'How Stress Gets Under Your Skin: Psychobiological Studies of Social Status, Stress and Health'

Prof Andrew Steptoe, British Heart Foundation Professor of Psychology, University College, London.

Overview:
This lecture (the first in the second seminar series) explored the relationships between psychology, biology, physiology and socio-economic status. Prof Steptoe shared many interesting insights concerning health and health inequality, developed by the emerging field of psychobiology.

Key Ideas:
- Psychosocial factors such as chronic life stresses, social environments and psychological factors may impact positively or adversely on health.
- Psychobiological processes such as neuroendocrine, cardiovascular, autonomic, immunological and other responses act as pathways through which biological changes occur related to external stresses, behaviours etc.
- Psychobiological responses to everyday stressors affect health outcomes, with small biological responses to stress having a cumulative impact over the years of a person's life.

Summary:
In introducing his lecture, Prof Steptoe suggested that it is necessary to locate the psychobiological factors he would speak of in a framework which related them to cultural, social, material and genetic factors.

The lecture began by highlighting the inverse association between socio-economic status and premature mortality. In addition to the established role of 'conventional' risk factors, such as smoking and physical inactivity, he suggested three types of psychosocial explanations for this:
Chronic life stresses which come from high demand/low control situations, effort/ reward imbalances within and outside the work setting, financial stress, marital conflict and the responsibility for caring for others.
Social environments which involve social isolation, do not offer emotional support and have low social cohesion.
Psychological factors such as depression, anger, hostility, anxiety and distress.

These points were illustrated with research examples which showed inverse relationships between incidence of coronary heart disease and social support; marital conflict and metabolic syndrome; and effort/reward imbalances at work and cardiac mortality.

Prof Steptoe went on to suggest that the mechanisms linking psychosocial factors and illness comprise behavioural processes (e.g. smoking, food choice, physical exercise, alcohol consumption, etc) and psychobiological processes such as:

- **Neuroendocrine** responses, involving production of cortisol, adrenaline, testosterone and noradrenaline. These can have potentially damaging effects if stimulated excessively. For example, high levels of cortisol are associated with increased lipid (LDL cholesterol) in the blood, suppression of immune function and decalcification of bone.
- **Cardiovascular** responses, with increases in blood pressure and heart rate.
- **Inflammatory** responses, producing substances associated with heart disease, type II diabetes, obesity, depression and disability.
- **Metabolic** responses, associated with type II diabetes.
- **Haemostatic** processes, involved in blood clotting, important for example in cardiac events.
- Impairment of **immune** responses, which are important in combating disease.

While such responses were developed as part of 'fight or flight' survival responses in the past, they are now elicited in conditions of everyday life in situations for which they are not appropriate. In addition, there is evidence to suggest that some groups of people demonstrate heightened responses and a longer delay before response levels return to normal.

From clinical studies and more naturalistic monitoring studies in everyday lives, a number of conclusions can be drawn about the relationships between psychobiological process, inequality and health.

People in different socio-economic groups demonstrate different biological processes relevant to cardiovascular risk. This was highlighted by a study of civil servants from higher, intermediate and lower occupational grades (the Whitehall Study) which suggested that biological responses to stress varied inversely with status. For example, while the initial blood pressure increase to stress was similar in all three groups, the blood pressure of the lower status group took longer to return to normal than other groups. This incomplete recovery could be an important biological process in populations experiencing chronic levels of stress, from which they do not have time to recover before the next stressor comes along.
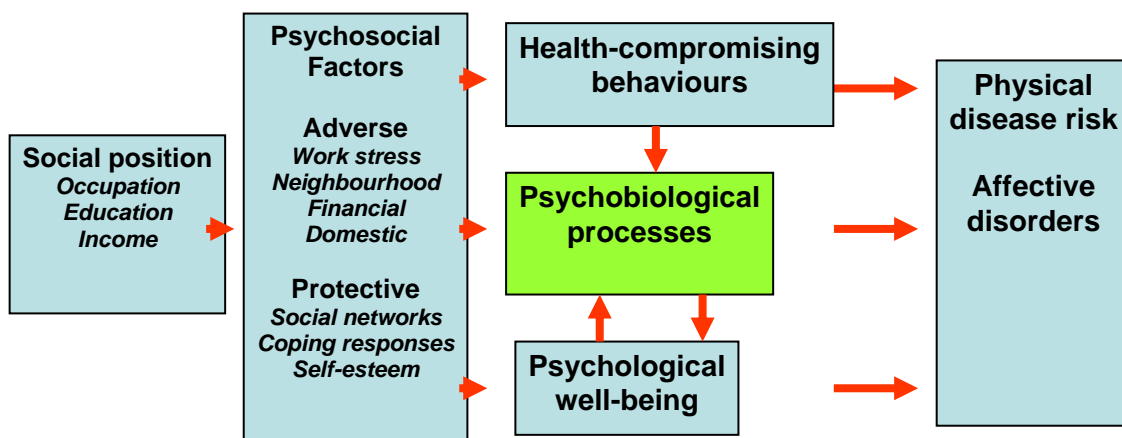
Those with low control over their situation experience stronger biological responses to stress than those with more control. In the same civil service cohort as that described above, those with low job control experienced higher levels of blood pressure throughout the working day, and had higher levels of cortisol, than those with high job control. Those of lower socio-economic status were also observed to have a higher cortisol increase on waking than those of higher socio-economic status. This response was stronger on working days than at the weekend and stronger for women than men.

There is a high level of association between self reported happiness and biological markers, and this is consistent across time. Again, among the civil service cohort, an inverse relationship between self reported happiness and levels of cortisol in the blood was observed. There was also an inverse relationship between blood pressure and happiness. These associations were observed again in the same group at a three-year follow up.

Individuals with stronger biological response to stress show more rapid progression of disease risk than those with a weaker response. Cholesterol, for example, was shown to increase in acute stress situations. A three-year follow up showed that those who exhibited stronger stress responses in the initial study were exhibiting more elevated levels of cholesterol at follow up, suggesting that repeated stress responses were driving cholesterol levels up in the most stress responsive. In a similar timeframe, it was shown that those whose blood pressure recovery was slower following stress were at higher risk of metabolic syndrome, indicators for which include high cholesterol, high blood pressure, high levels of blood glucose and larger waist circumferences.

These effects are small, cumulative and multiple but over time are significant. Acute and chronic responses are intertwined. Thus, while each one of these effects on its own is not acutely pathological, their cumulative effect is. The analogy which Prof Steptoe used was that whilst smoking one cigarette does not have a disease effect, smoking one cigarette several times every day over a number of years does produce a disease effect. The accumulation of small events adds up to more than the sum of their parts.

In concluding, Prof Steptoe suggested that this work was too much in its infancy to be conclusive in describing health pathways and outcomes. Acknowledging contributions of his colleagues, he offered the model below as way of understanding the interrelationships between social position, psychosocial factors, behaviours, psychological well-being and psychobiological processes and disease risk.