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**Interoception:  
A self-regulatory mechanism for  
self-management**

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*Emerging Nurse Researcher Award 2019*  
Latin America and Caribbean Region  
Sigma's 30th International Nursing Research Congress  
Calgary, Alberta, Canadá

# Costa Rica



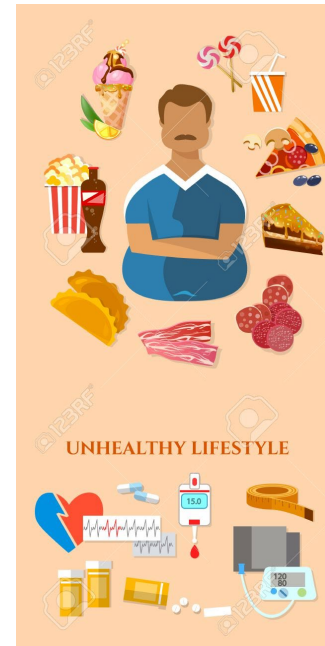
- Population: 5 million
- Life expectancy: 80y (82w, 77m)  
(USA 78y)
- Health investment: 8.1% GDP  
(WHO, 2015) (USA 16.8%, Canada 10.4%)
- Middle income country
- Public health care system (40's):  
Good health indicators



# My research journey



# Research Idea





# Body Awareness



**Exteroception**

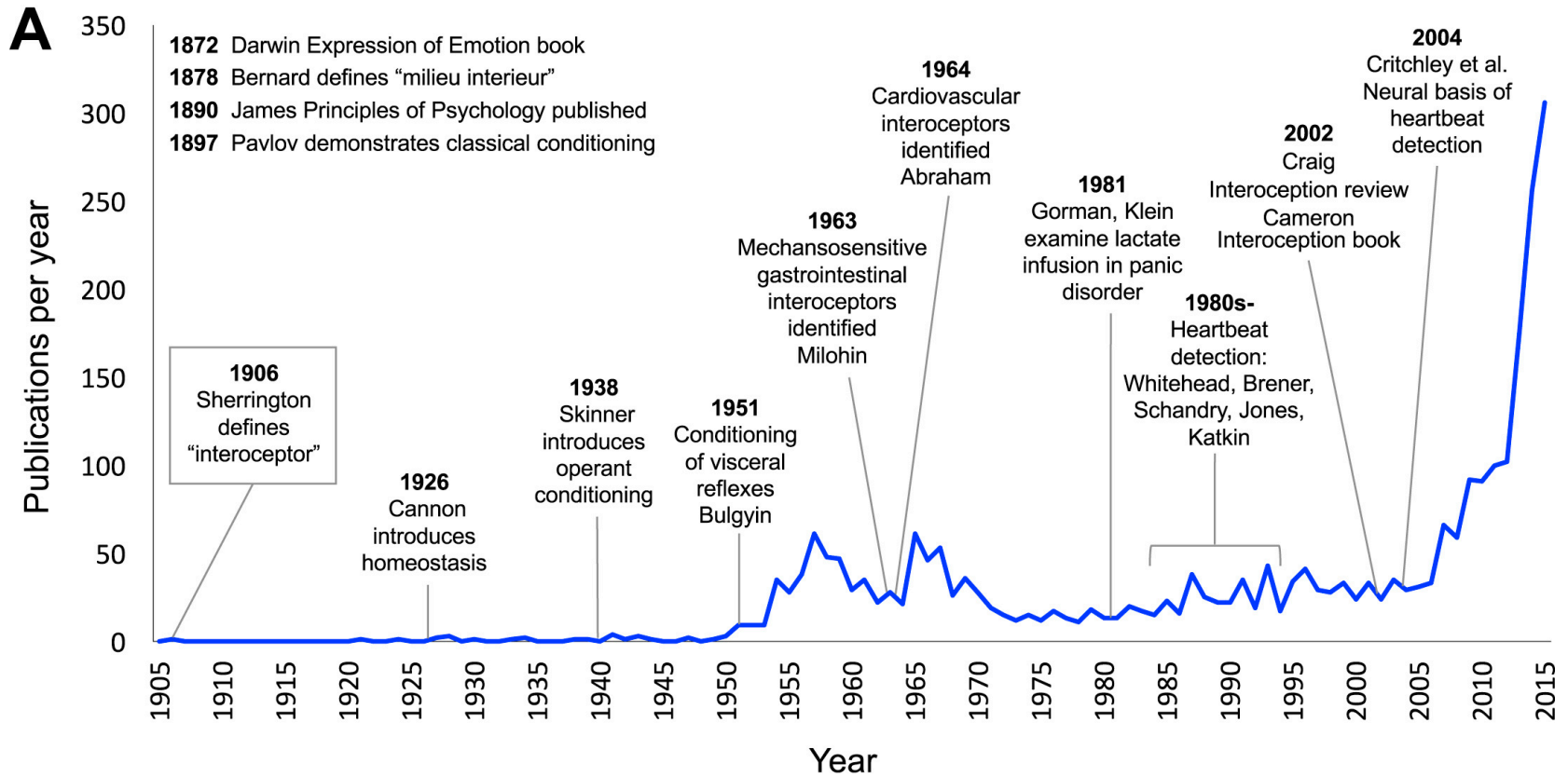


**Proprioception**



**Interoception**





Khalsa, S. S., Adolphs, R., Cameron, O. G., Critchley, H. D., Davenport, P. W., Feinstein, J. S., ... & Meuret, A. E. (2018). Interoception and mental health: a roadmap. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, 3(6), 501-513.



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# **The relationships among body awareness, self-regulation, self-management, and blood pressure in adults with hypertension**

Doctoral Dissertation



# Background

## Hypertension Self-Management

- Hypertension can be prevented, modified, and controlled, however, many patients have difficulty managing this condition
- Hypertension treatment depends on patient self-management: *Medication adherence, diet adherence, and physical activity*

**A bio-behavioral model of self-management is needed to identify and understand underlying physiological mechanisms potentially influencing self-management**



# Background

## Self-regulation

- Process that helps individuals attempt to make behavioral changes and modulate thoughts, emotions, and behaviors to achieve goals (Bandura, 2005; Cameron & Leventhal, 2003; Ryan & Sawin, 2009; Yeom, Choi, Belyea, & Fleury, 2011).



