

Words

Stress

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Author's abstract

'Stress' is a widely used word in clinical practice, the biological sciences and everyday life; but one which has little real value, serving mainly to confuse and confound rational thought. Whether it is described in terms of stimulus, response, or a combination of the two the definitions of stress are invariably found to be circular. We should stop using the word 'stress' and instead discuss specific stimuli or responses as appropriate. The author suggests that 'pressure' and 'tension' might provide suitable substitutes for everyday clinical practice.

Introduction

It is my thesis that stress is a word without real value. Worse, the concept of stress is a pseudo-explanation which provides a blind alley for rational thought.

'Stress' is used by a wide range of people to describe a wide range of things. It is one of the 'buzz words' of modern life. But the problem is not just that the word is overused or misused: the problem is that the word should not be used at all; at least not where importance is attached to clear thinking or effective action.

What is stress? Hans Selye, one of the most influential writers on the subject has described it in his monumental *Stress in Health and Disease* (1) as:

'... associated with a great variety of essentially dissimilar problems, such as surgical trauma, burns, emotional arousal, mental or physical effort, fatigue, pain, fear, the need for concentration, the humiliation of frustration, the loss of blood, intoxication with drugs or environmental pollutants, or even with the kind of unexpected success that requires an individual to reformulate his lifestyle. Stress is present in the businessman under constant pressure; in the athlete straining to win a race; in the air traffic controller who bears continuous responsibility for hundreds of lives; in the husband helplessly watching his wife's slow, painful death from cancer; in a race horse, its jockey and the spectator who bets on them' (1).

The key phrase is 'essentially dissimilar'. How could

Key words

Stress; medicine; science; stimulus; response.

the situation have arisen where such a collection of 'problems' could be regarded as merely examples of a single concept? Clearly, in one sense, 'stress' must be regarded as a very *useful* word if it can be applied so widely; but by the same token the potential for confusion is equally multiplied. It will be seen that even under ideal conditions, the illogical nature of the concept invariably leads to contradiction and confusion.

The origin of the concept

Stress as a scientifically 'respectable' concept has arisen from the observation of a correlation between events inside and outside of organisms when studied as a population: the stress stimulus and the stress response. A given example of stress produces the characteristic stress response. The diversity of the nature of stress stimuli is contrasted with the (relative) uniformity of the response. But the question arises: what counts as a stress?

The key factor is that stress is a unifying concept. As Selye describes stress, it is the non-specific response to a huge variety of stimuli – some of which are described above. 'There cannot be *different types of stress*, although the effects of stressors are almost invariably different. There is no "specific stress", this expression is a contradiction in terms' (1). We can see that stress is discussed in terms of stimuli, responses and the relationship between them.

Three concepts of stress

Stress is therefore defined in three basic ways: either 1. a type of stimulus; 2. a 'non-specific' response; or 3. a combination of the two – the response to a stimulus. We find that, on closer examination, none of these definitions are coherent.

1. STRESS AS STIMULUS

If stress is defined as a stimulus then no account must be taken of the response. The quality of stress must lie in the stimulus alone – what is this quality? Stress is often said to be aversive to an organism, but what counts as aversive? Alternatively, if it is defined as a threat to homeostasis then how can we know what is a threat without also looking at the response?

If stress is defined as any or all of the diverse and

'essentially dissimilar' situations mentioned above we run into the problem that each individual stress does not produce the same response; for example exercise has a different effect on the body than does the need for concentration. It is claimed, however, that there is a shared substratum of effects which are shared by all of these stresses, and it is this which defines them as an example of stress (it can be seen how difficult it is to discuss the 'cause' of stress without mentioning its 'effects').

But what happens when the same stress is repeatedly applied? Often the effects wear off, the organism becomes 'adapted'. The stress is no longer a stress. Even when adaptation does not occur, the application of a uniform stimulus to a population will always result in a variety of responses and some organisms will not respond at all. In this circumstance is the stimulus a stress or is it not? Clearly the concept of stress cannot be defined solely in terms of stimulus.

The best effort to do so has been made in the subject of endocrinology. However, in endocrinology the word stress is used in two distinct ways – specific and non-specific – although these may become confused. The specific usage of endocrinologists is invoked in the 'endocrine stress test'. This is a procedure which tends to produce an *increased release* of the hormone under study (and in doing so, obviously draws response into the definition – at least initially). For example, giving a mild overdose of insulin to produce a low blood sugar will, in most normal people, stimulate a large release of the hormone cortisol: this is called the 'insulin stress test'.

