PJOM Physician's Journal of Medicine

Fakiro Y, Auerbach E, Hizami G, et al. Congestive Heart Failure and Skin Cancer Risk: A Cross-Sectional Analysis. *PJOM*. 2025;4:1-5. doi:10.55070/001c.134107

Medical Journal

Congestive Heart Failure and Skin Cancer Risk: A Cross-Sectional Analysis

Yaacov Fakiro[1], Esther Auerbach[2], Gavriel Hizami[2], Marco Halabi[3], Myles Goliger[2], Shmuel Halpert[4], Marc Ganz[2]

[1] Touro University Nevada, [2] SUNY Downstate Health Sciences University, [3] Touro College of Osteopathic Medicine, [4] Technion – Israel Institute of Technology

Keywords: Skin Cancer, CHF, NHANES

https://doi.org/10.55070/001c.134107

Physician's Journal of Medicine

Vol. 4, 2025

Introduction

Congestive heart failure (CHF) is a chronic inflammatory condition that may influence immune surveillance and cancer risk. While CHF has been linked to increased incidence of certain malignancies, its relationship with skin cancer remains underexplored. Given the systemic immune changes in CHF and the immune-mediated aspects of skin cancer pathogenesis, this study aimed to assess whether CHF is associated with increased prevalence of skin cancer in a nationally representative sample of U.S. adults.

Methods

We analyzed data from the National Health and Nutrition Examination Survey (NHANES) collected between 2021 and 2023. CHF status was determined by self-reported physician diagnosis, and skin cancer was defined based on self-reported history of melanoma or non-melanoma skin cancer. A multivariable logistic regression model was used to assess the association between CHF and skin cancer, adjusting for age, gender, race/ethnicity, marital status, and education level.

Results

Among 7,791 participants, 343 (4.4%) reported a history of CHF. Skin cancer prevalence did not significantly differ between CHF and non-CHF groups. In adjusted analysis, CHF was not significantly associated with skin cancer (OR = 1.03, 95% CI: 0.64–1.63, p = 0.903). Female gender was associated with lower odds of skin cancer (OR = 0.65, p = 0.002), while college education was associated with higher odds compared to less than a 9th-grade education (OR = 3.33, p = 0.012). No other covariates showed significant associations.

Conclusion

Despite theoretical concerns regarding inflammation and immune dysfunction in CHF, we found no evidence that CHF is associated with increased skin cancer prevalence. Our findings suggest that systemic changes in CHF may not meaningfully impact skin cancer risk, or that detection patterns in this population may obscure true associations. The study also underscores the influence of demographic and socioeconomic factors on skin cancer reporting. Further research using prospective designs and detailed cancer subtype data is warranted to clarify potential links between CHF and skin cancer.

INTRODUCTION

Congestive heart failure (CHF) is a chronic and progressive condition that affects an estimated 6.7 million adults in the United States, with rising prevalence due to aging populations and improved survival from cardiovascular events.[1, 2] It is associated with high morbidity, diminished quality of life, and frequent hospitalizations, placing a significant burden on both patients and the healthcare system.[3] Beyond its direct cardiac effects, CHF is known to have systemic consequences that can influence immune function, circulation, and inflammation.[4]

Skin cancer is the most common form of cancer in the United States, with millions of cases diagnosed annually, including both melanoma and non-melanoma types.[5,6] While traditionally linked to ultraviolet radiation exposure, emerging studies have suggested that immune dysregulation and chronic systemic inflammation may play a role in skin cancer risk.[7,8]

Although CHF and skin cancer are both common conditions in the adult population, few studies have investigated whether a diagnosis of CHF is associated with an increased risk of skin cancer. The chronic immune and inflammatory changes seen in CHF could theoretically influence cancer surveillance and skin pathology.[9] Additionally, patients with CHF may have altered healthcare utilization patterns that could affect cancer screening or diagnosis.[10]

This study aims to examine whether individuals with CHF have a higher prevalence of skin cancer compared to those without CHF. Using data from the National Health and Nutrition Examination Survey (NHANES), we conducted a multivariable analysis adjusting for demographic and socioeconomic covariates to assess whether CHF is independently associated with skin cancer risk.