# Background



## Decision-making

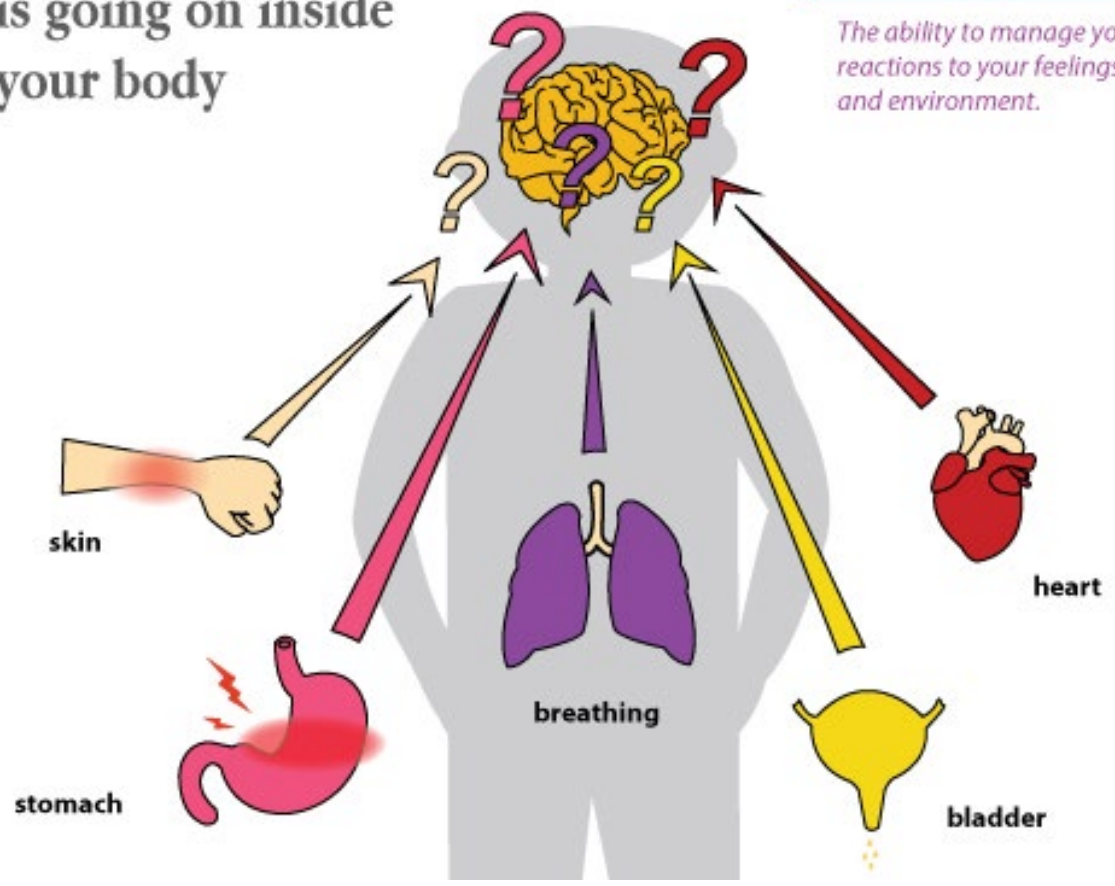
- Requires neurocognitive processes to appraise the individual status, goals, and environmental conditions, so they can regulate actions, thoughts, and emotions accordingly to maintain or bring a new homeostatic state (Paulus, 2007; Bandura, 2005)
- Paucity in decision-making research is noted in the individual's neurocognitive characteristics (Appelt, Milch, Handgraaf, & Weber, 2011; Mohammed & Schwall, 2009)

# INTEROCEPTION

*the 8th SENSE* that helps you *feel* what is going on inside your body

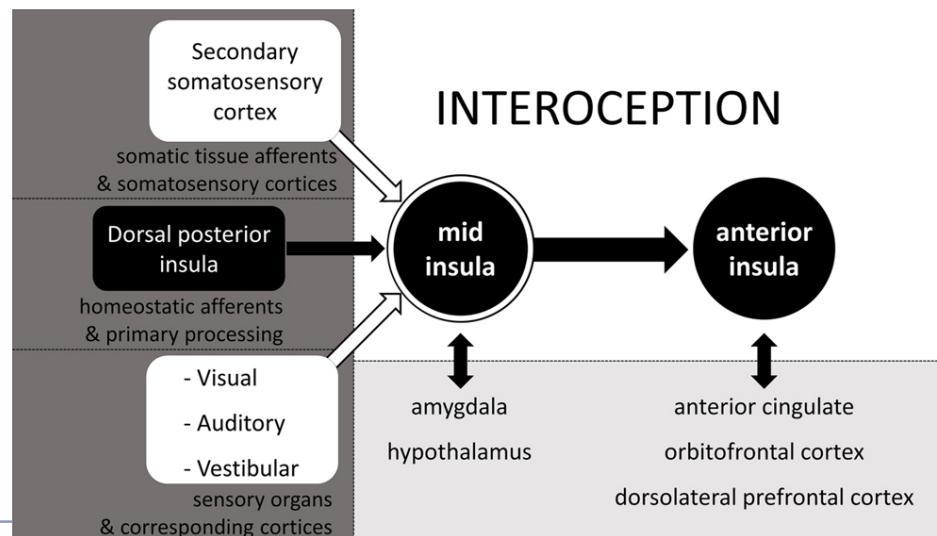
# Self-regulation

*The ability to manage your reactions to your feelings and environment.*



# Interoception

- The process by which the nervous system senses, interprets, and integrates signals originating from within the body, providing a moment-by-moment mapping of the body's internal landscape across conscious and unconscious levels. (Khalsa, et al., 2018).



