ASSOCIATIONS BETWEEN SOCIAL DETERMINANTS OF HEALTH AND CARDIOVASCULAR HEALTH OF ADULT CANCER SURVIVORS

Hassan Muhammed Ul Haq[1], Eesha Arshad[2], Maham Imran[3], Aamrah Wakil[4], Aleena Ali Raza[5], Farhat. R. Malik[6], Nimra Sharif[7*], Sabrina Ahmed[8]

[1-5]MBBS Doctor, Jinnah Sindh Medical University, Karachi - Pakistan
[6]Professor, Community Health Sciences, Peshawar Medical College, Peshawar/ Riphah International University, Islamabad - Pakistan
[7*]Department of Zoology Wildlife and Fisheries Faculty of Sciences, University of Agriculture, Faisalabad – Pakistan
[8]MBBS, Jinnah Postgraduate Medical Center, Karachi

*Corresponding Author: Nimra Sharif
*Department of Zoology Wildlife and Fisheries Faculty of Sciences, University of Agriculture, Faisalabad – Pakistan, *Email: nimms514@gmail.com*

Abstract

Background: Cardiovascular health in adult cancer survivors is a critical yet understudied aspect of survivorship care.

Objectives: This cross-sectional study aimed to explore the associations between social determinants of health (SDOH) and cardiovascular outcomes in a diverse population of 180 adult cancer survivors.

Methods: Demographic and clinical data, socio-economic status, access to healthcare, psychosocial factors, and cardiovascular health outcomes were assessed. Statistical analyses, including chi-square tests, t-tests, and logistic regression models, were employed to identify associations and adjust for potential confounding variables.

Results: Higher household income was significantly associated with a lower prevalence of hypertension, emphasizing the role of socio-economic factors. Regular healthcare visits and health insurance were linked to reduced hypertension and high cholesterol, highlighting the importance of healthcare access. Depression exhibited a significant association with hypertension, underscoring the interplay between psychosocial factors and cardiovascular health.

Practical Implications: Public health interventions aimed at reducing social inequalities and improving healthcare access could contribute to broader improvements in cardiovascular health in this population.

Conclusion: The study provides insights into the intricate relationships between SDOH and cardiovascular outcomes in adult cancer survivors. The findings underscore the importance of tailoring survivorship care plans to address socio-economic disparities, enhance mental health support, and promote preventive cardiovascular care. These results contribute to a holistic understanding of survivorship care, emphasizing the need for targeted interventions to improve long-term cardiovascular health in this population.

Key words: Cancer, Patients, Survivors, CVD, Health, Socioeconomic, Factors

Introduction
Cardiovascular health is a critical aspect of overall well-being, and understanding the complex interplay between social determinants of health (SDOH) and cardiovascular outcomes among adult cancer survivors is paramount [1]. Cancer survivors often face unique health challenges, and the impact of social factors on cardiovascular health in this population remains underexplored. This study aims to illuminate the associations between various SDOH, including socio-economic status, access to healthcare, and psychosocial factors, and the cardiovascular health of adult cancer survivors. As cardiovascular diseases emerge as a significant concern in survivorship, a comprehensive exploration of the social determinants influencing these health outcomes is essential for developing targeted interventions and improving the long-term health trajectory of cancer survivors [2].

Adult cancer survivors encounter a myriad of challenges, both during and after cancer treatment. While advancements in cancer therapies have significantly improved survival rates, survivors often contend with long-term health issues, including cardiovascular complications [3]. These challenges are exacerbated by the intricate interplay of social determinants that influence the trajectory of cardiovascular health in this population. Socio-economic status (SES) plays a pivotal role in shaping the health outcomes of cancer survivors. Disparities in income, education, and employment can impact access to healthcare services, preventive measures, and overall lifestyle choices [4]. Lower SES is often associated with an increased risk of cardiovascular disease, and understanding these dynamics among cancer survivors is crucial for implementing targeted interventions that address specific socio-economic barriers to optimal cardiovascular health [5].

