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ORIGINAL RESEARCH

Relationships Among Heart Rate Variability, Perceived Social Support, and Hopelessness in Adults With Ischemic Heart Disease

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BACKGROUND: Lower perceived social support is associated with hopelessness in patients with ischemic heart disease (IHD). Higher perceived social support is associated with higher heart rate variability (HRV) in adults following a stressful event, but the relationship between HRV and hopelessness has not been examined in patients with IHD. The purpose of this research was to evaluate the relationships among HRV, perceived social support, and hopelessness in patients with IHD.

METHODS AND RESULTS: Ninety-four participants were enrolled while hospitalized for an IHD event at a large hospital in the United States. Data collection occurred 2 weeks after hospital discharge and included the State–Trait Hopelessness Scale, ENRICHD Social Support Inventory, Patient Health Questionnaire-9, a demographic form, and a short-term HRV measurement taken at rest. Linear models were used to assess associations between variables in unadjusted and adjusted models. Most participants were men (67%), married (75%), and non-Hispanic White (96%) and underwent coronary artery bypass surgery (57%). There were inverse correlations between high frequency HRV and state hopelessness (r=−0.21, P=0.008) and root mean square of successive differences between normal heartbeats HRV and state hopelessness (r=−0.20, P=0.012) after adjusting for important covariates. High frequency and root mean square of successive differences between normal heartbeats did not show evidence of mediating the relationship between perceived social support and hopelessness.

CONCLUSIONS: There were significant inverse correlations between parasympathetic measures of HRV and hopelessness. Assessing high frequency and root mean square of successive differences between normal heartbeats during early recovery following an IHD event could provide promising evidence for understanding a possible precursor to hopelessness and targets for future interventions.

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Key Words: heart rate variability ■ hopelessness ■ ischemic heart disease ■ perceived social support

Ischemic heart disease (IHD) is a prevalent and chronic condition, with the most recent data estimating that 20.1 million Americans are affected, and ≈335 000 individuals with IHD will have a recurrent event this year.[1] People with IHD experiencing hopelessness, a negative outlook, and helpless expectancy about the future[2] are more likely to die from IHD.[3,4] Hopelessness is present in 27% to 52% of patients with IHD.[5,6] This high prevalence is concerning because in addition to the increased risk for death, hopelessness is associated with reduced physical activity,[7] increased subclinical atherosclerosis,[8] and increased risk of subsequent

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CLINICAL PERSPECTIVE

What Is New?

- Lower levels of parasympathetic measures of heart rate variability (HRV), including high frequency and the root mean square of successive differences between normal heartbeats, were associated with higher levels of state hopelessness in patients 2 weeks after hospital discharge for an ischemic heart disease (IHD) event.
- The inverse relationship between HRV and state hopelessness remained statistically significant after adjusting for sex, age, type of procedure during hospitalization, smoking status, time of day, β blocker prescription at time of hospital discharge, and depressive symptom severity.

What Are the Clinical Implications?

- The statistically significant correlation between HRV and hopelessness provides further insight into the mind–heart–body connection in people with IHD; screening for hopelessness can open communication for health care providers to discuss how the patient's social support and mental health impacts their ability to adapt to stressors and reduce hopelessness.
- Assessing parasympathetic measures of HRV, including high frequency and root mean square of successive differences between normal heartbeats, in the early recovery period following an acute IHD event, could provide promising evidence for understanding a possible precursor to hopelessness and targets for future interventions.
- Patients hospitalized for an IHD event, regardless of sex, type of IHD event, or prescription of a β blocker, may benefit from early identification of hopelessness screening or HRV monitoring so that those at greater risk for poor health outcomes can be provided early interventions.