However, even here it could be said that stress is a word being used to indicate (or disguise) an ignorance of mechanisms. Just how insulin works in this case is not well understood, but a similar cortisol response can be obtained from an injection of corticotropin-releasing hormone (CRH), a substance which is known to release adrenocorticotrophic hormone (ACTH) from the pituitary gland, which then stimulates cortisol release by well understood mechanisms. Because the mechanism is well understood, the test is called the 'CRH stimulation test'; and 'stress' has been dropped from the title.

Using stress to describe a test which tends to produce increased hormone secretion (although not in every case, that is how it is a test) is a specific and reasonable – if highly misleading – use of the word. Problems begin when endocrinologists talk of 'non-specific' stress as the 'reason' for unexplained changes in hormone concentrations; and in doing so close-off further enquiry in that direction. Any unusual hormonal behaviour which is not associated with defined endocrine disease can thus be dismissed as the result of this catch-all – or dustbin – concept of stress. Non-specific stress is the graveyard of speculative thought in endocrinology.

2. STRESS AS RESPONSE

If we run into unresolvable problems in defining stress

in terms of the nature of stimuli, it turns out that neither can it be defined in terms of response. The most influential theorist of stress seems to have been Hans Selye whose definition was: 'Stress is the non-specific response of the body to any demand' (1). It is a definition which appears to have captured the imagination of many. Nonetheless it requires to be unpacked. Selye claims that the non-specific response is composed of the General Adaptation Syndrome (GAS) which results from the prolonged action of 'diverse noxious agents' (so that the nature of the stimulus does, after all, play a part). In his original experiments he apparently noted the similar features of patients suffering from a variety of different severe diseases; in particular a triad of adrenal (cortex) enlargement, thymus gland involution and gastric/duodenal ulceration. Some years later the same triad was observed in rats injected with crude extracts of hormone derived from cattle. The syndrome could also be induced by other 'toxic' extracts. These signs became, for Selye, 'the objective indices of stress' (1).

Several things can be said about this. Quite obviously the massive range of 'stresses' described above do not all produce the signs of GAS. So obvious is this that nobody would even imagine looking for them. Indeed, in most so-called stress situations, experiments have not even been done to establish *any* objective correlates (biochemical, histological or whatever) of the stress. Stress as a unified response has been watered-down to a vague, undefined subjectively unpleasant feeling – an emotional reaction, in other words, like happiness, anger or irritability. Where objective correlates have been examined (for example the measurement of cortisol in psychiatric illnesses) there is a huge diversity of response – many subjects have *no* observable response. And this is only examining the adrenal aspect of the GAS.

Furthermore, almost as soon as the GAS had been defined, other 'objective' parameters of stress began to enter the literature to add to the original triad – in particular adrenaline and noradrenaline secreted by the adrenal medulla were added to the already expanding definition of adrenal cortex hypersecretion; but also innumerable other parameters ranging from beta-endorphin, growth hormone and other endocrine products, to skin electrical-resistance, blood-flow, sweating, heart-rate and whatever else you want. By no means could the resulting mish-mash be described as a unified response.

The problems of definition do not end here. If stress is 'the non-specific response of the body to any demand' then what is a demand? If we are looking at a stimulus, how can we tell if it results in a demand? What for that matter, is a 'noxious agent' – by what means can we recognise its noxious nature? The answer to both questions must surely be that a demand and a noxious agent are both things which produce a stress reaction: the definition is inevitably circular. One can only imagine that the satisfaction derived from unifying such an impressive collection of 'essentially

dissimilar problems' under a single heading is so intense that this circularity is not apparent to those who define stress in terms of response.

3. A COMBINED DEFINITION?

Although in practice it seems to be impossible for us to define stress without invoking both stimulus and response, one would have imagined that an *explicit* definition of stress in terms of a *combination* of stimulus and response would have been so obviously circular in its reasoning that it would never have got off the ground. However, in trying to make sense of the fundamentally nonsensical concept of stress several authors have fallen into this very trap. For example, noting that a given 'life event' (such as divorce or bereavement) will have a variable subjective impact on different people, Edwards and Cooper concluded that therefore the same life event could produce a different quantity of stress (2). It follows that the individual's subjective appraisal of the significance of a stress becomes a 'crucial intervening variable' between the stimulus and response. In other words we have a life event defined in terms of its effect, a variable 'objective' response to this 'stressful' stimulus, and a subjective response which explains any difference between the two. This scheme explains nothing by explaining everything. So, although we can (not surprisingly) make neat circular definitions about stress being the characteristic response to a subjectively felt stressful stimulus (and if there is no response, then the stimulus was obviously not stressful), we are justified in discarding such word games without further consideration.

