Chronic stress, often defined as repeated or constant exposure to psychological stressors, can significantly impact an individual’s mental and physical health. Research has linked chronic stress with increased symptoms of fatigue, cognitive dysfunction, and pain as well as higher incidence of diseases and disorders such as heart disease, stroke, and depression. Both behavioral pathways, such as poor sleep hygiene and eating habits, and underlying changes to biological processes help explain the connection between chronic stress and negative health outcomes. Some of the biological processes thought to contribute to the stress-health association include dysfunction of the hypothalamic-pituitary-adrenal (HPA) axis, alterations to immune and inflammatory pathways, and impaired adult neurogenesis. Given increased interest in understanding the connections between stress and health, many researchers are now collecting biological samples that can be assayed to provide measures of stress-related alterations to these biological processes. The purpose of the present paper is to provide a scoping review of the literature on minimally-invasive biological indicators of systems that increase in response to chronic stress, in an attempt to catalyze research in this area.

Minimally-invasive methods can be used to collect a variety of biological indicators and offer the opportunity to capture biological measures while creating less participant burden and fewer health risks than using more invasive or costly measures. Additionally, some vulnerable populations can be difficult to engage in studies and these methods may allow researchers to reach them more successfully. While the concept of “minimally-invasive” has not been clearly operationalized in the literature, or the purpose of this paper, a “minimally-invasive” method is defined as a measurement of a biological indicator that can be collected outside of the clinical setting with a low risk of mortality or complications. For example, a single puncture blood draw would be considered minimally-invasive, but intravenous catheter placement would not be due to the risk of infection from the extended placement of the catheter and the need for highly-trained clinical personnel to place the line and monitor participant responses.

As nurse researchers move forward with the use of minimally-invasive methods to investigate biological alterations in the face of chronic stress, they should be aware of which biological indicators have been recommended as common data elements to the National Institute of Nursing Research (NINR) at the National Institutes of Health. Common data elements are expected to be collected across studies in order to increase ease of combining data from those different studies; in doing so, nurse researchers worldwide will have access to publicly-available datasets with these indicators. In a position paper published by the Directors of NINR Centers of Excellence and Exploratory Centers, the authors identified hormones of the HPA axis (e.g., cortisol), immune and inflammatory markers (e.g., pro- and anti-inflammatory cytokines), and other biomarkers of interest (e.g., brain-derived neurotrophic factor) as recommended biomarkers to collect. All three categories are biological processes related to the experience of chronic stress and thus were used to guide this review.
Title:
Minimally-Invasive Methods of Examining Biological Changes in Response to Chronic Stress: A Scoping Review

Keywords:
Chronic stress, Cortisol and HPA Axis

References:

Neuroimaging


**Abstract Summary:**

Nurse researchers are increasingly interested in the biological effects of chronic stress. Using minimally invasive methods to collect biological indicators may improve research access to vulnerable populations. This review maps the indicators being measured through minimally invasive methods to investigate a variety of biological changes in response to chronic stress.

**Content Outline:**

**Background:** Chronic stress can negatively impact health, and nurse researchers are increasingly interested in incorporating biological indicators of altered processes. Using minimally invasive methods to collect biological indicators may improve access to vulnerable populations such as children or individuals with lower socioeconomic status.

**Objective:** To map the biological indicators being measured through minimally invasive methods to investigate a variety of biological changes in response to chronic stress.

**Design, data sources, and methods:** A systematic scoping review was completed following the guidelines of the Joanna Briggs Institute Manual. A literature search was completed in PubMed, PsycINFO, and Scopus; 671 articles were screened by multiple authors. 77 studies were included and data were extracted using a standardized extraction tool before being compiled into a single spreadsheet and coded for relevant findings.

**Results:** Studies conducted in 15 countries worldwide between 1998 and the present and included measures of the hypothalamic adrenal pituitary axis (N=69), immune and inflammatory markers (N=16), and adult neurogenesis (N=1). Of all biological indicators included, cortisol was most frequently measured (N=82) and was usually measured in saliva (N=62). The most common limitations listed across the measures were potential for interference by certain prescription medications, female menstrual cycle stage, and the time of sample collection.

**Conclusions:** Nurse researchers have access to minimally-invasive methods to measure altered biological processes related to chronic stress. Most of the limitations of these methods can be accounted for through study design. Nurse researchers should incorporate these biological indicators into their studies when possible, especially in light of the recent call for their use as common data elements.

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