METHODS

This study utilized data from the National Health and Nutrition Examination Survey (NHANES), a nationally representative dataset administered by the Centers for Disease Control and Prevention (CDC). We used data collected between 2021 and 2023 and extracted variables from the Demographics and Medical Conditions files.

CHF status was determined based on self-reported responses to whether a healthcare provider had ever diagnosed the participant with congestive heart failure. Responses of "Yes" were coded as 1 (CHF), and "No" as 0 (No CHF). Skin cancer was defined using three variables capturing the type of cancer for first, second, and third diagnoses. Any report of melanoma, non-melanoma skin cancer, or unspecified skin cancer in any of these fields was coded as 1 (Skin Cancer), while all other responses were coded as 0.

Covariates included in the analysis were age (continuous), gender (Male/Female), marital status (Married vs. Not Married), educational attainment (Less than 9th grade, 9–11th grade, High school graduate/GED, Some college or AA degree, College graduate or above), and race/ethnicity (Black, Hispanic, White). Standard NHANES coding conventions were applied to handle missing or refused responses.

Descriptive statistics were calculated to summarize demographic and clinical characteristics by CHF status. Continuous variables were summarized using means and standard deviations (SD), and categorical variables using frequencies and percentages. A logistic regression model was then used to assess the association between CHF status and skin cancer, adjusting for age, gender, marital status, education, and race. Odds ratios (ORs), 95% confidence intervals (CIs), and p-values were reported. A two-sided p-value of <0.05 was considered statistically significant. All analyses were conducted in R version 4.2.0.

RESULTS

A total of 7,791 participants with complete data on congestive heart failure (CHF) status were included in the analysis. Of these, 343 participants (4.4%) reported a history of CHF, while 7,448 (95.6%) did not. The average age of participants with CHF was 68.33 years (SD = 10.06), compared to 52.91 years (SD = 17.50) for those without CHF. The CHF group had a higher proportion of males (53.9%) than females (46.1%), whereas the non-CHF group had more females (55.8%) than males (44.2%) (Table 1).

In terms of racial distribution, 69.7% of participants with CHF were White, 16.0% were Black, and 14.3% were Hispanic. Among those without CHF, 66.1% were White, 14.4% were Black, and 19.5% were Hispanic. Regarding education, participants with CHF were more likely to have lower educational attainment. Specifically, 18.1% of CHF patients had completed only 9–11th grade, and only 16.1% held a college degree or higher. In contrast, 34.6% of non-CHF participants had a college education. A higher percentage of CHF participants were unmarried (56.4%) compared to the non-CHF group (46.4%).

A logistic regression model was performed to examine whether individuals with a history of CHF were more likely to report a history of skin cancer, controlling for gender, age, marital status, education, and race (Table 2). CHF was not significantly associated with skin cancer (OR = 1.03, 95% CI: 0.64–1.63, p = 0.903). Female participants had significantly lower odds of skin cancer compared to males (OR = 0.65, 95% CI: 0.50–0.85, p = 0.002). Age, marital status, and most education levels were not significantly associated with skin cancer, although college graduates had significantly higher odds compared to those with less than a 9th-grade education (OR = 3.33, 95% CI: 1.31–8.47, p = 0.012). Race coefficients were unstable, showing unusually large odds ratios and non-significant p-values, likely due to sparse event counts within some subgroups.

DISCUSSION

This study analyzed data from the National Health and Nutrition Examination Survey (NHANES) to evaluate the relationship between congestive heart failure (CHF) and self-reported history of skin cancer, including both melanoma and non-melanoma types. The primary finding of our analysis was that self-reported CHF was not significantly associated with skin cancer after adjusting for demographic and socioeconomic factors (OR = 1.03, 95% CI: 0.64–1.63, p = 0.903). However, notable findings included a protective effect of female gender against skin cancer and a positive association between higher educational attainment and increased odds of self-reported skin cancer.