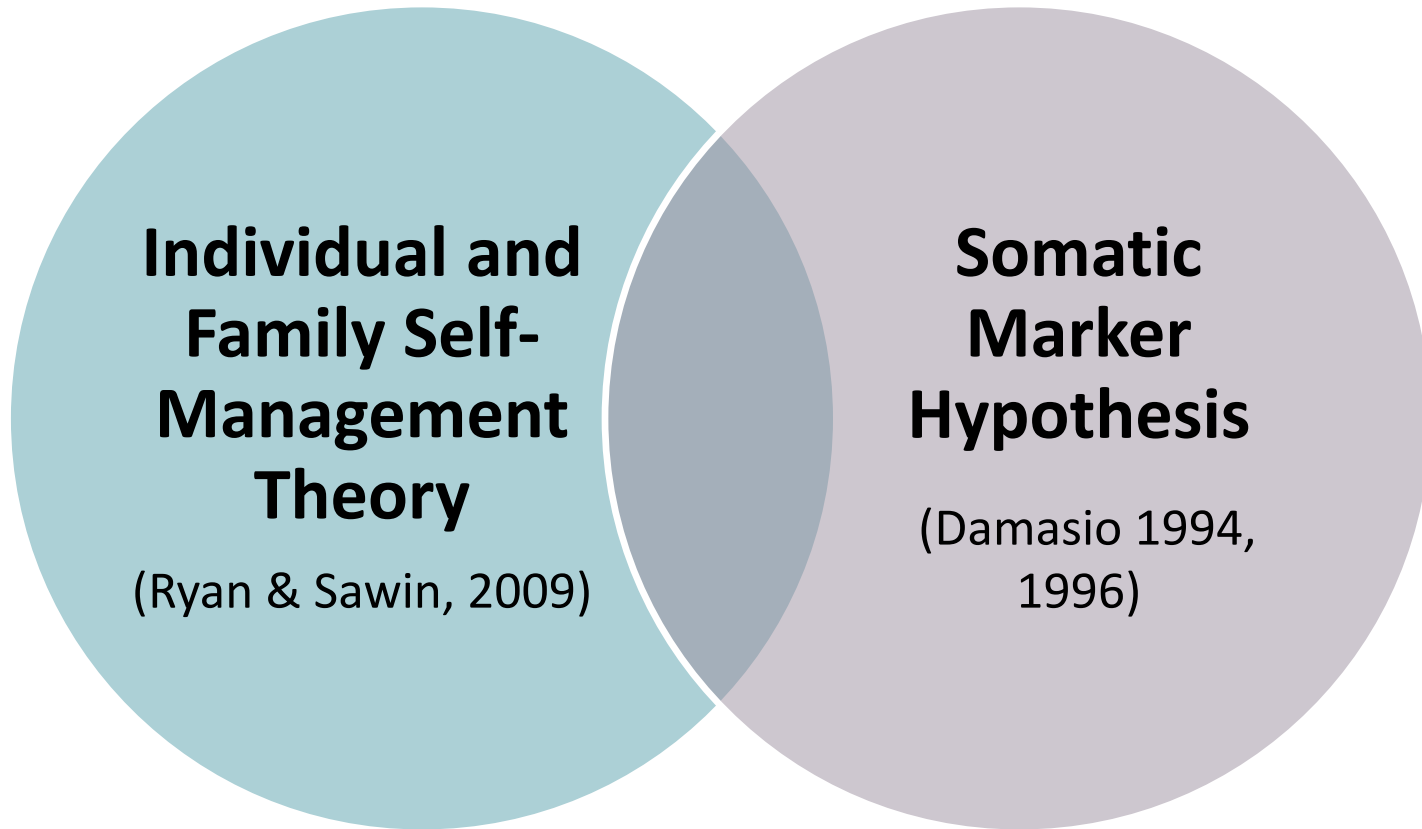
# Research Questions



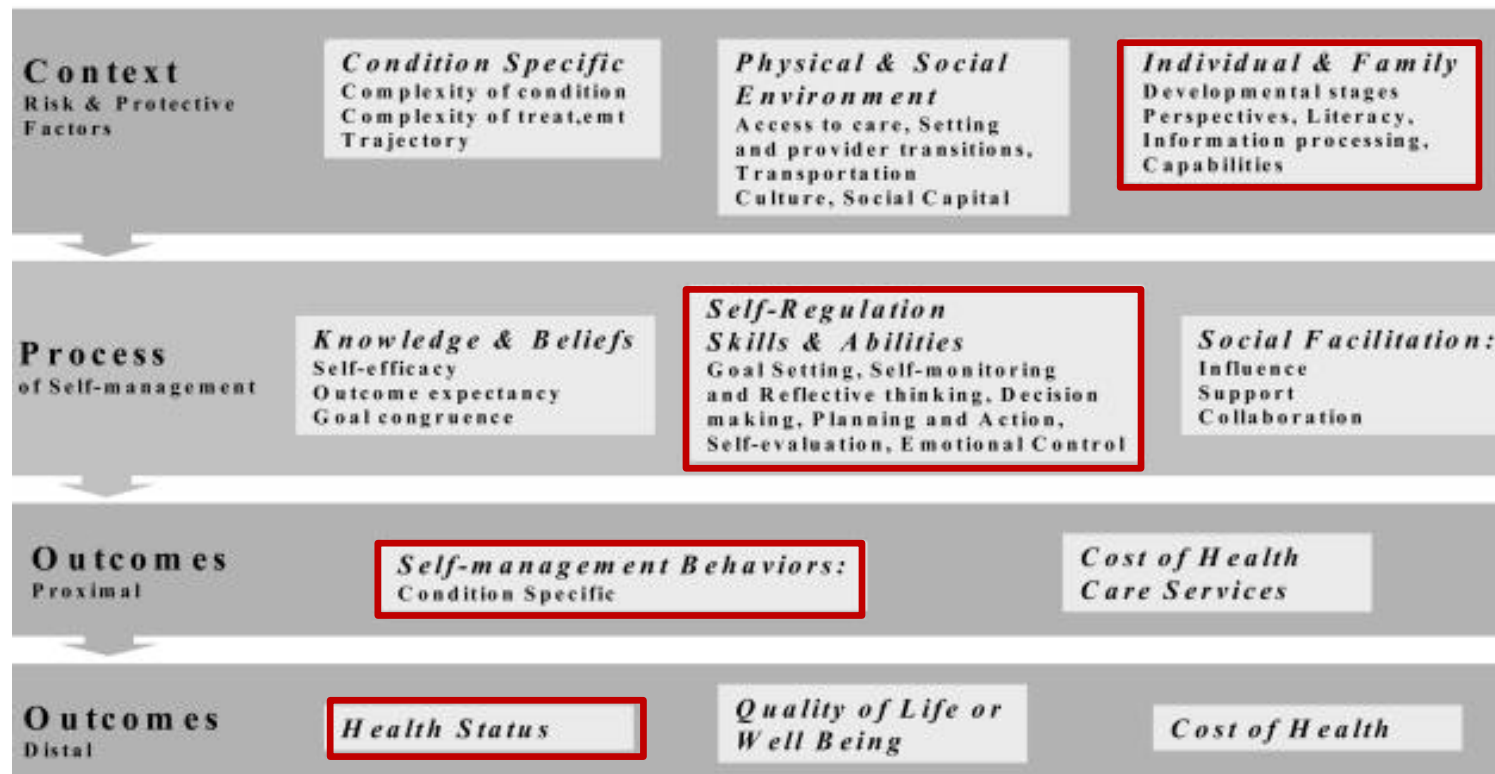
1. What are the relationships among interoceptive awareness, self-regulation (*decision-making ability, self-regulation skills*), self-management behaviors (*medication adherence, diet adherence, and physical activity*) and blood pressure?
2. Are these relationships moderated by age, sex, cognitive status, depressed mood, anxiety, hypertension knowledge, comorbidity, and complexity of medication regimen?