Nonstandard Abbreviations and Acronyms

IHD	ischemic heart disease
HF	high frequency
HRV	heart rate variability
RMSSD	root mean square of successive differences between normal heartbeats

myocardial infarction (MI) in patients with IHD.[4] A person can experience hopelessness throughout their life, referred to as trait hopelessness, or it can be expressed in response to a particular event, referred to as state hopelessness.[2] People with IHD can experience state hopelessness for up to a year after hospital discharge,[9] and state hopelessness may be more amenable to early intervention.[2]

Following a stressful event, such as an IHD diagnosis, coronary artery bypass graft surgery (CABG), or percutaneous coronary intervention, a person may experience increased hopelessness.[5,10] Maladaptive reactions to a stressful event can escalate the stress response and impair health.[11] Conversely, adaptive reactions to stress can buffer the stress response and promote health.[11] During a stressful event, the vagus nerve can activate a parasympathetic response (ie, rest/digest behaviors), or vagal withdrawal can inhibit parasympathetic signaling, permitting a sympathetic response (ie, fight/flight behaviors).[12] Heart rate variability (HRV), the beat-to-beat variability between normal heartbeats, is a biomarker of the fluctuations of vagal modulation associated with adaptive and maladaptive stress responses.[12,13] Common HRV measures of parasympathetic modulation include the high-frequency (HF) domain of spectral analyses and the root mean square of successive differences between normal heartbeats (RMSSD), observed in the time domain. Decreased parasympathetic measures of HRV predict greater risk for morbidity and death[13,14] and are associated with poor mental health in patients with IHD.[15,16] Psychological measures, including depression, have been associated with reduced HRV in patients with cardiovascular disease[16] and following an MI,[17] but the relationship between hopelessness and HRV in people with IHD has not yet been examined. Assessing this relationship could provide further insight into the mind–heart–body connection in people with IHD by focusing on a psychological and physiological variable linked to IHD.

The polyvagal theory posits that social support may positively influence HRV.[12] Perceived social support has been recognized as more beneficial for health and adjustment than the actual receipt of social support; however, the exact mechanisms of the health-promoting effects of perceived social support are not fully known.[18,19] There are several dimensions of perceived social support, including emotional support (eg, feeling cared for and loved), instrumental support (eg, tangible aid), informational support (eg, advice and educational support), and appraisal support (eg, self-esteem support).[20] Research examining the stress-buffering effects of increased perceived social support have found it to be associated with downregulation of the hypothalamic–pituitary–adrenal axis and a decrease in inflammation during times of stress, supporting health and longevity.[19] According to the polyvagal theory, social support instills feelings of a safe environment, enhancing activation of the parasympathetic nervous system and enabling an adaptive stress

response, as evidenced by increased HF and RMSSD HRV, markers of parasympathetic modulation.[12] Higher perceived social support is associated with higher HF and RMSSD in adults during the 3 phases of a stress response including rest, stress induction, and recovery,[21,22] and has also been associated with lower levels of hopelessness in patients with IHD.[23] Cardiac vagal modulation, as measured by HRV, has not yet been explored as a potential mechanism underlying the stress-buffering effects of perceived social support and how it relates to hopelessness. This is an important avenue to explore in understanding precursors to hopelessness and targets for future interventions.

Purpose

The purpose of this research was to examine the relationship between parasympathetic measures of HRV (ie, HF and RMSSD) and state hopelessness in patients with IHD. It was hypothesized that lower levels of HF and RMSSD would be cross-sectionally associated with higher levels of state hopelessness. We also sought to explore the possible mediating effect of cardiac vagal modulation (measured using short-term HRV) on the relationship between perceived social support and hopelessness, hypothesizing that HF and RMSSD HRV would mediate the relationship between perceived social support and state hopelessness.

METHODS

Sample and Setting

Participants (n=94) were enrolled while hospitalized for an IHD event in a large teaching hospital in the midwestern United States. Eligibility criteria included adults aged 40 to 80 years who had been diagnosed with MI, unstable angina, or had undergone CABG or percutaneous coronary intervention; had the ability to speak and read English; had the ability to complete the questionnaires; and had a useable short-term HRV recording and complete data on all covariates. An age range of 40 to 80 years was used to be representative of the IHD population while reducing the potential confounding effect of age on the HRV results.[24,25] Exclusion criteria included having a pacemaker, implanted cardioverter-defibrillator, or chronic arrhythmia; a history of or current valvular disease; an organ transplant; current use of immunosuppressive medications; or a diagnosis of diabetic autonomic insufficiency. These exclusion criteria were in place because the conditions are known to influence HRV.[13] Participants were informed of the voluntary nature of participation, risks, and benefits, and written informed consent was obtained from people who enrolled. Institutional review board approval was received from both the sponsoring university and the hospital where recruitment occurred. Data were collected from August 2019 to March 2023. The data that support the findings of this study will be available from the corresponding author upon reasonable request after completion of the parent study.