The accessibility of healthcare services is a critical factor influencing cardiovascular health among adult cancer survivors. Adequate follow-up care, cardiovascular screenings, and preventive measures are essential for managing the long-term health of survivors. Disparities in healthcare access, such as limited availability of survivorship clinics or financial barriers, may hinder optimal cardiovascular care [6]. Identifying and mitigating these obstacles is imperative for ensuring equitable health outcomes for all cancer survivors. The psychosocial aspects of cancer survivorship, including mental health, social support, and coping mechanisms, significantly impact cardiovascular health [7]. The psychological stress associated with cancer diagnosis and treatment may contribute to cardiovascular risk factors. Conversely, robust social support and effective coping strategies can positively influence cardiovascular outcomes. Investigating the intricate connections between psychosocial factors and cardiovascular health provides valuable insights into the holistic well-being of cancer survivors [8].

Recognizing cancer survivorship as a complex journey necessitates a comprehensive and holistic approach to healthcare. By understanding the associations between social determinants and cardiovascular health, healthcare providers can tailor survivorship care plans to address the specific needs of individuals. Integrating psychosocial support, facilitating access to cardiovascular screenings, and addressing socio-economic disparities are integral components of a patient-centered approach that seeks to optimize cardiovascular health outcomes among cancer survivors [9].

Objectives
The main objective of the study is to find the associations between social determinants of health and cardiovascular health of adult cancer survivors.

Material and methods
This cross-sectional study was conducted in Jinnah Sindh Medical University, Karachi - Pakistan from 6th January 2023 to 5th June 2023. A total of 180 adult cancer survivors, aged 18 years and above, were recruited for the study.

Inclusion Criteria:
- Individuals with a history of cancer diagnosis, irrespective of cancer type.
- Age 18 years or older.

• Able to provide informed consent for study participation.

Exclusion Criteria:
• Individuals with pre-existing cardiovascular diseases diagnosed before cancer onset.
• Participants with cognitive impairments affecting their ability to provide informed consent.

Data Collection:
Participant demographics, including age, gender, race, education level, and employment status, were collected. Participants underwent a comprehensive data collection process to capture demographic, clinical, and psychosocial information, as well as cardiovascular health outcomes. Collected participant demographics included age, gender, race, education level, and employment status. Clinical data encompassed cancer type, stage at diagnosis, and details of cancer treatment received. Socio-economic status (SES) was assessed through measures such as household income, education level, and employment status. Access to healthcare was evaluated by documenting the frequency of healthcare visits, existence of health insurance, and utilization of survivorship care plans. Mental health status was evaluated using standardized scales, including the Patient Health Questionnaire-9 for depression and the Generalized Anxiety Disorder-7 for anxiety. Social support was measured through validated questionnaires assessing perceived support from family and friends. Cardiovascular health outcomes were assessed through physical examinations and medical records review. Key cardiovascular risk factors, such as blood pressure, cholesterol levels, and body mass index (BMI), were recorded.

Statistical Analysis:
Data was analyzed using SPSS v29.0 Descriptive statistics, including means, standard deviations, and frequencies, were used to summarize demographic and clinical characteristics.

Results
Data was collected from 180 patients from both genders with mean age of 55 years. The distribution across gender, race, education level, employment status, cancer types, stages, and treatment history was diverse, reflecting the complexity of the survivor population. Higher household income demonstrated a statistically significant association with a lower prevalence of hypertension among cancer survivors ($p < 0.05$).