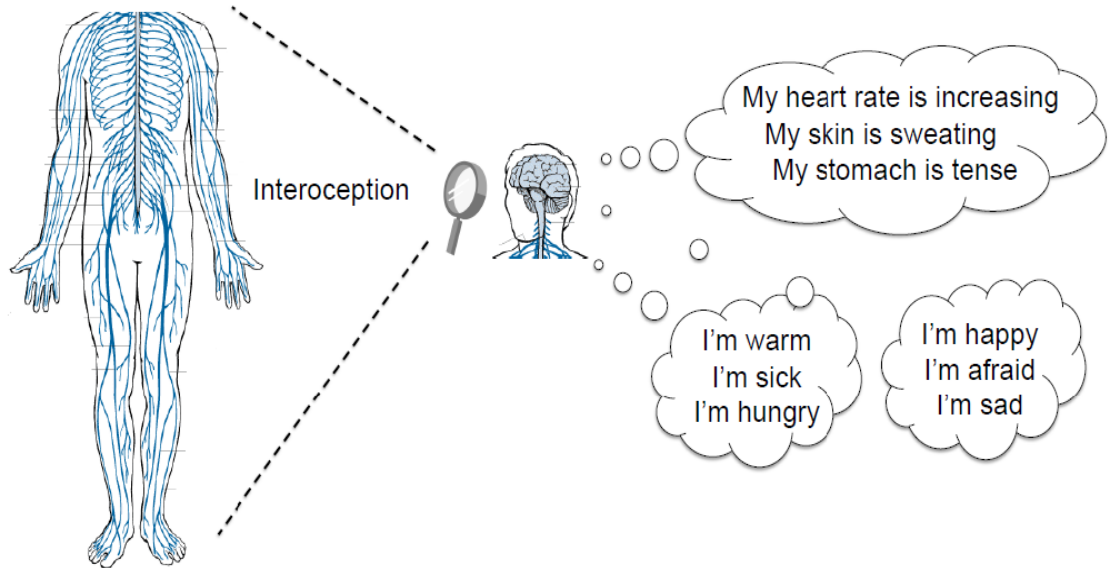
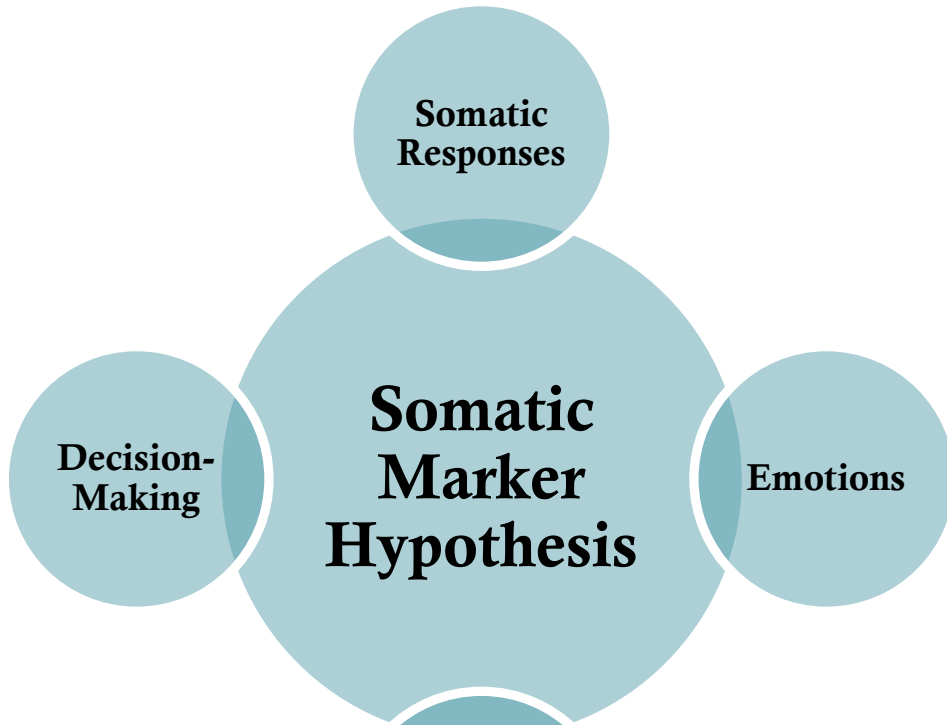


