in the face of adversity. Of particular interest are the biological processes and brain mechanisms that underlie such resilience. Thus, an additional set of findings explores these linkages. The model of resilience put forth is fundamentally biopsychosocial in scope. A concluding section notes intervention strategies designed to promote resilience among ever larger segments of society.

Prevailing in the face of adversity

At its core, human resilience involves the juxtaposition of the positive and the negative—i.e., how strengths are maintained, if not deepened, in the confrontation with difficult life challenges. Our initial studies formulated the positive in terms of psychological well-being (Ryff, 1989). We were interested in who was able to show high well-being in the face of various types of adversity, such as living with an alcoholic, parenting a child with disabilities, providing care to an aging parent or spouse, enduring socioeconomic disadvantage, or negotiating the losses of growing old (e.g., relocation, increased chronic conditions) (for a summary see Ryff & Singer, 2003). Our studies emerged in the context of numerous other efforts to advance understanding of the construct of resilience (see Luthar, Cicchetti, & Becker, 2000; Reich, Zautra, & Hall, 2010). More recently, we have examined resilience and its health consequents in the context of a national study of U.S. adults, known as MIDUS (Midlife in the U.S.). Funded by the John D. and Catherine T. MacArthur Foundation, MIDUS was launched in 1995/96 with over 7,000 adults aged 25 to 74. Its primary objectives were to investigate the roles of psychological and social factors in understanding how people age across the decades of adult life. In 2004/05, a longitudinal follow-up was initiated, with funds from the National Institute on Aging. The second wave repeated baseline assessments and added new measures (cognition, biomarkers, brain-based emotional reactivity and recovery). Currently, we are “refreshing” the MIDUS study—i.e. we are recruiting new members to the sample with a focus on studying the impact of the ongoing economic recession on the lives of U.S. adults via comparison of same-aged adults from different historical periods. We are also initiating the third wave of assessments on the existing sample.

Data from MIDUS are publicly available (http://www.midus.wisc.edu). To date, more than 400 publications have been generated from the study. They cover a wide array of topics that have appeared in premier journals across the scientific disciplines. For those interested in studying resilience, MIDUS is unique among population-based inquiries, given its unusual depth and breadth in assessments of psychological and social strengths, key ingredients needed to document the presence of wellness in the face of adversity and possibly to explain why, via key protective resources. Three varieties of resilience research from MIDUS are summarized below.

Resilience in the face of socioeconomic inequality. MIDUS is a key forum for investigating social inequalities in health and in so doing, adds to the growing literature documenting more unfavorable health profiles among those with lower standing in the socioeconomic hierarchy (Adler & Stewart, 2010). Many MIDUS studies have, however, documented that some individuals of limited means (low incomes or low educational attainment) are nonetheless doing well. Thus, they do not fit the average profile wherein socioeconomic disadvantage culminates in poor health. For example, Lachman and Weaver (1998) found that low income individuals who possess high levels of personal mastery did not show compromised health. Instead, their self-rated health was comparable to that observed among higher income respondents. In addition, Lachman, Agrigoroaei, Murphy, and Tun (2010) showed that low education adults who engaged in greater cognitive activities (reading, writing, word games) were protected against the lower performance on memory and executive function typically found among the less educated. Ethnic/racial disparities in health are a variant on the theme of inequality. An unexpected finding from the MIDUS baseline data was that minority respondents reported higher psychological well-being than their majority counterparts, independent of differences in educational attainment (Ryff, Keyes, & Hughes, 2003). The minority advantage was even greater after controlling for perceived discrimination, suggesting that some aspects of positive psychological functioning (e.g., purpose in life, personal growth) may, paradoxically, be honed by living with the challenges of minority life.

Resilience vis-à-vis the challenges of aging. Older people (age 65+) are at higher risk for various health problems (e.g., cardiovascular disease, cancer, diabetes, Alzheimer's disease). They also face loss of significant social roles (e.g., widowhood, retirement) as they age. Perhaps related to these challenges, older persons show downward trajectories on numerous aspects of psychological well-being and are at increased risk for depression and cognitive impairment (see Ryff, Friedman, Morozink, & Tsenkova, 2012). Nonetheless, there is notable variability among older adults, such that many do not fit such negative psychological profiles. Moreover, those who maintain high well-being show diminished risk for subsequent morbidity, and they live longer. For example, MIDUS investigators have found that although self-rated health tends to worsen with age, those who report better social relationships and a higher sense of control had better self-rated health at the follow-up assessment (Cotter & Lachman, 2010). In addition, Lachman and Agrigoroaei (2010) found that decline in functional health over time was reduced among those possessing more protective factors (i.e., control beliefs, social support, physical exercise). Other studies from MIDUS have examined behavioral factors, such as volunteering, as protective influences on the health and well-being of older individuals. Choi and Kim (2011) found that those who volunteer and make charitable donations had higher well-being, with effects possibly attributable to participants' sense of efficacy, altruism and desire to do good deeds. Greenfield and Marks (2004) found that formal volunteering was associated with more positive affect among older adults. Volunteering also buffered against declines in purpose in life associated with loss of major social roles. Greenfield (2009) further examined felt obligation to help others as a protective factor vis-à-vis loss of well-being following decline in functional abilities. Seeman et al. (2011) investigated whether social contacts and support were related to cognitive abilities in middle-aged and older adults. Significant positive associations were observed between greater social contact and support with both executive function and episodic memory, whereas declines in social contact were negatively associated with both outcomes, particularly among younger adults. Taken together, the above findings underscore the role of various positive psychosocial factors in reducing the likelihood of health and cognitive decline in later life.