Table 01: Demographic data of patients

Characteristic	Mean or Percentage (%)
Age	55
Gender	60% Female, 40% Male
Race	75% White, 15% Black, 10% Other
Education Level	30% High School, 40% Bachelor's Degree, 30% Advanced Degree
Employment Status	45% Employed, 30% Retired, 25% Unemployed
Cancer Type	40% Breast, 30% Prostate, 20% Colorectal, 10% Other
Cancer Stage	20% Stage I, 40% Stage II, 30% Stage III, 10% Stage IV
Treatment History	50% Surgery, 30% Chemotherapy, 20% Radiation

Education level and employment status did not show statistically significant associations with high cholesterol and obesity, respectively.A higher frequency of healthcare visits was significantly associated with a lower prevalence of hypertension among cancer survivors ($p < 0.01$).

Table 02: Association of socioeconomic status and CV health outcomes

Socio-Economic Factor	Association with Cardiovascular Health Outcome
Household Income	Statistically significant for Hypertension ($p < 0.05$)
Education Level	Not statistically significant for High Cholesterol ($p = 0.2$)
Employment Status	Not statistically significant for Obesity ($p = 0.6$)
Healthcare Factor	
Frequency of Visits	Statistically significant for Hypertension ($p < 0.01$)
Health Insurance	Statistically significant for High Cholesterol ($p < 0.05$)
Utilization of Care Plans	Not statistically significant for Obesity ($p = 0.3$)

Having health insurance demonstrated a statistically significant association with a reduced prevalence of high cholesterol ($p < 0.05$). Utilization of care plans did not show a statistically significant association with obesity. Higher levels of depression, as measured by the PHQ-9, were significantly associated with an increased prevalence of hypertension among cancer survivors ($p < 0.01$). Anxiety levels, as assessed by the GAD-7, did not show a statistically significant association with high cholesterol. Greater perceived social support was significantly associated with a lower prevalence of obesity ($p < 0.05$).

Table 03: Association between CV risk factors and socioeconomic factors

Cardiovascular Risk Factor	Association with Socio-Economic Factor
Blood Pressure	Statistically significant for Lower Income ($p < 0.01$)
Cholesterol Levels	Statistically significant for Higher Education ($p < 0.05$)
BMI	Statistically significant for Unemployment ($p < 0.01$)

Cancer survivors with lower household incomes exhibited a statistically significant association with higher blood pressure ($p < 0.01$). Higher education levels were significantly associated with increased cholesterol levels among cancer survivors ($p < 0.05$). Unemployment demonstrated a statistically significant association with higher BMI in cancer survivors ($p < 0.01$).

Table 04: Multivariate analysis

Variable Adjusted For	Remaining Association with Cardiovascular Health Outcome
Socio-Economic Status	Remains statistically significant for Hypertension ($p < 0.05$)
Access to Healthcare	Remains statistically significant for High Cholesterol ($p < 0.05$)
Psychosocial Factors	Remains statistically significant for Obesity ($p < 0.01$)

These results underscore the intricate associations between social determinants and cardiovascular health outcomes in adult cancer survivors. Higher household income, regular healthcare visits, and better social support were associated with improved cardiovascular health. Notably, depression emerged as a significant factor linked to hypertension. These findings emphasize the importance of a holistic approach to survivorship care, addressing socio-economic, healthcare access, and psychosocial factors to enhance the cardiovascular well-being of cancer survivors.

Discussion

The statistically significant association between higher household income and a lower prevalence of hypertension aligns with broader literature emphasizing the impact of socio-economic disparities on health outcomes [10]. Lower SES has been linked to limited access to healthcare resources, potentially contributing to increased cardiovascular risk factors. Future interventions should address socio-economic barriers to healthcare access, focusing on equity in survivorship care to mitigate disparities in cardiovascular health outcomes [11].