# Theories

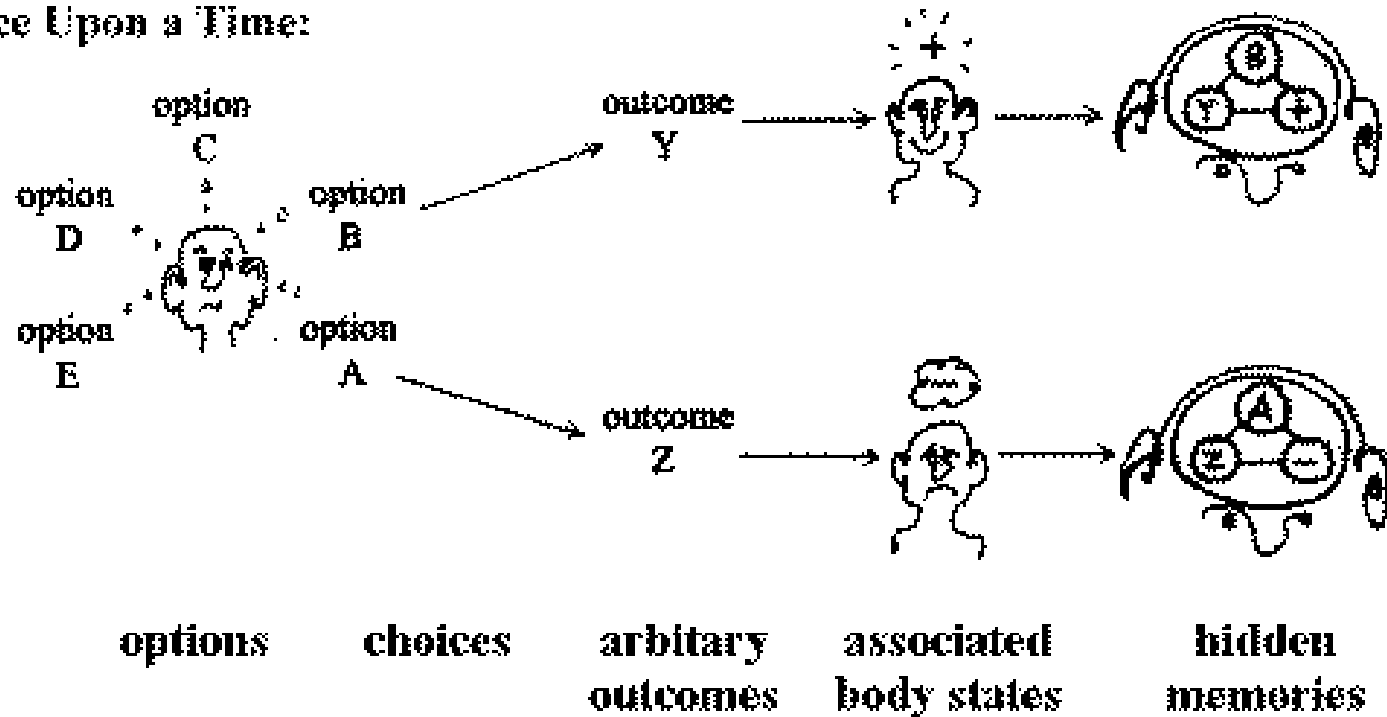


# Individual and Family Self-Management Theory (Ryan & Sawin, 2009)





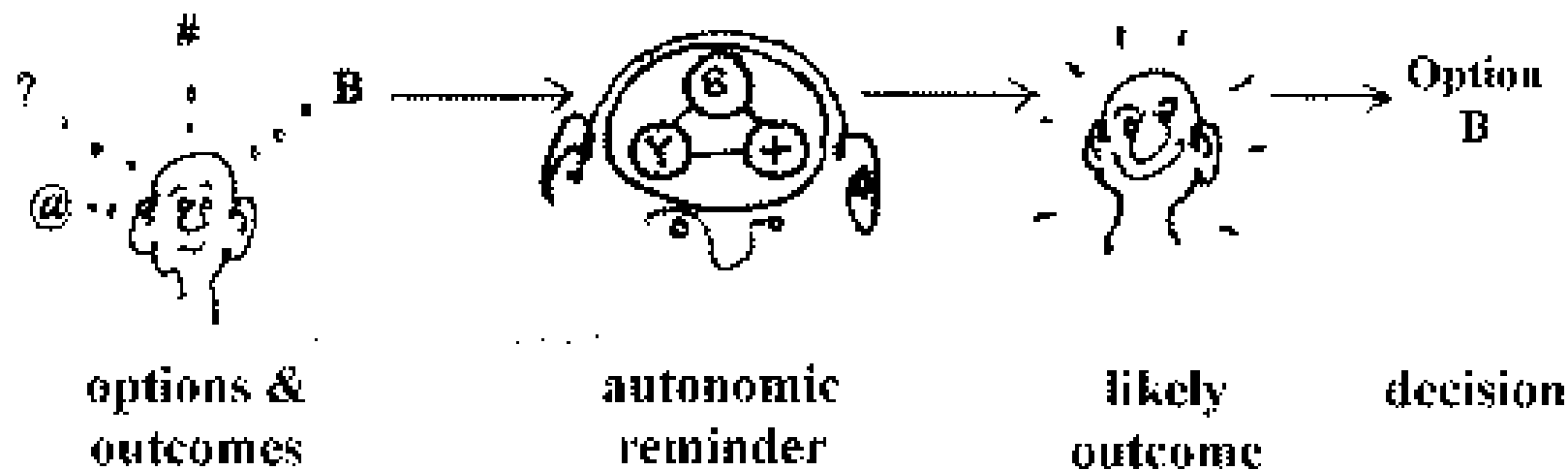
Once Upon a Time:



How personal intuitions are formed

Figure 2: Somatic Marker Maker

Some time later:



How personal intuitions are fulfilled

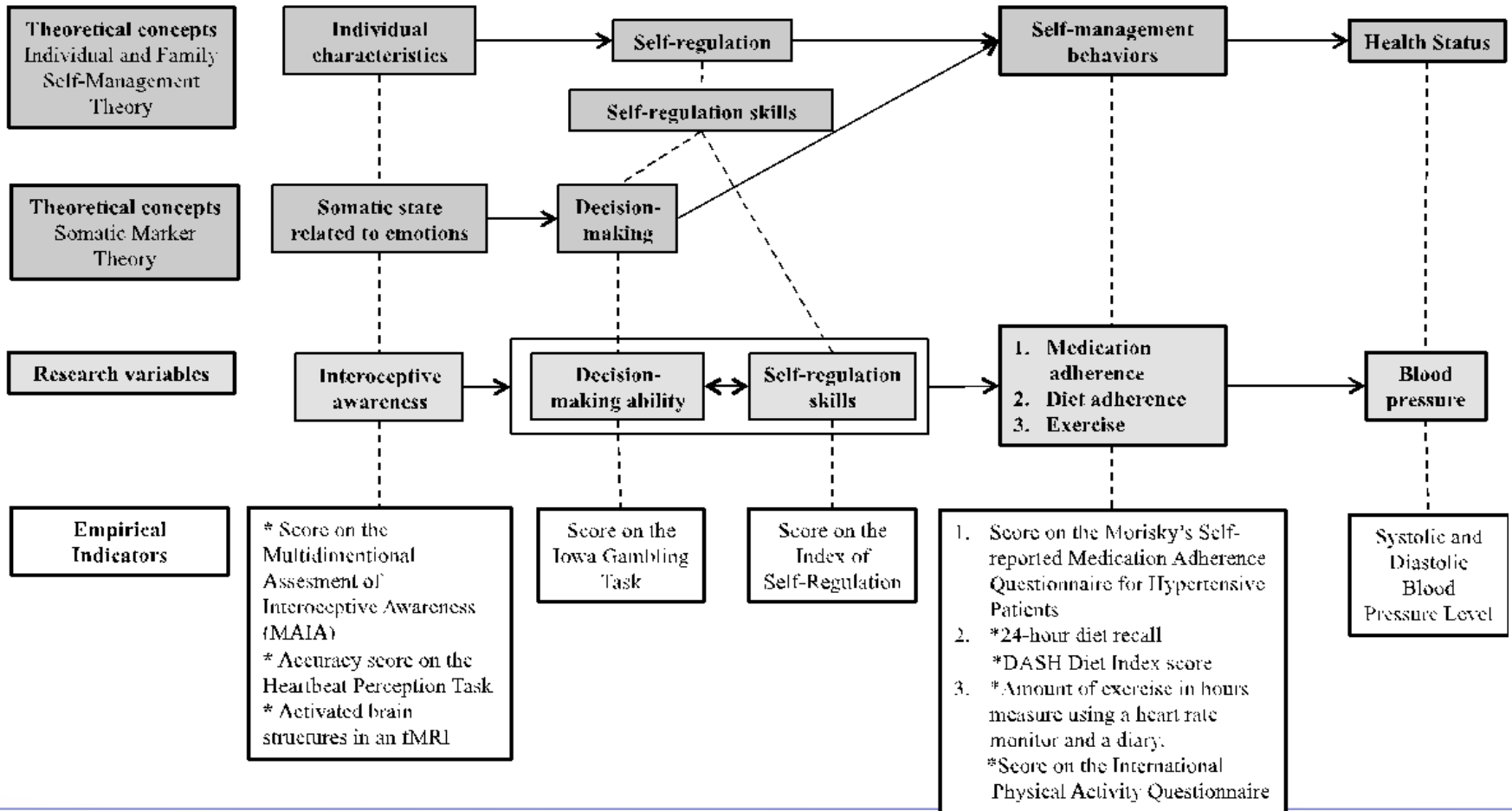
**Figure 3: Somatic Decision Maker**



# Substruction

## Covariates/Potential Moderators

- Age
- Gender
- Education
- Comorbidities
- Anxiety
- Depressive mood
- Hypertension knowledge
- Complexity of medication regimen



