

Sodium and HF: Myth?

Ileana L. Piña, MD, MPH, FACC

Professor of Medicine and Epidemiology/Population
Health

Albert Einstein College of Medicine

Associate Chief for Academic Affairs Cardiology

Montefiore-Einstein Medical Center



ACC Latin America
Conference 2016

***Dietary Guidelines for Americans, 2010. Alexandria, VA: US
Department of Agriculture, Center for Nutrition Policy and Promotion.***

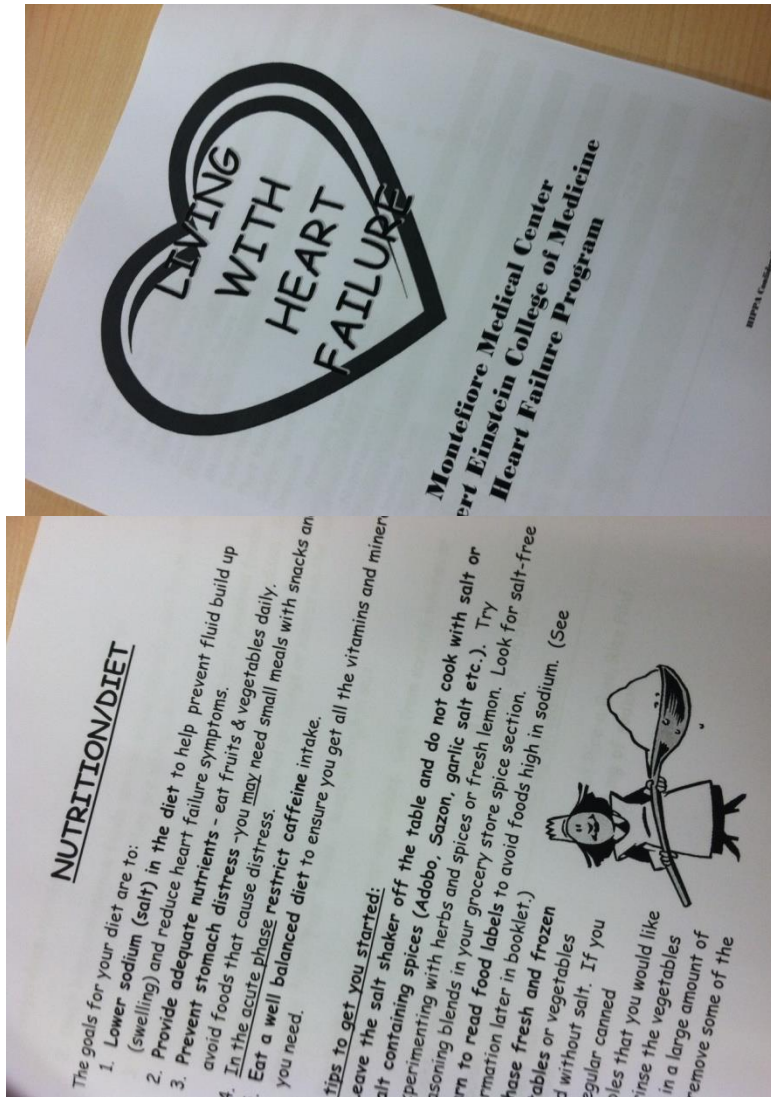
- Reduce daily sodium intake to less than 2,300 milligrams (mg) and further reduce intake to 1,500 mg among persons who are 51 and older and those of any age who are African American or have hypertension, diabetes, or chronic kidney disease. The 1,500 mg recommendation applies to about half of the U.S. population, including children, and the majority of adults.

***The U.S. Department of Agriculture (USDA) and the U.S. Department of
Health and Human Services***



ACC Latin America
Conference 2016

Patient education



- ▶ Education of HF patients and their families is critical and often complex.
- ▶ **2 gm/day sodium diet**
- ▶ Educate patients/caregivers about *indications and adverse effects of medications*
- ▶ *Symptoms to look for*
- ▶ *Management of fluid retention*
- ▶ Patient education booklet:
- ▶ Repeat at each visit
- ▶ Break down into sections



HFSA 2010 Practice Guideline

Nonpharmacologic—Diet and Nutrition

Recommendation 6.1

Dietary instruction regarding sodium intake **is recommended** in all patients with HF.

Patients with HF and diabetes, dyslipidemia or severe obesity should be given specific dietary instructions.

Strength of Evidence = B

HFSA 2010 Practice Guideline

Nonpharmacologic—Dietary Sodium

Recommendation 6.2

Dietary sodium restriction (2-3 g daily) **is recommended** for patients with the clinical syndrome of HF and preserved or depressed LVEF.

- Further restriction (< 2 g daily) **may be considered** in moderate to severe HF.

Strength of Evidence = C

2009 Focused Update: ACCF/AHA Guidelines for the Diagnosis and Management of Heart Failure in Adults

- Many patients are able to modify their own diuretic regimen in response to changes in weight that exceed a predefined range. The restriction of dietary sodium (to 2 g daily or less) can greatly assist in the maintenance of volume balance.



Low K⁺ Diet Is Now Recommended Management, But Compliance Is Difficult

1. Foods rich in potassium content are pervasive and all encompassing
2. Consequently, strictly adhering to a low potassium diet exerts a toll on the patient's quality of life



Conference 2016

2013 ACCF/AHA Guidelines for the Management of HF

- **Class IIa**
- **Sodium restriction is reasonable for patients with symptomatic HF to reduce congestive symptoms. (*Level of Evidence: C*)**
- Even the widely embraced dictum of sodium restriction in HF is not well supported by current evidence.

Yancy C. et al. ***Circulation***. 2013;128:1810-1852.)