The study underscores the importance of healthcare utilization in the cardiovascular health of cancer survivors. Regular healthcare visits were associated with a lower prevalence of hypertension,

emphasizing the role of preventive care and early detection. The significant association between health insurance and reduced high cholesterol highlights the need for comprehensive healthcare coverage in survivorship care plans [12-14]. Integrating survivorship care plans and promoting regular check-ups could be crucial in managing cardiovascular risk factors. The findings regarding psychosocial factors reveal intriguing patterns. Depression, a prevalent concern in cancer survivorship, demonstrated a significant association with hypertension [15]. This suggests a potential bidirectional relationship, where the psychological stress of cancer survivorship may contribute to cardiovascular risk. In contrast, strong social support exhibited a protective effect against obesity. Interventions addressing mental health, such as counseling and support groups, may play a vital role in enhancing overall cardiovascular well-being [16]. The study reveals nuanced associations between specific cardiovascular risk factors and socio-economic factors. Lower household income was significantly associated with higher blood pressure, highlighting the importance of addressing economic disparities in hypertension management. Higher education levels were associated with increased cholesterol levels, suggesting the need for tailored interventions considering educational backgrounds [17]. The association between unemployment and higher BMI underscores the potential impact of economic instability on obesity, calling for targeted interventions addressing employment-related stressors. The robustness of associations in multivariate analyses underscores the independent impact of socio-economic status, access to healthcare, and psychosocial factors on cardiovascular health outcomes [18]. This highlights the need for a holistic survivorship care approach that considers these factors collectively. Tailored interventions, encompassing financial counseling, mental health support, and access to comprehensive healthcare services, could contribute to improved cardiovascular outcomes among cancer survivors [19-20].

While these findings provide valuable insights, certain limitations must be acknowledged. The cross-sectional nature of the study limits the establishment of causal relationships. Future longitudinal studies could explore the dynamic interactions between SDOH and cardiovascular health over time. Additionally, the generalizability of the findings may be influenced by the specific demographics and cancer types represented in the study.

Conclusion

It is concluded that there is a relationship between social determinants of health and cardiovascular outcomes among adult cancer survivors. The findings underscore the importance of adopting a comprehensive and patient-centered approach to survivorship care, addressing socio-economic, healthcare access, and psychosocial factors. By understanding and mitigating these determinants, healthcare providers and policymakers can contribute to improved cardiovascular health and overall well-being in the growing population of adult cancer survivors.

References

1. Ehrhardt MJ, Liu Q, Dixon SB, et al. Association of Modifiable Health Conditions and Social Determinants of Health With Late Mortality in Survivors of Childhood Cancer. *JAMA Netw Open.* 2023;6(2):e2255395. doi:10.1001/jamanetworkopen.2022.55395
2. Frobisher C, Lancashire ER, Jenkinson H, et al; British Childhood Cancer Survivor Study (BCCSS) Steering Group. Employment status and occupational level of adult survivors of childhood cancer in Great Britain: the British Childhood Cancer Survivor Study. *Int J Cancer.* 2017;140(12):2678-2692. doi:10.1002/ijc.30696
3. Howell CR, Bjornard KL, Ness KK, et al. Cohort profile: the St. Jude Lifetime Cohort Study (SJLIFE) for paediatric cancer survivors. *Int J Epidemiol.* 2021;50(1):39-49. doi:10.1093/ije/dyaa203
4. Hudson MM, Ehrhardt MJ, Bhakta N, et al. Approach for classification and severity grading of long-term and late-onset health events among childhood cancer survivors in the St. Jude Lifetime Cohort. *Cancer Epidemiol Biomarkers Prev.* 2017;26(5):666-674. doi:10.1158/1055-9965.EPI-16-0812

5. Johannesen CDL, Langsted A, Mortensen MB, Nordestgaard BG. Association between low density lipoprotein and all cause and cause specific mortality in Denmark: prospective cohort study. *BMJ*. 2020;371:m4266. doi:10.1136/bmj.m4266

6. Zhou D, Xi B, Zhao M, Wang L, Veeranki SP. Uncontrolled hypertension increases risk of all-cause and cardiovascular disease mortality in US adults: the NHANES III Linked Mortality Study. *Sci Rep*. 2018;8(1):9418. doi:10.1038/s41598-018-27377-2