# Method



**Design:** Correlational cross-sectional

## Sample

- The final sample consisted of 76 participants:
  - Mean age 52 years old, predominantly female, African American, with 12 or less years of education and morbidly obese.
  - Mean of 9 active comorbidities and 7 medications to treat all their conditions.



# Sample



## Inclusion

- Adults from 18 to 75 years of age
- Diagnosis of primary hypertension, at least 6 months before the recruitment date
- Undergoing medical treatment (at least one prescribed antihypertension drug and lifestyle modifications identified on patient's medical record)
- Attend to a specific primary care clinic.

## Exclusion

- Inability to understand English or Spanish
- Documented cognitive impairment or prior stroke
- People with documented secondary causes of hypertension
- Other conditions that may reduce the ability to engage in physical activity (chronic kidney disease stages IV and V, heart failure stage III and IV, obvious musculoskeletal functional disabilities, use of an ambulatory assistive device (e.g. cane, walker), etc.)

<b>Variable</b>	<b>Measure</b>
<b>Interoceptive Awareness</b>	Heartbeat perception task (Schandry) and Multidimensional Assessment of Interoceptive Awareness Questionnaire (MAIA)
<b>Decision-Making Ability</b>	Iowa Gambling Task
<b>Self-Regulation Skills</b>	Index of Self-Regulation
<b>Medication Adherence</b>	Morisky's Medication Adherence Scale for people with hypertension
<b>Diet Adherence</b>	24-hour Diet Recall (ASA24) and DASH Diet Index
<b>Physical Activity</b>	International Physical Activity Questionnaire, Heart Rate Monitor (Polar RS400) and Exercise Diary
<b>Blood Bressure</b>	Electronic Blood Pressure Monitor, using guidelines from James et al. (2014)
<b>Age, Sex</b>	Self-report
<b>Cognitive Status</b>	Montreal Cognitive Assessment (MOCA)
<b>Depressed Mood</b>	PROMIS Depression
<b>Anxiety</b>	PROMIS Anxiety
<b>Complexity of Medication Regimen</b>	Medication Regimen Complexity Index
<b>Comorbidity Index</b>	Charlson's Comorbidity Index
<b>Hypertension Knowledge</b>	Blood Pressure Knowledge Scale



# Results of study questions



# RQ1

## Descriptive Statistics Main Variables

Main Variable/Measure	Mean	SD	Range	Possible score
<b>Interoceptive awareness</b>				
• MAIA* (n=76)	78.70	16.71	27-113	0-128
• Heartbeat Perception Task (n=74)	.48	.27	0-.95	0-1
<b>Decision-Making Ability</b>				
• Iowa Gambling Task (n=76)	.76	24.60	-60-86	
<b>Self-Regulation Skills</b>				
• Index of Self-Regulation (n=76)	27.62	5.76	3-36	0-36
<b>Self-Management Behaviors</b>				
<b>Medication adherence (MA)</b>				
• Morinsky's MA Scale (n=76)	4.37	2.29	0-8	0-8
<b>Diet</b>				
• DASH Diet Index (n=67)	3.26	1.54	.5-8	0-11
<b>Physical Activity (PA)</b>				
• International PA Questionnaire				
✓ Total Physical Activity (n=76) (METs-minutes/week)	7482.5	10044.16	0-44946	
✓ Sedentary activities (n=74) (hours/day)	6.48	4.3	.5-24	
<b>Blood Pressure</b>				
• Systolic Blood Pressure (n=76)	143.66	21.66	101.5-194	
• Diastolic Blood Pressure (n=76)	86.59	12.25	61.5-123.5	

# Descriptive statistics: Covariates

Covariate/Measure	Mean	SD	Range	Possible score
<b>Hypertension knowledge</b>				
• Blood Pressure Knowledge Scale (n=76)	32.50	5.86	6-40	0-40
<b>Anxiety</b>				
• PROMIS Anxiety (n=76)	4.04	3.85	0-15	0-16
<b>Depression</b>				
• PROMIS Depression (n=75)	3.40	3.93	0-16	0-16
<b>Cognitive Status</b>				
• MOCA test (n=74)	23	3.65	14-29	0-30
<b>Comorbidity Index</b>				
• Charlson's Comorbidity Index (n=76)	1.11	1.10	0-4	0-37
<b>Medication Regimen Complexity</b>				
• Medication Regimen Complexity Index (n=76)	17.07	12.39	2-51.5	

# Associations among main variables

Variables	1	2	3	4	5	6	7	8	9
<b>1. Interoceptive Awareness</b> (Self-Report Measure, MAIA)	1								
<b>2. Interoceptive Awareness</b> (Heartbeat Perception Task)	-.14	1							
<b>3. Decision-Making Ability</b>	-.09	-.01	1						
<b>4. Self-Regulation Skills</b>	<b>.49**</b>	-.02	-.02	1					
<b>5. Medication Adherence</b>	.18	-.08	.07	<b>.24*</b>	1				
<b>6. Diet Adherence</b>	.60	.03	<b>-.27*</b>	.60	.02	1			
<b>7. Physical Activity</b>	.13	.07	.15	.14	.12	.05	1		
<b>8. Systolic Blood Pressure</b>	.15	.23	-.14	.04	-.21	-.11	-.01	1	
<b>9. Diastolic Blood Pressure</b>	-.03	.01	.03	-.07	-.18	.02	.03	<b>.63**</b>	1

\*Significant at the 0.05 level (2-tailed)

\*\*Significant at the 0.01 level (2-tailed)