The lack of a significant relationship between CHF and skin cancer was somewhat unexpected, given the potential for chronic inflammation and immune dysregulation in CHF patients to impair cancer surveillance. CHF is known to induce systemic inflammatory changes and alter immune function, theoretically increasing susceptibility to malignancy. However, our findings may suggest that these immune alterations do not have a substantial impact on skin cancer risk, or that other unmeasured factors mitigate this risk. These unmeasured factors could include healthcare utilization patterns or preventive care, which may influence the detection and reporting of skin cancer.

Table 1. Demographic Characteristics of Participants by CHF Status

Variable	No CHF N (%)	CHF N (%)	Total N
Total	7,448 (95.6%)	343 (4.4%)	7,791
Age (Mean ± SD)	52.91 ± 17.50	68.33 ± 10.06	—
Gender			
Male	3,292 (44.2%)	185 (53.9%)	3,477 (44.6%)
Female	4,156 (55.8%)	158 (46.1%)	4,314 (55.4%)
Race			
Black	944 (14.4%)	49 (16.0%)	993 (14.5%)
Hispanic	1,277 (19.5%)	44 (14.3%)	1,321 (19.1%)
White	4,331 (66.1%)	214 (69.7%)	4,545 (66.4%)
Education			
<9th grade	342 (4.6%)	30 (8.8%)	372 (4.8%)
9–11th grade	602 (8.1%)	62 (18.1%)	664 (8.5%)
High school graduate/GED	1,648 (22.2%)	92 (26.9%)	1,740 (22.3%)
Some college or AA degree	2,265 (30.5%)	103 (30.1%)	2,368 (30.4%)
College graduate or above	2,568 (34.6%)	55 (16.1%)	2,623 (33.7%)
Marital Status			
Married	3,980 (53.6%)	149 (43.6%)	4,129 (53.0%)
Not Married	3,445 (46.4%)	193 (56.4%)	3,638 (47.0%)

Table 2. Logistic Regression Results Examining the Association Between CHF and Skin Cancer

Variable	Odds Ratio (OR)	95% CI	P-value
CHF	1.03	0.64 – 1.63	0.903
Female	0.65 **	0.50 – 0.85	0.002
Age (years)	1	0.99 – 1.01	0.464
Not Married	0.79	0.61 – 1.02	0.087
Education: 9–11th grade	1.18	0.40 – 3.42	0.77
Education: High school/GED	2.1	0.81 – 5.42	0.13
Education: Some college/AA	2.37	0.92 – 6.13	0.074
Education: College graduate+	3.33 *	1.31 – 8.47	0.012
Race: Hispanic	$\sim 7.88 \times 10^6$	—	0.969
Race: White	$\sim 2.17 \times 10^7$	—	0.967

Significance Legend:
*p < 0.05
**p < 0.01
***p < 0.001

Additionally, the observed association between higher education and increased skin cancer prevalence may reflect increased health awareness and access to dermatologic care in more educated populations. Conversely, the protective effect seen in females aligns with prior literature, which attributes lower skin cancer risk in women to factors such as behavioral differences in sun exposure and use of sunscreen, as well as potential biological differences in immune response and skin physiology.

Our results align with prior studies that highlight the immune dysfunction associated with CHF but diverge from the expected link to increased cancer risk. While previous research has demonstrated a heightened risk for certain malignancies in CHF populations, the association with skin cancer remains less explored. A study by Meijers et al. (2012) reported an increased incidence of malignancy in heart failure patients, though skin cancer-specific outcomes were discussed as they pertained to cardiovascular drugs, specifically diuretics.[10] Additionally, research examining immune dysregulation in CHF has primarily focused on its impact on systemic inflammation, with limited emphasis on cutaneous immunity.

This study has several limitations. First, the reliance on self-reported skin cancer data introduces the potential for

recall bias, which may underestimate or overestimate true skin cancer prevalence. Second, the relatively small sample size of individuals with CHF in the NHANES dataset may have contributed to the limited power to detect subtle associations. Moreover, sparse event counts for certain subgroups, particularly in racial and ethnic minorities, resulted in wide confidence intervals and unstable effect estimates. Additionally, NHANES data does not allow for differentiation between melanoma and non-melanoma skin cancers, which may have different biological pathways and risk profiles. Finally, the cross-sectional nature of the NHANES data prevents us from establishing a causal relationship between CHF and skin cancer. We were only able to assess the prevalence of skin cancer at a single time point.

