ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26jan390

Climate-Adjusted Biosensing for Hypertension Prevention: A Conceptual Framework for a Multimodal Sweat-Sodium, Thermoregulation, and Heart-Rate Patch

Sean Somersall-Weekes[1]

[1]Strategic Transformation Architect & Behavioural Insight Specialist Tadley, Hampshire, UK

[1]ORCID: 0009-0002-0651-8639

Publication Date: 2026/01/17

Abstract: Building on prior conceptual work linking migration from hot to cooler climates with increased sodium retention and hypertension risk (Somersall-Weekes, 2025), this paper proposes a novel technological framework for empirical validation: a multimodal wearable patch capable of measuring sweat sodium concentration, sweat rate, skin temperature, ambient temperature, and heart rate. Recent physiological research demonstrates that sweat sodium concentration varies significantly with environmental temperature, heat acclimatisation, and individual characteristics (Baker et al., 2022), reinforcing the need for climate-aware biosensing. The proposed device, termed the *Thermoregulatory Sodium Assessment Patch (ThermaPatch)*, integrates thermoregulatory and autonomic cardiovascular biomarkers to generate climate-adjusted hypertension risk insights. This paper outlines the physiological rationale, biosensing architecture, data-integration model, and public health implications. By combining climate physiology, sodium metabolism, and heart-rate monitoring, the framework advances a new direction in equitable hypertension prevention for migrant and multi-ethnic populations.

How to Cite: Sean Somersall-Weekes (2026) Climate-Adjusted Biosensing for Hypertension Prevention: A Conceptual Framework for a Multimodal Sweat-Sodium, Thermoregulation, and Heart-Rate Patch. *International Journal of Innovative Science and Research Technology*, 11(1), 895-897. https://doi.org/10.38124/ijisrt/26jan390

I. INTRODUCTION

Hypertension disproportionately affects individuals of African, Caribbean, and South Asian descent, with salt sensitivity and environmental adaptation playing key roles in risk variation. Recent conceptual work has proposed that migration from hot to cooler climates may reduce sweat-mediated sodium excretion, increasing sodium retention and elevating blood pressure among salt-sensitive individuals (Somersall-Weekes, 2025).

Physiological evidence supports this mechanism. Sweat sodium concentration and sweat rate vary widely across individuals and are strongly influenced by environmental temperature, heat acclimatisation, and exercise intensity (Baker et al., 2022). Individuals accustomed to hot climates typically exhibit higher sweat output and lower sweat sodium concentration due to acclimatisation. Migration to cooler climates disrupts this thermoregulatory pattern, potentially increasing sodium retention.

However, sodium retention is only one component of the broader physiological response. Salt-sensitive individuals also exhibit heightened sympathetic nervous system activation, reflected in elevated resting heart rate and reduced heart-rate variability. Integrating heart-rate measurement into a biosensing system therefore provides a more complete picture of the climate–migration–physiology interaction.

This paper proposes a conceptual design for a multimodal patch capable of capturing these variables to empirically test the climate–sodium hypothesis and support personalised hypertension prevention.

II. RATIONALE FOR A MULTIMODAL SWEAT–SODIUM AND HEART-RATE PATCH

➢ *Physiological Basis*

The proposed device captures five key physiological and environmental variables:

- Sweat sodium concentration, a direct indicator of sodium excretion efficiency
- Sweat rate, a proxy for thermoregulatory activation
- Skin temperature, reflecting heat-dissipation demand
- Ambient temperature, contextualising sweat output
- Heart rate, indicating autonomic cardiovascular load

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26jan390

Baker et al. (2022) demonstrate that sweat sodium concentration varies significantly with:

- Environmental temperature
- Heat acclimatisation
- Exercise intensity
- Individual physiological characteristics

These findings reinforce the hypothesis that climate change, or climate displacement through migration, may alter sodium excretion patterns.

Heart-rate monitoring adds an essential dimension:

- Salt-sensitive individuals often show elevated resting heart rate.
- Sympathetic activation increases both heart rate and blood pressure.
- Heart rate helps distinguish thermoregulatory sweating from exertion-driven sweating.