# Associations among main variables and covariates

	Age	Sex <sup>2</sup>	Depressed mood	Anxiety	Cognitive Status	Comorbidity Index	Medication Regimen Complexity	Hypertension Knowledge
<b>Interoceptive Awareness (Self-Report Measure, MAIA)</b>	.19	-.09	<b>-.25*</b>	<b>-.23*</b>	.13	.19	.14	<b>.26*</b>
<b>Interoceptive Awareness (HBPT)<sup>1</sup></b>	-.12	.12	.02	.17	.13	-.08	-.16	-.07
<b>Decision-Making Ability</b>	-.04	.22	-.10	-.12	.12	.08	.04	.13
<b>Self-Regulation Skills</b>	.19	-.09	<b>-.31**</b>	<b>-.27*</b>	.06	.15	.02	<b>.24*</b>
<b>Medication Adherence</b>	.13	-.13	<b>-.48**</b>	<b>-.37**</b>	.15	.15	.14	.12
<b>Diet Adherence</b>	.00	.03	.17	.23	-.07	-.20	-.07	-.02
<b>Physical activity</b>	-.19	<b>.28*</b>	-.11	.01	.06	-.13	-.17	.15
<b>Systolic Blood Pressure</b>	.17	.00	.07	.10	.17	.09	-.09	.03
<b>Diastolic Blood Pressure</b>	<b>-.29*</b>	-.05	.20	.22	.15	-.17	-.10	-.10

\*Significant at the 0.05 level (2-tailed)

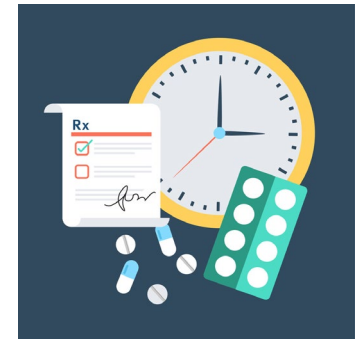
\*\*Significant at the 0.01 level (2-tailed)

<sup>1</sup> Heartbeat Perception Task

<sup>2</sup> Sex: 0=Women, 1= Men

# Independent variables as predictors of BP

- Medication adherence was the only significant predictor of systolic blood pressure, explaining 12% of the variance
- Regression with MAIA,  $F=2.61$ ,  $p<.05$ , with heartbeat perception task,  $F=2.34$ ,  $p<.05$
- For each point increase in medication adherence score, there was a reduction of 12 mmHg in systolic BP



# *Discussion*

## **Interoception**

- Heartbeat perception task and the self-reported measure (MAIA) were not related
- The self-reported measure (MAIA) was associated with self-regulation skills, depressed mood, and anxiety, the heartbeat perception task was not
- Possible explanation: Interoception has dimensions that may have distinct and dissociable contributions to affective behavior
  - Interoceptive Accuracy
  - Interoceptive Sensibility
  - Interoceptive Awareness
- **Other studies with similar findings** (Garfinkel, Seth, Barrett, Suzuki, & Critchley, 2015; Cali, Ambrosini, Picconi, Mehling, & Committeri, 2015).

**Table 2. Features of Interoceptive Awareness**

Feature	Definition
Attention	Observing internal body sensations
Detection	Presence or absence of conscious report
Magnitude	Perceived intensity
Discrimination	Localize sensation to a specific channel or organ system and differentiate it from other sensations
Accuracy (Sensitivity)	Correct and precise monitoring
Insight	Metacognitive evaluation of experience/ performance (e.g., confidence–accuracy correspondence)
Sensibility	Self-perceived tendency to focus on interoceptive stimuli (trait measure)
Self-report Scales	Psychometric assessment via questionnaire (state/trait measure)



# Race, Ethnicity and Culture

- Interoceptive differences
- Few studies have focused on these aspects
- Most research have been in white, young and healthy populations





# Significance

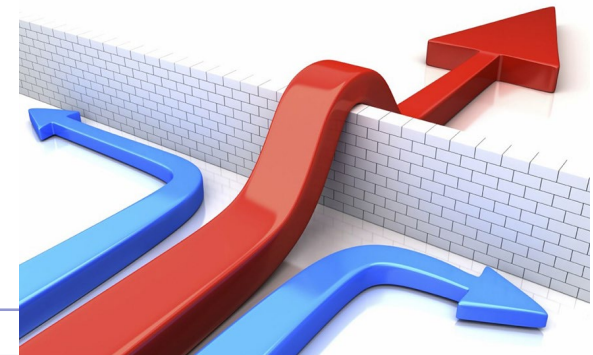
- Findings from this study add to our understanding of a more bio-behavioral model of self-management
- A better understanding of neurocognitive processes supporting self-management behaviors for disease management is essential for providers to support patient's behavior change efforts
- Need for more clarity regarding the definitions and attributes of the different components of interoception

# After Graduation



# Challenges

- No protected-paid time for research
- No nursing research mentors in the country
- New research regulations (2014)
- No governmental agency for research funding
- UCR lacks of strong budget for research
- No research infrastructure



# Opportunities

- We are paving the way for future generations!
- Teaching:
  - Undergraduate and graduate courses
  - Good Clinical Practices
  - CENDEISSS
  - NNA
- Innovation
- Networking
  - National and international level



# Opportunities

## Principal Investigator

- The relationships among interoception, decision-making, self-management behaviors, and cardiovascular health indicators in adults with chronic diseases. University of Costa Rica, Nursing School. Costa Rica. Project # Pry01-1422-2017.
- Psychometric characteristics of a self-efficacy scale for chronic disease management in people with cardiovascular disease who are working at universities in Costa Rica. University of Costa Rica, Nursing School. Project # Pry01-249-2016


# Working with students

- Analysis of therapeutic adherence in people with cardiovascular diseases.
- The relationships among emotion regulation, stress, and health-related quality of health in workers from a Costa Rican public institution.
- The relationships among physical activity, self-efficacy, and perceptions of benefits and barriers of physical activity in nursing students.
- Self-efficacy in working adults with chronic cardiovascular diseases at the National University of Costa Rica.
- Illness representation and its relationship with self-management outcomes in adults with hypertension.
- Health promoting lifestyle behaviors and self-efficacy in cancer patients

Case Study |  [Free Access](#) |

## Reviving Human Research in Costa Rica

Michael Householder, Ana Laura Solano-López, Derby Muñoz-Rojas, Suzanne M. Rivera

First published: 22 January 2019 | <https://doi.org/10.1002/eahr.500004> SECTIONS PDF TOOLS SHARE

### ABSTRACT

Costa Rica is a small developing nation in Central America with a well-regarded universal health care system and a strong human rights tradition. In the latter part of the twentieth century, it became a popular site for clinical trials funded by multinational pharmaceutical companies. In light of concerns about ineffective oversight and alleged research abuses, the Constitutional Chamber of the Supreme Court passed a moratorium on all biomedical studies involving humans. This moratorium was in place between 2010 and 2014, when the Legislative Assembly passed a new national law to protect participants' rights and welfare. This case study reviews the history of human research protections in Costa Rica and provides recommendations for how Costa Rica can move forward responsibly as a leader in human research for the region.