HRV Protocol

Two weeks after hospital discharge, participants were mailed a package containing a Polar H7 heart rate monitor (Polar Electro Oy, Kempele, Finland) and ActiGraph wGT3X-BT (ActiGraph, LLC., Pensacola, FL) to link to the Polar monitor for HRV data collection. Participants were also provided written, illustrated, video (by accessing a link), and verbal (by phone) instructions for proper HRV measurement. They were instructed to wear the monitors for 10 minutes while lying supine, still, and silent. Body position (eg, supine, sitting, standing) is known to influence HRV.[26] The supine position was chosen to standardize posture for the recording and reduce the potential influence of orthostatic hypotension that has been demonstrated in sitting and standing positions for older populations.[27] Participants were encouraged to complete the HRV measurement in the morning before taking any medications or completing any tasks. Time of day that the HRV measurement took place was recorded.

HRV was measured using the Polar H7 heart rate monitor. This monitor has a strong correlation with the ECG for measuring short-term HRV (r=0.99).[28] Participants wore the heart rate monitor across the center of their chest and were provided ultrasound gel to place on the inside part of the monitor to achieve satisfactory conduction. The Polar H7 heart rate monitor connected via Bluetooth to an ActiGraph wGT3X-BT worn around the participant's waist. The heart rate monitor was programmed so that a blue light flashed on the ActiGraph when heart rate data were being collected, which helped participants confirm successful HRV data collection. The HRV measures of focus included HF and RMSSD, as these are both thought to reflect parasympathetic modulation of the heart.[13] HF is a frequency domain measure of HRV in the range of 0.15 to 0.4 Hz and is influenced by respiratory rate.[13] Frequency domain measures quantify the cyclic fluctuations of HRV.[13] The time domain measure of RMSSD reflects the beat-by-beat variation in heart rate.[13] Although RMSSD is highly correlated with HF, RMSSD is relatively free from respiratory influences.[29]

The time between normal heartbeats data obtained from the Polar H7 heart rate monitor was downloaded using ActiLife software (ActiGraph, LLC). The Excel file containing the time between normal heartbeats data was then uploaded into Kubios HRV Software version 3.3.1 (Kubios Oy, Kuopio, Finland) for HRV analysis. From the 10-minute HRV recordings, the 5-minute

intermediate segment with the least amount of artifact was used for analysis. Kubios uses fast Fourier transform to run frequency domain analyses.[30] Artifacts were identified and corrected using a threshold-based artifact correction algorithm in Kubios that compares time between normal heartbeats against a local average interval.[30] The lowest-level threshold thought to detect artifact without overcorrecting normal beats was used for each recording. Only recordings with <5% artifact were used in the analysis.

Data Collection Phone Visit and Medical Record Abstraction

All participants also completed a phone visit with a research staff member 2 weeks after hospital discharge for the completion of several questionnaires. Primary cardiac diagnosis for hospital admission, other medical diagnoses, cardiac procedures and surgeries during hospitalization, length of hospital stay, and discharge medications were recorded from the electronic health record.

Measures

Demographic data, including age, sex, race, ethnicity, marital status, education level, insurance status, and employment status, were collected by self-report.

The State–Trait Hopelessness Scale was used to measure state and trait hopelessness. The State–Trait Hopelessness Scale uses a Likert-type scale ranging from 1 (strongly disagree) to 4 (strongly agree) and differentiates state and trait hopelessness. For the 10-item state subscale, participants respond to statements on the basis of how they feel today (right now). For the 13-item trait subscale, responses are based on how participants feel typically (over the years). The responses for each subscale are totaled and divided by the number of items in the subscale to provide a final score ranging from 1 to 4, with lower scores indicating lower levels of hopelessness.[31] The instrument has been tested in patients with IHD and is psychometrically sound.[31–33] The instrument had high reliability for state (α=0.86) and trait (α=0.93) subscales in this study.