While our findings did not demonstrate a significant link between CHF and skin cancer, they highlight the importance of continued vigilance in monitoring skin health in high-risk populations. Given the systemic inflammation and immune alterations associated with CHF, clinicians should remain attentive to potential dermatologic manifestations and consider incorporating routine skin cancer screenings, particularly in older patients or those with prolonged disease duration.

Future research should aim to explore this association in larger, prospective cohorts to confirm or refute our findings. Longitudinal studies with more granular data on healthcare utilization, inflammatory biomarkers, and detailed cancer histology may provide greater clarity on potential mechanisms linking CHF and skin cancer. Additionally, studies focusing on high-risk subgroups, including those with advanced CHF or immunosuppressive comorbidities, could offer further insights into the complex relationship between heart failure, immune modulation, and cancer risk.

CONCLUSION

This study did not find a significant association between self-reported CHF and skin cancer prevalence in a nationally representative sample of US adults. However, we observed significant associations between gender and education with skin cancer. While our study has limitations, it highlights the need for further research to clarify the complex interplay between cardiovascular disease, inflammation, and cancer risk and underscores the importance of dermatologic vigilance in patients with chronic conditions like CHF.

Published: March 04, 2025 EDT.

REFERENCES

1. Martin SS, Aday AW, Allen NB, et al. 2025 Heart disease and stroke statistics: A report of US and global data from the American Heart Association. *Circulation*. 2025;151(8):e123-e134. doi:10.1161/CIR.0000000000001303

2. Daubert C, Gold MH, Abraham WT, et al. Prevention of disease progression by cardiac resynchronization therapy in patients with asymptomatic or mildly symptomatic left ventricular dysfunction. *J Am Coll Cardiol*. 2009;54(20):1837-1846. doi:10.1016/j.jacc.2009.08.011

3. Bozkurt B, Ahmad T, Alexander K, et al. HF STATS 2024: Heart failure epidemiology and outcomes statistics an updated 2024 report from the Heart Failure Society of America. *J Card Fail*. 2024;31(1):e1-e8. doi:10.1016/j.cardfail.2024.07.001

4. Van Linthout S, Tschöpe C. Inflammation – Cause or consequence of heart failure or both? *Curr Heart Fail Rep*. 2017;14(4):251-265. doi:10.1007/s11897-017-0337-9

5. Guy GP Jr, Machlin SR, Ekwueme DU, Yabroff KR. Prevalence and costs of skin cancer treatment in the U.S., 2002-2006 and 2007-2011. *Am J Prev Med*. 2015;48(2):183-187. doi:10.1016/j.amepre.2014.08.036

6. Lomas A, Leonardi-Bee J, Bath-Hextall F. A systematic review of worldwide incidence of nonmelanoma skin cancer. *Br J Dermatol*. 2012;166(5):1069-1080. doi:10.1111/j.1365-2133.2012.10830.x

7. Bottomley MJ, Thomson J, Harwood C, Leigh I. The role of the immune system in cutaneous squamous cell carcinoma. *Int J Mol Sci*. 2019;20(8):2009. doi:10.3390/ijms20082009

8. Maru GB, Gandhi K, Ramchandani A, Kumar G. The role of inflammation in skin cancer. *Adv Exp Med Biol*. 2014;816:437-469. doi:10.1007/978-3-0348-0837-8_17

9. Banke A, Schou M, Videbaek L, et al. Incidence of cancer in patients with chronic heart failure: A long-term follow-up study. *Eur J Heart Fail*. 2016;18(3):260-266. doi:10.1002/ejhf.472

10. Meijers WC, de Boer RA. Common risk factors for heart failure and cancer. *Cardiovasc Res*. 2019;115(5):844-853. doi:10.1093/cvr/cvz035