Wherever we look in the vast literature on stress we find this circularity. A stress is something which produces a stress response; the stress response is what is produced by a stress. And each rotation of the circle can draw more material into this black hole of a concept until its mass becomes immense and 'stress' threatens to swallow 'life, the universe and everything'!

If not 'stress', then what?

In criticising the word 'stress' it is important to say something about what I would put in its place. I am not saying that the things that we at present call stressful are actually insignificant: the 'stresses' of life are not affected by what we may or may not call them. What I am saying is that there is no reason to call all these 'essentially dissimilar problems' by a single name.

When Selye stated that 'there cannot be *different types of stress*' he was actually off target by one hundred and eighty degrees. There can *only* be different kinds of stress if it is to be a coherent (never mind scientific) concept. And if we acknowledge that there are different kinds of stress, then we do not need the word. Instead we simply describe, as precisely as we can, the nature of a stimulus and the response it evokes. Or else we describe a precise response and the (diverse?) mechanisms by which it is elicited. And we describe them one at a time and we do not mix them up.

To say that an observation is an example of the 'non-specific stress' response is to say that we do not know what causes it. To say that a stimulus is a 'stress' is to say that we cannot understand how it has its effect. Sometimes, it may be to say that we are not even interested in finding-out.

In using the word stress we have put a stop to further thought and investigation. When stress is allowed validity it is a guarantee that the discussion will proceed at such a level of generality that nothing specific can be said, no science can be done, no conclusions can be drawn. The circularity of its definition will inevitably confuse rather than clarify.

Clinical aspects

The word 'stress' is used mostly in the realms of psychiatric and psychosomatic illness, and it is here that its demise would be most keenly mourned. But even in the most modest clinical usage there is considerable potential for confusion: confusion perhaps of the doctor but more likely of the patient. Stress as a stimulus is often linked with development of minor psychological illness or distress, and even as the precipitant (if not a cause) of major psychosis. So that excessive busy-ness at work, the uncertainties of moving house or the desolation of bereavement may all be associated with the development of illness.

On the other hand 'stress' is also used to describe a response, a subjective feeling, a symptom which may or may not be connected to some change in personal situation; 'I don't know why, doctor, but I've been feeling stressful lately'.

So there are these two clinical situations corresponding to stress as stimulus or as response: to objective life-event or subjective emotion: to cause or effect. Thus there is a rich source of clinical confusion – leaving aside the possible additional factor of the patient equating these clinical meanings of stress with the many other usages described above. If the doctor ascribes a patient's dis-ease to 'stress' does s/he mean the environment or the organism is at fault, or both? Each might have different consequences for action.

To circumvent this ambiguity I propose that we stop using the word 'stress' in clinical practice, and instead replace it with the two near-synonyms of 'pressure' and 'tension': Pressure to mean the external forces acting to provoke illness – pressure as the cause: tension to mean the internal symptom of unpleasant hyper-arousal – tension as the effect. By doing this the doctor will clarify his or her own thoughts on cause and effect, while reducing the likelihood of unintended confusion on the side of the patient.

To conclude: 'stress' usually functions as a synonym for the unknown and a euphemism for ignorance. There is no compelling reason for us to use the word and many reasons why we should not. Essentially dissimilar things need essentially dissimilar names.

Acknowledgement

Thanks are due to Professor Robin Downie of Glasgow

University for valuable criticism of the manuscript.

Bruce G Charlton, MD, MA, has written a doctoral thesis and numerous articles on cortisol (the 'stress' hormone par excellence), and its control mechanisms, especially as this relates to psychiatric illness. He also has a postgraduate degree in English Literature.

References

- (1) Selye H. *Stress in health and disease*. London: Butterworth, 1976.
- (2) Edwards J R, Cooper C L. Research in stress, coping and health: theoretical and methodological issues. *Psychological medicine* 1988; 18: 15–20.

News and notes

Health Economics

A new journal, *Health Economics*, edited by Professor Alan Maynard and John Hutton, both of the Centre for Health Economics at the University of York, will publish articles on all aspects of health economics: theoretical contributions, empirical studies, economic evaluations and analyses of health policy from the economic perspective. Its scope will include the determinants of health and its definition and valuation, as well as the demand for and supply of health care; planning and market mechanisms for achieving equilibrium; micro-economic evaluation of individual procedures and treatments; and evaluation of the performance of health-

care systems in terms of equity and allocative efficiency.

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