Depression symptom severity was measured with the Patient Health Questionnaire-9. Items on the Patient Health Questionnaire-9 are scored on a Likert-type scale from 0 (not at all) to 3 (nearly every day). Responses are summed for a total score ranging from 0 to 27, with lower scores indicating less depressive symptom severity.[34] The instrument has demonstrated internal reliability and validity.[34,35] The instrument has been validated in patients with IHD.[36,37] Reliability of the Patient Health Questionnaire-9 was sufficient (α=0.80) in this sample.

The ENRICHD Social Support Inventory was used to measure perceived social support. We used the validated 5-item version of the scale that focuses on the emotional dimension of perceived social support.[38] The ENRICHD Social Support Inventory uses a Likert-type scale ranging from 1 (none of the time) to 5 (all of the time). Responses for each item are summed for a final score ranging from 5 to 25 for the 5-item version. Higher scores indicate greater levels of perceived social support.[38] The instrument is deemed valid and reliable in patients with IHD,[38,39] and demonstrated high reliability in this sample (α=0.90).

Statistical Analysis

Data collected from questionnaires and electronic medical record abstraction were exported from REDCap, a secure research database where research staff input participant responses. Statistical analyses were conducted with SPSS Statistics software version 28.0 (IBM, Inc., Chicago, IL), and a significance level was set at 0.05 for each test. The study was powered (>80%) to detect bivariate Pearson correlations greater than r=0.17 (or r<–0.17). Descriptive statistics including means, SDs, frequencies, and ranges were used to summarize participant characteristics and study measures. HRV measures (ie, HF and RMSSD) were log transformed to account for nonnormal distributions. The relationship between HRV and hopelessness was assessed using a multiple regression framework. Variables known to influence HRV or hopelessness in previous research, including age,[24] sex,[40] smoking status,[13] β blockers,[41] type of procedure during hospitalization,[42] and depressive symptom severity[15] were controlled for in adjusted models. Linear models with interaction terms and t-tests were used to examine differences between prespecified groups including sex, type of IHD event, and prescription of a β blocker at hospital discharge, and the effect size was examined using Cohen's d (difference in group means divided by the pooled SD). The PROCESS macro version 4.1 (model 4) was used to evaluate HRV as a mediator between perceived social support and hopelessness. Bootstrapping was used to determine the significance of the mediation effect.[43]

RESULTS

Participant Characteristics

The mean age was 61 years, and the majority of participants were men (67%), married (75%), employed (52%), non-Hispanic White (96%), completed some college or higher (78%), had insurance coverage that did not include Medicaid (82%), were prescribed a β blocker at hospital discharge (86%), underwent CABG (57%), and did not smoke (95%) (see Table 1).

Mean HF was 118 ms^2 (SD, 203.58) and mean RMSSD was 16.92 ms (SD, 12.23), indicating low average HRV levels compared with a healthy population

Table 1. Participant Demographic and Clinical Characteristics

Variables	Participants (n=94)
Age, y, mean (SD)	61 (9.73)
Male sex	63 (67)
Completed some college education or higher	73 (77.7)
Married	70 (74.5)
Employed	49 (52.1)
Non-Hispanic White	90 (95.7)
History of depression	40 (42.6)
No insurance or reported use of Medicaid	17 (18.1)
Prescribed β blocker at discharge	81 (86.2)
Procedure during hospitalization*	
Noninvasive intervention	11 (11.7)
Percutaneous coronary intervention	29 (30.9)
Coronary artery bypass graft surgery	54 (57.4)
Nonsmoker	89 (94.7)

*If participants had multiple procedures, the most invasive procedure was listed. Data are presented as n (%) unless otherwise indicated.

(eg, HF range, 82–3630 ms^2; and RMSSD range, 19–75 ms).[44] As expected, there was a strong correlation between HF and RMSSD (r=0.83). Mean state hopelessness was 1.75 (SD, 0.45) and mean trait hopelessness was 1.77 (SD, 0.45). These means are just below the established cut point criteria for moderate to severe hopelessness (see Table 2).

