What's stress got to do with it?

Ecclesiastes tells us that 'there is nothing new under the sun', and it is certainly true that the idea that the mind and body may be connected has been around for a long time. But a chance discovery in the 1970s revolutionised our understanding in this area. Ader and Cohen were seeking to produce a taste aversion response in animals trained to associate saccharine (conditioned stimulus) with an immunosuppressant substance known to produce nausea and vomiting: cyclophosphamide (unconditioned stimulus). However, in their early trials they noticed a significantly higher mortality rate in the animals exposed to the unpaired saccharine. This observation led them to wonder whether they had inadvertently conditioned their animals to suppress their immune systems. They tested this seemingly outrageous proposal by conducting a further conditioning experiment in which they also assessed the immune system. Ader and Cohen reported that, even after a single exposure to the conditioned stimulus (i.e. saccharine), 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.

In the years that followed, investigators widened their focus to the psychological parameters that appeared to affect our biology. This research demonstrated, time and again, that psychological stress modulated the immune system. Much of this early research was, however, conducted in vitro: the clinical relevance was unknown. This all changed with the ground-breaking study of Cohen et al. (1991). They exposed healthy volunteers to respiratory viruses; quarantined them and monitored them for the development of respiratory symptoms and clinical colds. Cohen reported that the greater the level of stress at baseline, the greater the incidence of both respiratory symptoms and clinical colds. Psychological stress, it would appear, could significantly increase vulnerability to infectious disease.

So, stress might increase disease risk in young healthy people. But the young and healthy can, and do, recover quickly from minor illnesses such as the common cold. What happens in populations more vulnerable to ill health and for whom even minor illnesses can be fatal? This was examined by Jan Kiecolt-Glaser and colleagues (1996). She recruited a small 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 able to generate an antibody response denoting protection against flu. The rate of vaccine failure was significantly higher in the chronically stressed group: with only 38 per cent of carers being protected against flu, compared with 68 per cent of the control group. Perhaps the most striking feature of these results, which have been replicated many times, is that they reveal that the effects of chronic stress on the immune system are so insidious, that even after vaccination, the chronically stressed remain at increased risk of disease.

The effects of stress on health appear not, however, to be restricted to disease vulnerability. Considerable effort has been devoted to exploring the effects of psychological stress on disease progression and disease activity. A multitude of chronic diseases have been investigated (HIV, cancers, autoimmune conditions, etc.). Here the evidence is less clear cut, confounded, perhaps inevitably, by the complexity of the diseases and their treatments. But we are observing the development of psychological interventions aimed at, not only enhancing emotional well-being and quality of life, but potentially also prolonging life and/or reducing symptom burden. The results from these early intervention studies offer considerable hope and promise. For example, stress management in women positive for viruses associated with an increased risk of cervical cancer, has been shown to reduce the risk of developing the disease (Antoni et al., 2008). Similarly, stress management has been shown to boost the effectiveness of influenza vaccinations in chronically stressed older individuals (Vedhara et al., 2003).

So the mind and body are indeed connected, and these connections may be of clinical relevance. In decades to come, health psychology will advance our understanding of these relationships; the mechanisms that underlie them and will develop interventions which harness these powerful effects of the mind on the body. We are facing an unrivalled opportunity to make health psychology central to our understanding of health and disease.

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What can the internet do for future health psychology?

Findings that open up fascinating possibilities for the future point to the potential role of the internet in supporting healthy behaviour and illness management (Heron & Smyth, 2010). The internet could potentially give lay people convenient, private access to expert advice and support for managing all aspects of health – and it presents healthcare providers with an inexpensive means of offering this to much of the population. Encouragingly, a recent review (Webb et al., 2010) confirmed that, on the whole, web-based health behaviour change interventions are effective. However, their effectiveness varies widely, indicating that much more research is needed into when, why and how these interventions can work.