➢ *Measurement Gap*

Current hypertension screening tools do not incorporate:

- Sweat sodium
- Sweat rate
- Climate exposure
- Migration history
- Autonomic cardiovascular markers

A multimodal patch would fill this gap and enable empirical testing of the climate–migration–sodium hypothesis.

III. DEVICE CONCEPT: THE THERMAPATCH SYSTEM

➢ *Core Sensing Modalities*

- Sweat Sodium Sensor Ion-selective electrode or microfluidic conductivity sensor.
- Sweat Rate Sensor Microfluidic channel with optical or impedance-based flow detection.
- Skin Temperature Sensor Thermistor or infrared micro-sensor.
- Ambient Temperature Sensor Measures environmental conditions influencing sweat output.
- Heart-Rate Sensor (PPG) Photoplethysmography module to measure:

✓ Resting heart rate
✓ Heart-rate variability (HRV)
✓ Sympathetic activation patterns

➢ *Data Integration Model*

The system calculates:

$$\text{Estimated Sodium Loss} = \text{Sweat Rate} \times \text{Sweat Sodium Concentration}$$

- *And Integrates:*

✓ Heart-rate trends
✓ Climate exposure
✓ Migration origin climate
✓ Ethnicity-linked salt sensitivity
✓ Behavioural patterns

This produces a Climate-Adjusted Sodium and Autonomic Risk Index (CASARI).

IV. METHODOLOGICAL FRAMEWORK

➢ *Study Populations*

As previously described (Somersall-Weekes, 2025), the focus is on:

- African, Caribbean, and South Asian migrants
- First- to third-generation individuals
- Living in cooler climates

➢ *Proposed Study Designs*

- Cross-sectional pilot
- Pre-/post-migration longitudinal study
- Climate-exposure trials
- Behavioural intervention trials

Heart-rate data enables additional analyses of autonomic stress and salt sensitivity.

V. PUBLIC HEALTH IMPLICATIONS

➢ *The Integration of Heart Rate Strengthens the System's Ability to:*

- Detect early autonomic dysregulation
- Personalise salt-reduction strategies
- Refine climate-adjusted screening thresholds
- Support migrant-focused health equity initiatives

This aligns with global priorities around climate adaptation, precision prevention, and cardiovascular equity.

VI. LIMITATIONS

➢ Prototype hardware not yet developed
➢ Need for laboratory validation of PPG accuracy on adhesive patches
➢ Variability in sweat production and autonomic responses

VII. CONCLUSION

This paper extends earlier conceptual work (Somersall-Weekes, 2025) by proposing a multimodal biosensing patch that integrates sweat sodium, thermoregulation metrics, and heart-rate monitoring. Supported by physiological evidence demonstrating climate-linked variation in sweat sodium concentration (Baker et al., 2022), the system offers a pathway toward

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26jan390

empirical validation of the climate–migration–sodium hypothesis and supports personalised hypertension prevention for salt-sensitive migrant populations.

DECLARATIONS

- *Ethics Approval and Consent to Participate*

Not applicable. This study is a conceptual analysis and did not involve human participants, personal data, or biological material.

- *Consent for Publication*

Not applicable.

- *Availability of Data and Materials*

No datasets were generated or analysed during the current study. All referenced materials are publicly available and cited appropriately.

- *Competing Interests*

The author declares no competing interests.

- *Funding*

No external funding was received for this study.

- *Authors' Contributions*

Sean Somersall-Weekes conceived the hypothesis, developed the concept and drafted the manuscript. The author read and approved the final manuscript.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the contributions of colleagues encouraging me to progress this very important topic.

REFERENCES

[1]. Baker, L.B. et al. (2022) 'Explaining variation in sweat sodium concentration: effect of individual characteristics and exercise, environmental, and dietary factors', *Journal of Applied Physiology*, 133(5), pp. 1250–1259. doi:10.1152/japplphysiol.00391.2022.

[2]. Somersall-Weekes, S. (2025) *Climate, migration, and sodium sensitivity: A systems-level hypothesis for hypertension risk in migrant populations.* International Journal of Innovative Science and Research Technology, 10(9), pp. 2201–2203.