HRV and Hopelessness

There was a small inverse correlation between HF and state hopelessness (r=−0.24 [95% CI, −0.44 to −0.03]; P=0.023) and RMSSD and state hopelessness (r=−0.24 [95% CI, −0.44 to −0.04]; P=0.021). These relationships remained statistically significant and showed little change in estimated correlation after controlling for variables associated with HRV in previous research including sex, age, procedure during hospital stay (ie, noninvasive intervention, percutaneous coronary intervention, or CABG), time of day, and prescription of a β blocker at discharge (model 2), as well as after adding depressive symptom severity to the model (model 3) (see Table 3). The correlation between RMSSD and trait hopelessness was not statistically significant (r=−0.09 [95% CI, −0.30 to 0.12]; P=0.38), and findings were similar for HF and trait hopelessness (r=−0.10 [95% CI, −0.31 to 0.11]; P=0.33).

Subgroup Analysis

Subgroup analyses were conducted to determine if there was evidence of any differences in the relationship between HF and state hopelessness or RMSSD and state hopelessness between groups. There was no evidence of an effect of sex on state hopelessness and HF or RMSSD (interaction P=0.20 and P=0.47, respectively). Additionally, there was no evidence of a difference in the hopelessness and HRV relationships comparing people who underwent CABG and those who did not (HF, interaction P=0.22; RMSSD, interaction P=0.41). However, patients undergoing CABG did have statistically significantly lower HF (Cohen's d=0.78, P<0.001) and RMSSD (Cohen's d=0.68, P=0.002) compared with patients not undergoing CABG. State hopelessness levels did not differ between patients undergoing CABG and patients not undergoing CABG (Cohen's d=−0.13, P=0.54). Prescription of a β blocker at the time of hospital discharge did not show evidence of an interaction on the relationship between state hopelessness and HF (P=0.14) or RMSSD (P=0.27). Furthermore, HF and RMSSD did not statistically significantly differ between people prescribed a β blocker at discharge and those who were not (HF, Cohen's d=−0.23, P=0.44; RMSSD, Cohen's d=−0.12, P=0.69).

Table 2. Descriptive Statistics of Study Measures (n=94)

Variable	Mean (SD)	Observed range
State hopelessness	1.75 (0.45)	1–2.9
Trait hopelessness	1.77 (0.45)	1–3
RMSSD, ms	16.92 (12.23)	2.5–66.3
Log RMSSD	2.62 (0.66)	0.92–4.19
HF, ms^2	118.18 (203.58)	3–1246
Log HF	3.97 (1.29)	0.95–7.13
Perceived social support	22.22 (3.86)	9–25
Depressive symptom severity	5.46 (4.74)	0–19

HF indicates high frequency; and RMSSD, root mean square of successive differences between normal heartbeats.

Mediation Analysis of HRV

A mediation model was used to explore the potential mediating effect of cardiac vagal modulation, measured using short-term HF and RMSSD, on the relationship between perceived social support and state hopelessness. Results indicated that there was a statistically significant, negative, moderate estimated total effect of perceived social support on state hopelessness (r=−0.29 [95% CI, −0.49 to −0.09]; P=0.004). The direct effect for perceived social support on state hopelessness was r=−0.26 (95% bootstrap CI, −0.05 to −0.01) with HF as a mediator, while in the model with RMSSD as a mediator it was r=−0.26 (95% bootstrap CI, −0.05 to −0.01). The estimated indirect effect of perceived social support on state hopelessness through HF was not statistically significant (r=−0.03 [95% bootstrap CI, −0.09 to 0.02]), with similar results found using RMSSD in the mediation model (r=−0.03 [95% bootstrap CI, −0.10 to 0.01]). See Figure 1 for the model examining the mediating effect of HF on the