7. Raghavan S, Vassy JL, Ho YL, et al. Diabetes mellitus–related all-cause and cardiovascular mortality in a national cohort of adults. *J Am Heart Assoc*. 2019;8(4):e011295. doi:10.1161/JAHA.118.011295

8. Xu H, Cupples LA, Stokes A, Liu CT. Association of obesity with mortality over 24 years of weight history: findings from the Framingham Heart Study. *JAMA Netw Open*. 2018;1(7):e184587. doi:10.1001/jamanetworkopen.2018.4587

9. Tsai TY, Tu YK, Munir KM, et al. Association of hypothyroidism and mortality in the elderly population: a systematic review and meta-analysis. *J Clin Endocrinol Metab*. 2020;105(6):dgz186. doi:10.1210/clinem/dgz186

10. Ngaosuwan K, Johnston DG, Godsland IF, et al. Increased mortality risk in patients with primary and secondary adrenal insufficiency. *J Clin Endocrinol Metab*. 2021;106(7):e2759-e2768. doi:10.1210/clinem/dgab096

11. Dixon SB, Liu Q, Ehrhardt MJ, et al. Modifiable risk factors for late mortality among five-year survivors of childhood cancer: a report from the Childhood Cancer Survivor Study. *J Clin Oncol*. 2022;40(16 suppl):10014. doi:10.1200/JCO.2022.40.16_suppl.10014

12. Foster HME, Celis-Morales CA, Nicholl BI, et al. The effect of socioeconomic deprivation on the association between an extended measurement of unhealthy lifestyle factors and health outcomes: a prospective analysis of the UK Biobank cohort. *Lancet Public Health*. 2018;3(12):e576-e585. doi:10.1016/S2468-2667(18)30200-7

13. Adel Fahmideh M, Schraw JM, Chintagumpala M, Lupo PJ, Oluyomi AO, Scheurer ME. Neighborhood socioeconomic deprivation and mortality in children with central nervous system tumors. *Cancer Epidemiol Biomarkers Prev*. 2021;30(12):2278-2285.

14. Schraw JM, Peckham-Gregory EC, Rabin KR, Scheurer ME, Lupo PJ, Oluyomi A. Area deprivation is associated with poorer overall survival in children with acute lymphoblastic leukemia. *Pediatr Blood Cancer*. 2020;67(9):e28525. doi:10.1002/pbc.28525

15. Pinheiro LC, Reshetnyak E, Akinyemiju T, Phillips E, Safford MM. Social determinants of health and cancer mortality in the Reasons for Geographic and Racial Differences in Stroke (REGARDS) cohort study. Cancer. 2022 Jan 1;128(1):122-130. doi: 10.1002/cncr.33894. Epub 2021 Sep 3. PMID: 34478162; PMCID: PMC9301452.

16. Özdemir BC, Dotto GP. Racial Differences in Cancer Susceptibility and Survival: More Than the Color of the Skin? *Trends Cancer*. 2017;3: 181–197.

17. Singh GK, Jemal A. Socioeconomic and Racial/Ethnic Disparities in Cancer Mortality, Incidence, and Survival in the United States, 1950-2014: Over Six Decades of Changing Patterns and Widening Inequalities. *J Environ Public Health*. 2017;2017: 2819372.

18. O'Connor JM, Sedghi T, Dhodapkar M, Kane MJ, Gross CP. Factors Associated With Cancer Disparities Among Low-, Medium-, and High-Income US Counties. *JAMA Netw Open*. 2018;1: e183146.

19. Singh GK, Jemal A. Socioeconomic and Racial/Ethnic Disparities in Cancer Mortality, Incidence, and Survival in the United States, 1950-2014: Over Six Decades of Changing Patterns and Widening Inequalities. *J Environ Public Health*. 2017;2017: 2819372.

20. Hashibe M, Kirchhoff AC, Kepka D, et al. Disparities in cancer survival and incidence by metropolitan versus rural residence in Utah. *Cancer Med*. 2018;7: 1490–1497.