West J Nurs Res. 2018 Sep 4;193945918798374. doi: 10.1177/0193945918798374. [Epub ahead of print]

## Dimensions of Body-Awareness and Depressed Mood and Anxiety.

Solano López AL<sup>1</sup>, Moore S<sup>2</sup>.

### Author information

#### Abstract

Interoception, the multidimensional ability to sense the physiological condition of the body, is a key mechanism in emotional processing. However, the relationships between interoceptive dimensions and depressed mood and anxiety have not been widely studied. The aim of this secondary analysis, correlational and cross-sectional study, was to determine the relationships among interoceptive accuracy, interoceptive sensibility, depressed mood, and anxiety in adults with hypertension. The sample consisted of 76 adults, predominately African American women. Correlational analysis showed that most participants had low levels of interoceptive accuracy and relatively high levels of interoceptive sensibility. Interoceptive sensibility was negatively associated with depressed mood and anxiety. Interoceptive accuracy and interoceptive sensibility were not associated between each other. Further examination of the dimensions of interoception is needed to better understand the mechanisms by which it is associated with emotions that are known to have an influence on health behaviors and quality of life.

**KEYWORDS:** anxiety; chronic disease; depression; hypertension; interoception

PMID: 30178716 DOI: [10.1177/0193945918798374](https://doi.org/10.1177/0193945918798374)

Format: Abstract ▾

Send to ▾

Worldviews Evid Based Nurs. 2018 Oct;15(5):344-352. doi: 10.1111/wvn.12319. Epub 2018 Aug 19.

## Effectiveness of the Mindfulness-Based Stress Reduction Program on Blood Pressure: A Systematic Review of Literature.

Solano López AL<sup>1,2</sup>.

### ⊕ Author information

#### Abstract

**BACKGROUND:** In spite of the advances in hypertension prevention and treatment, there is a high percentage of people with elevated or uncontrolled blood pressure. New patient-centered strategies are needed to support people managing their condition. A complementary behavioral treatment, the mindfulness-based stress reduction (MBSR) program, needs to be evaluated for its potential to reduce blood pressure.

**AIMS:** To examine the literature on MBSR program effectiveness for blood pressure in adults with hypertension or elevated blood pressure.

**METHODS:** A systematic literature review of randomized control trials reporting the effectiveness of the MBSR program on systolic and diastolic blood pressure in people with hypertension or elevated blood pressure, published between 2012 and 2017 was conducted. Five databases were searched (PubMed, EMBASE, Web of Science, PsycINFO, and Cochrane Library). Data extraction and risk-of-bias assessment were performed.

**RESULTS:** A total of five articles were included in the review. Most studies found a reduction in systolic and diastolic blood pressure between the intervention and control groups; however, this reduction was only observed in clinical blood pressure (in office settings) and not in ambulatory blood pressure (in out-of-office settings) measurements. Analysis within intervention groups suggests that MBSR program reduces clinical blood pressure measurements. Even though these reductions in blood pressure may be of clinical relevance, the findings should be interpreted with caution in view of the lack of studies and study limitations.

**LINKING EVIDENCE TO ACTION:** The MBSR program is a promising behavioral complementary therapy to help people with hypertension lower their blood pressure through modifications in their lifestyle. More research is needed not only to identify the effectiveness of the MBSR program on blood pressure, but also to explore the mechanisms by which the program influences blood pressure.

© 2018 Sigma Theta Tau International.

**KEYWORDS:** blood pressure; hypertension ; mindfulness; mindfulness-based stress reduction; systematic review

PMID: 30123977 DOI: [10.1111/wvn.12319](https://doi.org/10.1111/wvn.12319)

# Potential grants

- Emerging Global Leader Award (K43). Proposal: Integrating mHealth mindfulness interventions for self-management in Costa Rican adults with hypertension.
- Fogarty International Center. National Institutes of Health. USA. 2017.
  - Participant institutions: Universidad de Costa Rica (Nursing School, Research center for information and communication technology, and Psychology Research Institution) and Case Western Reserve University (Frances Payne Bolton Nursing School).

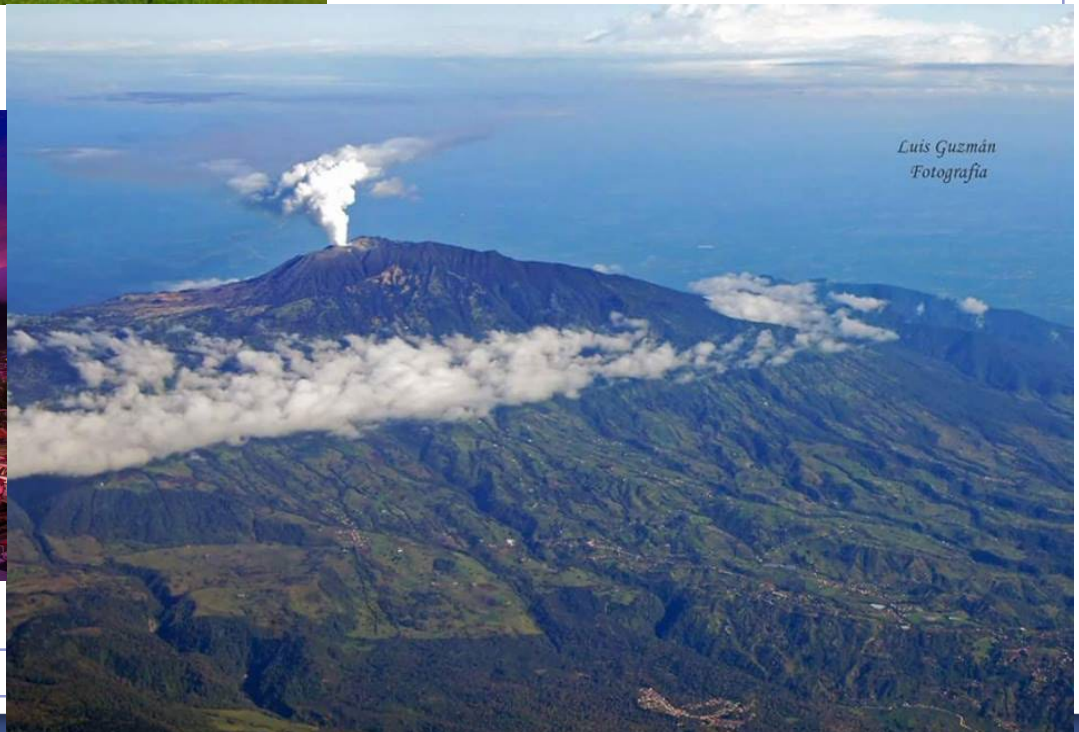


**FUNDING**  
next exit ↗





**Gracias**



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