Table 3. Correlations Between Heart Rate Variability and State Hopelessness

Variables	Model 1*		Model 2†		Model 3‡	
	Correlation (*r*)	95% CI; *P* value	Correlation *r*	95% CI; *P* value	Correlation *r*	95% CI; *P* value
HF	−0.24	−0.44 to −0.03; 0.023§	−0.25	−0.40 to −0.09; 0.002§	−0.21	−0.37 to −0.06; 0.008§
RMSSD	−0.24	−0.44 to −0.04; 0.021§	−0.22	−0.38 to −0.07; 0.005§	−0.20	−0.35 to −0.04; 0.012§

n=94. HF indicates high frequency; and RMSSD, root mean square of successive differences between normal heartbeats.
*Model 1 is an unadjusted model.
†Model 2 is adjusted for sex, age, procedure, smoking status, time of day, and β blocker prescription.
‡Model 3 is adjusted for model 2 covariates plus depressive symptom severity.
§Indicates statistical significance.

relationship between perceived social support and state hopelessness and Figure 2 examining RMSSD as a mediator.

DISCUSSION

The results support our hypothesis that lower levels of HF and RMSSD are associated with higher levels of state hopelessness. These relationships remained statistically significant when controlling for factors known to influence HRV and hopelessness. These findings align with prior research demonstrating a reduction in HRV linked to depression.[16,17] Although hopelessness can be related to depression,[2] hopelessness was independently associated with decreased HRV in this study. These results also support the polyvagal theory that enhanced activation of the parasympathetic nervous system following a stressful event (eg, an acute IHD event), as evidenced by increased HF and RMSSD, is associated with an adaptive response, in this case decreased state hopelessness.[45] Although trait hopelessness was not a main focus of the study, it is important to note that parasympathetic measures of short-term HRV were not associated with trait hopelessness. The relationship between trait hopelessness, a chronic outlook on the future, and HRV may be more appropriate to examine with a long-term HRV recording that is influenced by several physiological processes including core body temperature, circadian rhythm, sleep cycle, and metabolism.[29]

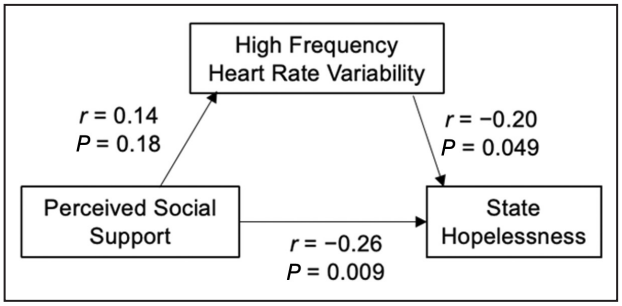

Figure 1. Mediation model examining high-frequency heart rate variability.

To improve risk stratification and secondary prevention in people with IHD, it is vital to understand patient characteristics and explore underlying mechanisms that promote adaptive responses to stress.[11] Identification of these characteristics can lead to early risk detection and provide targets for future interventions. Assessing parasympathetic measures of HRV, including HF and RMSSD, in the early recovery period following an acute IHD event, could provide promising evidence in understanding a possible precursor to state hopelessness and targets for future interventions. State hopelessness can persist for up to a year after hospital discharge,[9] so early intervention is vital to mitigate the risk of poor health outcomes associated with hopelessness, including decreased physical activity,[7] greater subclinical atherosclerosis,[8] and increased risk of subsequent MI and death in patients with IHD.[4] There is a need for well-powered randomized controlled trials to test interventions to reduce hopelessness in patients with IHD.

Cardiac vagal modulation, measured using short-term HF and RMSSD, did not show evidence of mediating the relationship between perceived social support and state hopelessness. This research focused on the functional social support measure of perceived social support, specifically perceived emotional support, as it is one of the social support dimensions most predictive of death in patients with IHD.[38] Social support is multidimensional, and there may be other dimensions of social support (eg, informational, instrumental, appraisal, and received support),[20] that should

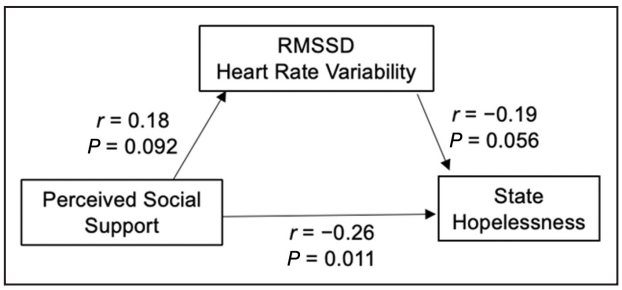

Figure 2. Mediation model examining RMSSD heart rate variability.
RMSSD indicates root mean square of successive differences between normal heartbeats.