Resilience vis-à-vis targeted life challenges. MIDUS researchers have investigated the impact of specific life events on respondents' health and well-being. Experiencing abuse (emotional, physical, sexual) in childhood has been of considerable interest. Pitzer and Fingerman (2010) invoked the idea of resilience by showing that the impact of severe physical abuse in childhood on adult problems (poor health, negative affect) was reduced among those with a greater sense of agency (sense of control) over their lives. Greenfield and Marks (2010) found that sense of community served to mitigate the impact of child abuse on psychological distress in adulthood. Other studies have examined resilience in the context of dealing with cancer. Costanzo, Ryff, and Singer (2009) found that although depression worsened over time among cancer survivors, they showed resilience in several other ways. Specifically, their profiles of mood, psychological and social well-being, and spirituality over time were no different than what was observed among demographically similar adults not dealing with cancer. In addition, Pudrovska (2010) found that cancer diagnosis among younger cohorts resulted in increases in personal growth compared to individuals without cancer. Loss of spouse constitutes a significant life challenge of interest in MIDUS. Ong et al., (2010) compared a sample of bereaved individuals who lost a spouse between wave 1 and 2 with a demographically matched group of continuously married individuals. Although spousal loss predicted greater decreases in positive emotions across time, those who reporter higher levels of positive reappraisal (conceptualized as a resilience factor) showed less decrease in positive emotions following death of spouse. Thus, across multiple types of life challenge, MIDUS investigators have documented profiles of sustained or enhanced well-being in the face of adversity.

Biological concomitants of resilience

The above examples document the capacity to maintain health and well-being vis-à-vis challenge but do not explicate underlying biological processes. Years ago Dienstbier (1989) put forth the concept of "physiological toughness" to account for a pattern of arousal that works together with effective psychological coping to comprise positive physiological reactivity. It includes low sympathetic nervous system (SNS) arousal base rates combined with strong, challenge-induced SNS-adrenal-medullary arousal and resistance to brain catecholamine depletion and suppression of pituitary adrenal-cortical responses. In addition, Charney (2004) has elaborated the mechanisms of resilience at psychobiological levels via multiple neurochemical patterns of response to acute stress, which he connects to neural mechanisms of reward and motivation as well as adaptive social behaviors. MIDUS includes assessments of biological factors and brain-based measures of emotional reactivity and recovery on subsamples of respondents. It is therefore possible to bring these measures to formulations of resilience, albeit with less mechanistic detail than formulated by Dienstbier (1989) or Charney (2004). Initial empirical tests have focused on whether the maintenance of high psychological well-being in the face of challenge translates to better biological regulation (see Ryff & Singer, 2009 for a summary of evidence prior to MIDUS). With the MIDUS national sample, recent findings document that biological costs of socioeconomic inequality are mitigated among low education individuals who have higher levels of psychological well-being (Morozink, Friedman, Coe, & Ryff, 2010). The outcome of interest was interleukin-6 (IL-6), an inflammatory marker implicated in the etiology of numerous adverse outcomes, including cardiovascular disease, diabetes, osteoporosis, and Alzheimer's disease. As predicted, we found that those with lower levels of educational attainment had higher levels of IL-6. However, such patterns were moderated by levels of psychological well-being, such that low education individuals with high levels of purpose in life, environmental mastery, self-acceptance, etc., had lower levels of IL-6 (comparable to those with higher levels of educational attainment). A related study by Miller et al. (2011) showed that although coming from an impoverished childhood environment increases adult risk for metabolic syndrome (MetS, a cluster of cardiovascular risk factors) in middle age, such risk is offset among those who had a nurturing mother in childhood. Thus, individuals from low SES households who also reported experiencing high maternal nurturance had a MetS prevalence comparable to those from high SES households in childhood.

