Using SAS® 9.4 to run Survival Analysis on Nationally Representative Data

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Abstract

In population based studies, it is often important to apply sample weights in order to derive estimates that apply to the population. PROC SURVEYPHREG can be used to incorporate stratification, clustering, and unequal weighting. The findings demonstrate the importance of assessing CRP in individuals who are obese in order to prevent mortality.

Relevant Literature

- More than 1/3 adults have obesity in the United States
- Cardiorenal Syndrome (CRS), gradually develops in a continuum as seen in Figure 1.
- Instead of using cardiovascular disease and renal disease as separate confounding variables, they must be used in conjunction.
- This closely related comorbidity of diabetes, is associated with increased mortality, growing complications, and increased cost of care[1]
- Defined as a bidirectional pathological impairment of either the heart or the kidney as a result of acute or chronic primary dysfunction in either organ, both adversely affected by diabetes[2].
- Depending on the primary organ affected and the acuteness of the condition, this syndrome constitutes five subtypes[3], as seen in Figure 1.

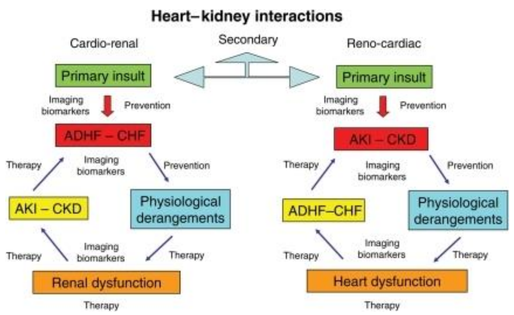


Figure 1: Diagrammatic demonstration of different types of Cardiorenal Syndrome and

Research Question

Does C-reactive protein level modify the effect of obesity on all cause mortality?

Procedures/Data Analysis

- The NHANES survey is a population-based survey in the United States
- This is an annual survey done on the non-institutionalized population of the United States by the National Center for Health Statistics (NCHS).
- All respondents from this nationally representative study were 20 years and older.
- Analysis was performed using complex samples Cox Regression to determine the relationship of obesity and all cause mortality.
- All patients from the nationally representative NHANES study, 20 years and older between the years 1999-2010 were included in the analysis.
- Glomerular filtration rate (GFR) was derived from the Cockcroft-Gault equation.

Creatinine Clearance (mL/min) = [(140 - age) x Lean Body Weight (LBW)] / Cr x 72 (For women multiplied by 0.85 to account for smaller muscle mass compared with men)

- A GFR of less than 60 was considered to be CKD as previously validated.
- CVD was determined by the self-reported diagnosis of coronary heart disease, angina, stroke, congestive heart disease, and heart attack.
- All missing variables were excluded.
- National Vital Statistics was linked to yield followup mortality data
- SAS 9.4 was used for analysis

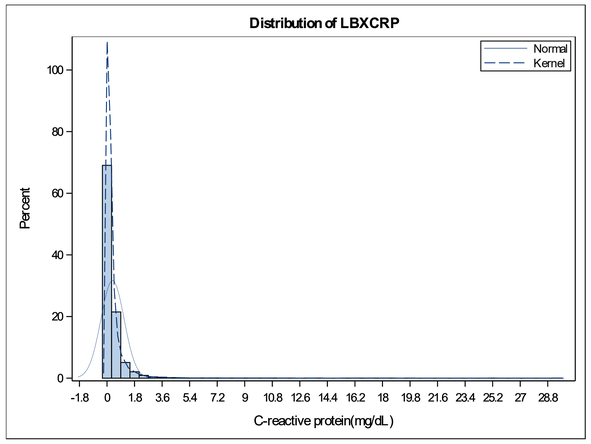


Figure 2: Distribution of hs-CRP in the sample.

Findings

Parameter	Estimate	Standard Error	t Value	Pr > |t|	Hazard Ratio	95% Hazard Ratio Confidence Limits	
Gender	0.099231	0.093131	1.07	0.2898	1.104	0.918	1.329
Obesity	-0.034335	0.063680	-0.54	0.5912	0.966	0.851	1.097
Smoking Status	0.138602	0.064298	2.16	0.0341	1.149	1.011	1.305
Diabetes status	-0.241532	0.140376	-1.72	0.0891	0.785	0.594	1.038
Cardiorenal Syndrome	0.442258	0.055642	7.95	<.0001	1.556	1.393	1.738

Figure 3: Maximum Likelihood Estimate for Cox Regression for individuals in <1 mg/dL hs-CRP.

Parameter	Estimate	Standard Error	t Value	Pr > |t|	Hazard Ratio	95% Hazard Ratio Confidence Limits	
Gender	-0.047371	0.286229	-0.17	0.8690	0.954	0.540	1.686
Obesity	1.057863	0.245669	4.31	<.0001	2.880	1.767	4.696
Smoking Status	-0.035714	0.315791	-0.11	0.9102	0.965	0.515	1.809
Diabetes	-0.270044	0.494771	-0.55	0.5867	0.763	0.285	2.043
Cardiorenal Syndrome	0.600758	0.281150	2.14	0.0356	1.824	1.042	3.190

Figure 4: Maximum Likelihood Estimate for Cox Regression for individuals in > 3 mg/dL of hs-CRP

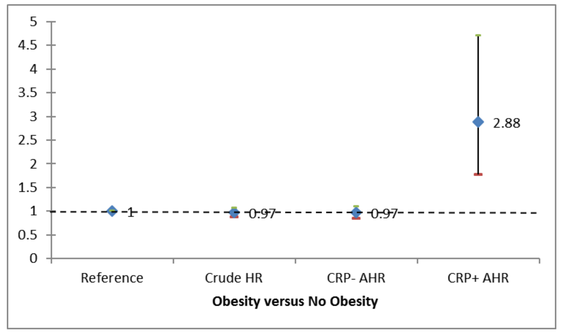
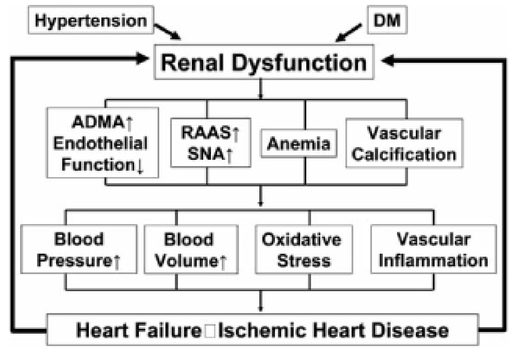


Figure 5: Crude and Adjusted Hazard Ratio of all-cause mortality in those with obesity (Adjusted for gender, smoking status, diabetes, and cardioreanal syndrome)

Conclusions

- Among those individuals with highest tertile hs-CRP, individuals that are obese have 188% higher likelihood mortality than those who are not obese
- Consequently individuals with CRS and obesity need to inflammatory markers monitored in order to assess risk of mortality
- *Risk factors need to be*
- Health care practitioners need to be made aware of this potential effect of inflammatory biomarkers.



Future Research Implications

- More research needs to be conducted to understand how inflammatory biomarkers modify the effect of obesity on mortality.
- Further analysis can utilize structural equation modeling in order to explore the relationships between the variables.