be considered. Although the relationship between perceived social support and hopelessness did not show evidence of mediation by HRV, previous research examining the stress-buffering effects of perceived social support have found it to be associated with inhibition of the body's defense system, including a downregulation of the hypothalamic–pituitary–adrenal axis and a decrease in inflammation during times of stress.[19] Results may have been affected by the high levels of social support in this sample. Future longitudinal research in a sample of participants with lower levels of social support is needed to test temporal mediation.

The observed mean HF and RMSSD were low compared with average short-term HRV measurements in healthy adults.[44] This is to be expected following an IHD event given the trauma inflicted on the heart.[42] The relationship between HRV and state hopelessness did not differ between patients undergoing CABG and patients not undergoing CABG, but participants who underwent a CABG procedure had lower HF and RMSSD compared with those who did not. These findings align with previous research demonstrating CABG surgery results in a greater reduction in HRV compared with MI.[42] The greater reduction in HRV in patients who undergo CABG is thought to be the result of the combined effects of ischemia-related trauma to the heart as well as surgical manipulation.[42] There were also no statistically significant differences in the results when stratifying by sex. Patients hospitalized for an IHD event, regardless of sex or type of IHD event, may benefit from early identification of hopelessness during hospitalization. Screening for hopelessness can open communication for health care providers to discuss how the patient's social support and mental health impacts their ability to adapt to stressors and reduce hopelessness.[46]

Clinical guidelines recommend early β blocker treatment for patients with IHD who do not have contraindications.[47] In this study, 81 (86%) patients were prescribed a β blocker at the time of hospital discharge. We did not find a statistically significant difference in HF or RMSSD comparing people prescribed a β blocker at the time of hospital discharge with those who were not. Prior research has demonstrated continued use of β blocker medication improved HRV, including HF and RMSSD, in patients with MI 6 weeks after hospital discharge for an acute event.[48] Data collection in this study took place 2 weeks after hospital discharge, and it is unknown if or how long participants may have been on a β blocker before hospitalization. An integrative review of the acute effects of pharmacological manipulation on HRV metrics did not find an effect of β blocker administration on HF or RMSSD.[41] The prescription of a β blocker at discharge did not affect the relationship between HF or RMSSD and state hopelessness in this study. These results highlight the relevance of the relationship between lower HRV and greater state hopelessness in patients following an IHD event, regardless of β blocker prescription at the time of discharge.

This study had limitations. The sample lacked racial and ethnic diversity and was recruited from 1 large hospital in the midwestern United States. The relationship between HRV and hopelessness should be examined in a more diverse population to assess if race and ethnicity, geographic location, culture, or socioeconomic status impact the strength or direction of the relationship. Exploring potential differences in this relationship in a more heterogeneous sample may provide further insight into identifying patients at greater risk for experiencing hopelessness. There are also many factors known to influence HRV (eg, physical activity, illness, posture, alcohol consumption, medications),[13] and we were not able to control for everything that could be influencing the measurement. However, a strength of the study included the multiple exclusion criteria implemented to mitigate the potential confounding effects of specific conditions known to influence HRV. We also adjusted for other important variables including sex, age, procedure, smoking status, time of day, β blocker prescription, and depression severity in the analysis.

CONCLUSIONS

There were small inverse correlations between HF and state hopelessness as well as RMSSD and state hopelessness in patients 2 weeks after hospital discharge for an IHD event. These results remained statistically significant when controlling for factors known to influence HRV and hopelessness including age, sex, smoking status, β blocker prescription, type of procedure during hospitalization, time of day, and depressive symptom severity. There was no evidence indicating that HF and RMSSD mediate the relationship between perceived social support and state hopelessness. Assessing parasympathetic measures of HRV including HF and RMSSD could provide promising evidence for understanding precursors to hopelessness and targets for future interventions.

ARTICLE INFORMATION

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Disclosures

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