Body-Mass Index and Heart Failure in HIV in a Large Electronic Cohort

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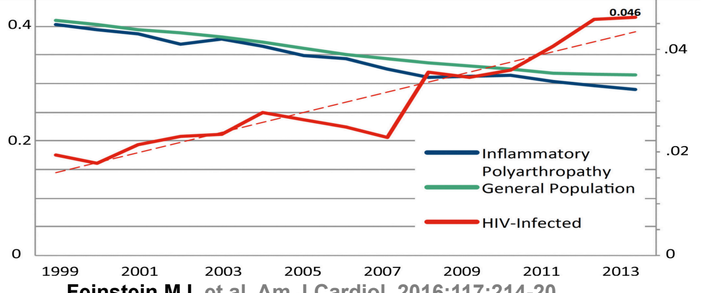
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BACKGROUND

HIV and Cardiovascular Diseases (CVD)

HIV+ persons: Accelerated, elevated, and increasing CVD risks.

Proportionate CVD Mortality in the United States, 1999-2013



Feinstein MJ, et al. Am J Cardiol. 2016;117:214-20.

-Heart Failure Risks are 1.5-2x greater in HIV even after adjustment for relevant demographic and clinical covariates.
-General Population: HF more common w/ higher BMI, but "obesity paradox" exists for total mortality: higher mortality for low-normal weight, perhaps due to unrecognized comorbidity.
-The **association between BMI and HF in HIV is unknown.**
-HIV+ persons **at low BMI may have elevated HF risk due to advanced HIV/AIDS**, whereas **HIV+ persons at high BMI may be at risk for HF** due to traditional CVD risk factors

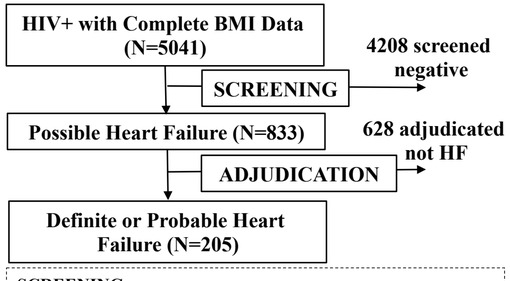
OBJECTIVES & HYPOTHESES

Objective: Evaluate the association between BMI and adjudicated HF for HIV-infected persons.

Hypothesis: HIV+ persons with extremes of BMI (>20 and >30 kg/m^2) will have significantly elevated risks for heart failure

METHODS AND RESULTS

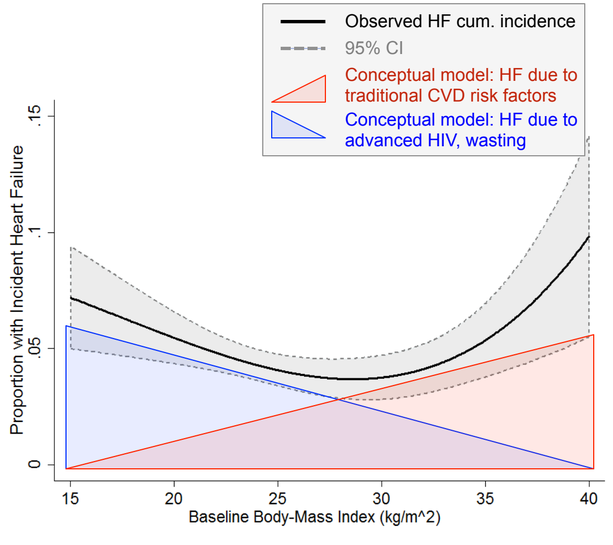
Study Population and Screening: Northwestern Medicine Enterprise Data Warehouse HIV-CVD Cohort



SCREENING
Possible heart failure (HF) if ANY of the following:
1. **Validated ICD-9-CM or ICD-10-CM codes for HF**
2. **Any Brain natriuretic peptide (BNP) value >100 pg/mL**
3. **Any NTpro-BNP value >300 pg/mL**
4. **Any use of intravenous diuretic**

ADJUDICATION
Probable HF:
HF symptoms + physician diagnosis + medical therapy for HF
Definite HF:
Probable HF + objective findings of cardiac dysfunction and/ or volume overload on cardiac imaging

Heart Failure Cumulative Incidence by Body-Mass Index with Overlaid Conceptual Model



Heart Failure Odds by Body-Mass Index

	Model 1		Model 2		Model 3		Model 4	
Body-Mass Index	Odds Ratio (95% CI)	P value	Odds Ratio (95% CI)	P value	Odds Ratio (95% CI)	P value	Odds Ratio (95% CI)	P value
<18.5	3.25 (1.78-5.95)	<0.001	2.30 (1.23-4.30)	0.009	2.95 (1.39-6.28)	0.005	2.33 (1.05-5.14)	0.04
18.5-20	2.72 (1.56-4.77)	<0.001	2.33 (1.31-4.15)	0.004	2.32 (1.19-4.49)	0.01	2.13 (1.08-4.21)	0.03
20-22.5	1.84 (1.17-2.89)	0.008	1.69 (1.07-2.68)	0.025	1.94 (1.16-3.27)	0.01	1.87 (1.10-3.18)	0.02
22.5-25 (Referent)								
25-30	0.85 (0.54-1.33)	0.47	0.70 (0.44-1.12)	0.14	0.53 (0.32-0.91)	0.02	0.49 (0.28-0.85)	0.01
30-35	1.60 (0.95-2.71)	0.08	1.46 (0.85-2.49)	0.17	1.21 (0.68-2.16)	0.51	1.23 (0.68-2.22)	0.49
35-40	1.93 (0.94-3.97)	0.08	1.67 (0.79-3.51)	0.18	1.34 (0.60-2.97)	0.47	1.46 (0.65-3.27)	0.36
40+	1.16 (0.65-2.04)	0.62	1.01 (0.55-1.84)	0.97	1.17 (0.61-2.25)	0.64	1.15 (0.58-2.27)	0.69

Model 1: Unadjusted
Model 2: Adjusted for age, sex, race
Model 3: Adjusted for age, sex, race, hypertension, diabetes, HDL cholesterol, and total cholesterol
Model 4: Adjusted for age, sex, race, hypertension, diabetes, HDL cholesterol, and total cholesterol, CD4 count nadir, peak HIV viral load (category), ART use, PI use

CONCLUSIONS

- Among HIV-Infected Persons, Heart Failure is **Most Prevalent at Relative Extremes of BMI(<20 kg/m^2 and ≥35 kg/m^2)** and least prevalent in the mildly overweight (25-29.9 kg/m^2) range
  - Odds of HF remained **significantly elevated for low BMI persons after adjustment** for demographics, CVD risk factors, and HIV-related factors
  - **Different than the general population**: graded, consistently greater HF prevalence at increasing BMI levels
- Why might the distribution of HF across BMI levels differ in HIV & general population
  - Different causes of HF (see conceptual model):
    - General population: Hypertension, coronary disease ((+) assoc w/ BMI)
    - HIV: Some HTN & CAD, some non-vascular causes (viral/immune) actually (-) assoc w/ BMI
  - Residual confounding: HIV+ persons at low BMI generally "sicker"
  - BMI not the *cause* of HF, but rather associated with other factors predisposing to HF

LIMITATIONS

- Cross-sectional study, not longitudinal
- No uninfected controls w/ adjudicated HF (yet)
- Out-of-network HF events missed

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