Moving to the challenges of aging, Friedman and Ryff (2012) focused on the reality of later life co-morbidity—namely, that with age, individuals are at increased risk for having multiple chronic medical conditions. These conditions are both the consequent of elevated levels of inflammatory proteins (e.g., IL-6, C-reactive protein), and they also contribute to further inflammatory problems. However, we found that among older adults who reported a greater sense of purpose in life and stronger social relationships, the link between multiple chronic conditions and elevated inflammatory markers was mitigated. That is, high well-being protected against elevated inflammation, thereby reducing risk of still further disability ahead as well as earlier mortality.

Brain-mechanisms involved in resilience need to be explicated as well. Urry et al., (2004) examined the neural correlates of psychological well-being and found that those with higher well-being had greater left than right superior frontal activation (referred to as EEG asymmetry) compared to those with lower well-being. This activation pattern has been previously linked to positive dispositional styles and reduced risk of depression. Using neuroimaging, van Reekum et al. (2007) found that those who evaluated negative stimuli more quickly showed greater activation of the amygdala. However, such effects varied depending on respondents' levels of psychological well-being. Those with higher well-being were slower to evaluate the negative information, and they showed lower amygdala activation. In addition, they showed increased activation of the anterior cingulate cortex (ACC). The interpretation given was that those with high well-being effectively recruit the ventral ACC when confronted with aversive stimuli, manifest reduced activity in the amygdala and appraise such information as less salient (reflected in slower evaluative speed). The two prior studies were not based on MIDUS data, although Heller et al., (2012) used fMRI with MIDUS respondents to show that individuals with more sustained engagement of the ventral striatum in response to positive stimuli (embedded within mixed valence stimuli) reported higher levels of well-being and showed lower levels of cortisol output. The results suggested that being able to repeatedly engage reward circuitry when encountering positive events in the midst of negative ones may underlie eudaimonic well-being, with related implications for adaptive regulation of the hypothalamic-pituitary-adrenal axis.

In summary, the above work has begun to tell a story about resilience that is broad in scientific scope. It begins with the concrete challenges that individuals encounter on their journeys through life and then documents the capacity of some to sustain high well-being despite such adversity. More recent inquiries bring biological risk factors and brain-based mechanisms into the inquiry to show that resilience (i.e., the presence of well-being in the face of life difficulties) contributes to better regulation of biological systems as well as to neural mechanisms that underlie healthy patterns of emotional reactivity and recovery. Much work remains to be done in painting the larger biopsychosocial portrait of human resilience. Fortunately, opportunities to contribute to such work are available to all members of the scientific community, given the public availability of data from the MIDUS national study (www.midus.wisc.edu). ■

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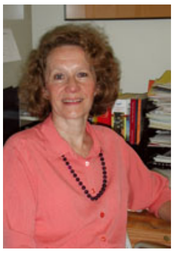

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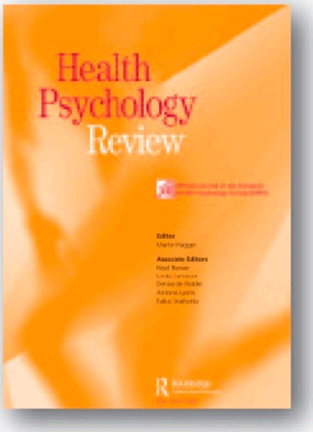
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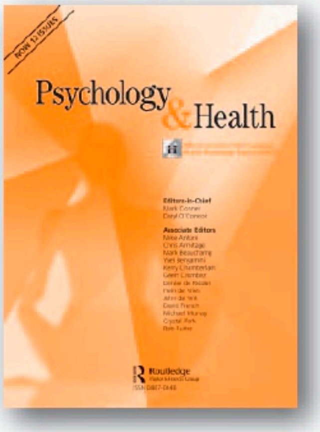
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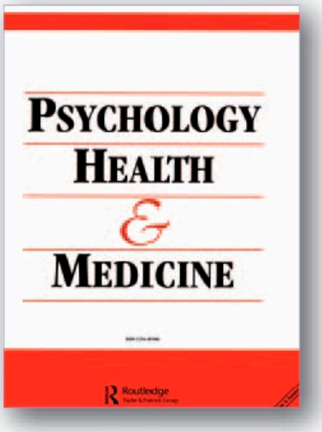
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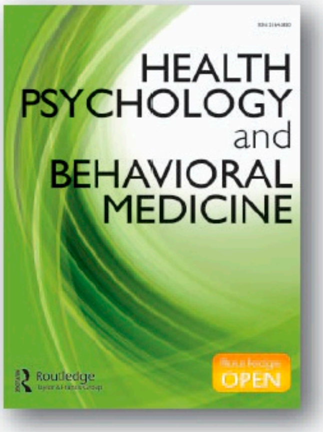
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