Until now, a barrier to research into web-based interventions has been the need for the software infrastructure for each

intervention to be programmed individually by software developers – a laborious and costly process that results in an intervention that then cannot easily be modified. However, over the past three years the LifeGuide team, led by University of Southampton, has overcome this problem by creating free, open source software that can be used by people without a programming background to build and modify their own web-based interventions and easily adapt them for use in different contexts. The LifeGuide Community (which anyone can join, simply by logging onto www.lifeguideonline.org) already has over 500 members worldwide who are interested in creating their own interventions, ranging from postgraduate students to leading international researchers. LifeGuide interventions now being developed and trialled include interventions to help people to lose weight, increase their physical activity, stop smoking, and prevent or self-manage colds and flu (Yardley et al., 2010), bowel symptoms, high blood pressure, eczema and stroke.

LifeGuide is particularly useful for international collaboration, as interventions can be copied and then modified for different countries. For example, hundreds of GPs from the UK, Spain, Belgium, the Netherlands and Poland are currently recruiting thousands of patients in an EC-funded LifeGuide intervention to reduce antibiotic prescribing rates across Europe; this has involved translating the webpages into five different European languages and altering text to suit local customs and preferences. As this example illustrates, a scientific advantage of web-based interventions is that they can facilitate cost-effective automated collection of very large data-sets, providing sufficient statistical power to permit sophisticated analyses of the mediators and moderators of interventions – allowing us to find out what works for whom.

A particularly interesting finding from the review of web-based interventions cited above (Webb et al., 2010) is that digital interventions appear to be more effective if they use more ways of interacting with the user, by e-mail and text messages (e.g. to motivate and cue behaviour). Increasingly, internet users are turning to mobile phones to provide the information and support they need where and when they need it. Previously, digital behaviour change interventions have mainly been delivered by PCs and provide advice for users to implement at some point in the future, based on users' answers to questions about their past or future activities and feelings. Over the next few years the LifeGuide team will be developing software to allow all LifeGuide users to fully exploit the potential of mobile phones to provide more timely support for behaviour change. Mobile phones can detect what the user is currently doing, without the need for users to answer questions, by sensing their location, activity level, who they are with or talking to and even their mood (Klasnja et al., 2009). Detecting this information will allow us to deliver exactly the right kind of support to users at the right time. We will also link to online social networks, which can provide information about users' attitudes and social contacts, so that our interventions can draw on encouragement from a virtual community of online peers. It may sound like science fiction, but technology is making strides towards allowing us to provide affordable, personalised health interventions, accessible anywhere, any time.

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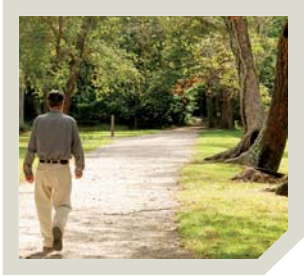
Helping people to walk more

Guidelines for good health encourage regular physical activity of moderate intensity (i.e. sufficient to get a person slightly out of breath). Brisk walking is a form of moderate physical activity that is especially acceptable to populations who are the most physically inactive. It does not have to be scheduled, nor does it require any special clothes or equipment, so it is very low cost.

Although there have been many studies demonstrating that interventions can successfully increase walking, they have largely been devoid of theory. Consequently there is a limit to how much evaluations of these interventions can inform the development of future interventions: they provide little information on *why* these interventions work or do not work. We have developed and evaluated an intervention to help adults increase their walking, based on the theory of planned behaviour, a generic model of human behaviour that has been used in literally hundreds of studies. This theory was extended to include consideration of volitional processes, specifically how to help people translate their 'good' intentions into action.



Extended developmental work using this theory identified that the strongest predictor of intentions to walk more was self-efficacy – the degree of confidence a person has that they can successfully carry out a behaviour (in this case walking). Thus, the people who most intended to increase their walking were those who felt most confident that they could walk more, not those who thought they would enjoy it, or who thought that it would be good for their health. Further, the most common reasons why the general public gave for why it would be easy or difficult to walk more concerned (lack of) time (Darker et al., 2007).

Our intervention therefore had the overall strategy of changing this belief about not having enough time to walk more, thereby