ACCF/AHA
Conference 2016

Table. Guideline Recommendations for Dietary Sodium and Fluid Restriction in Heart Failure

Guideline	Year	Recommendation	Level of Evidence
		Sodium Restriction Recommendation Fluid Restriction Recommendation	
National Heart Foundation of Australia/Cardiac Society of Australia and New Zealand	2006 ⁷	<3 g/d for NYHA class II without peripheral edema/ <2 g/d for NYHA class III and IV <2 L/d for all patients and <1.5 L/d during fluid retention episodes	C
Heart Failure Society, India	2007 ⁴	<2 g/d <2 L/d	Not Stated
European Society of Cardiology	2008 ⁵	Moderate restriction 1.5–2 L/d in patients with severe symptoms and especially with hyponatremia	C
Canadian Cardiovascular Society	2008 ⁶	<2 g/d 2 L/d	Not Stated
American College of Cardiology/American Heart Association	2009 ²	Moderate restriction (≤ 2 g/d, if volume overload, followed by fluid intake restriction to 2 L/d if fluid retention persists)	C
Royal College of Physicians	2010 ³	<i>Salt reduction</i> <i>Fluid restriction</i>	Limited; further research required
Heart Failure Society of America	2010 ⁸	2–3 g/d; <2 g/d may be considered in moderate to severe heart failure <2 L/d, if fluid retention persists and if severe hyponatremia (serum Na <130 mEq/L) is present	C
Scottish Intercollegiate Guidelines Network	2010 ⁹	<2.4 g/d tailored fluid restriction	1+
American Dietetic Association	2011 ¹⁰	<2 g/d 1.4–1.9 L/d depending on clinical symptoms	Fair

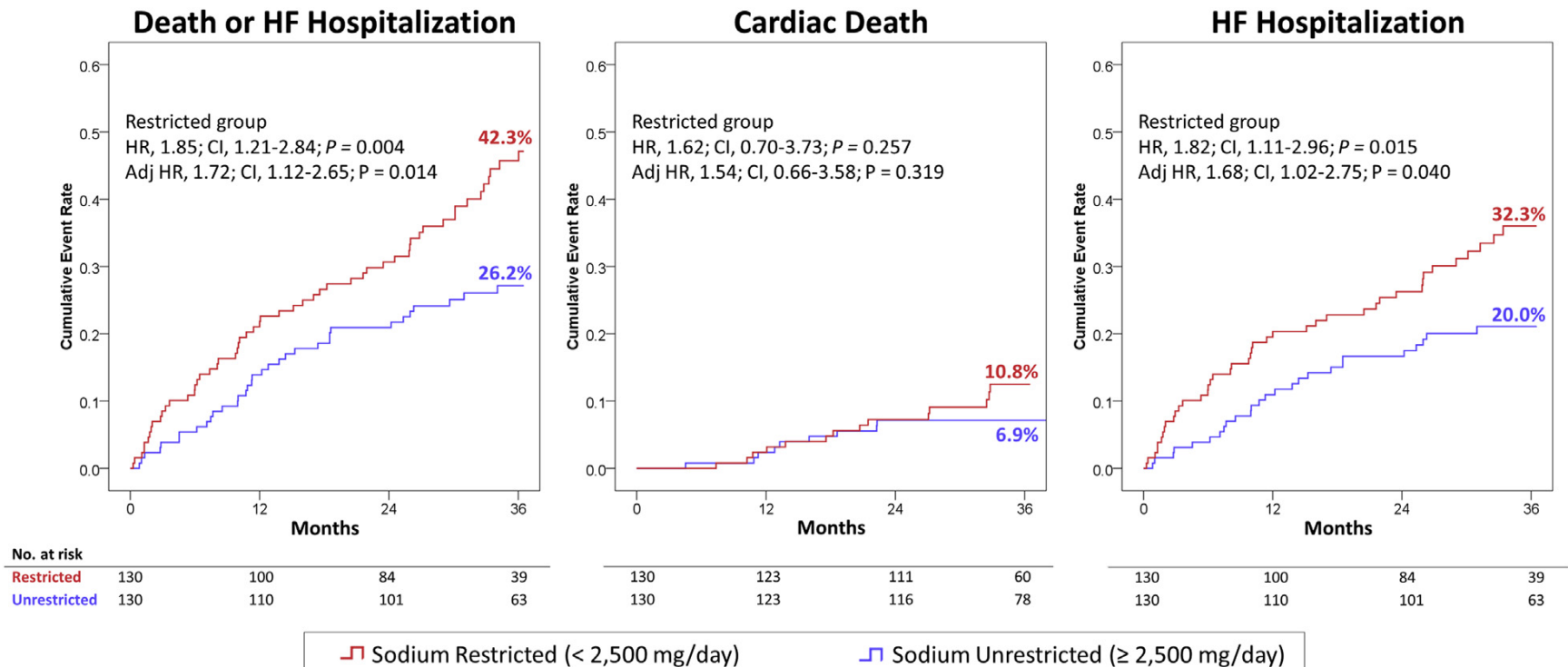
Level of Evidence: C=Limited populations evaluated. Only consensus opinion of experts, case studies, or standard of care; Fair=Benefits exceed the harms but quality of evidence is not as strong; 1+ = well-conducted meta-analysis, systemic reviews, or randomized controlled trials with low risk of bias. NYHA indicates New York Heart Association.



Impact of Dietary Sodium Restriction on Heart Failure Outcomes

Rami Doukky, MD, MSc,*†‡§ Elizabeth Avery, MS,*§ Ashvarya Mangla, MD,*†§ Fareed M. Collado, MD,† Zeina Ibrahim, MD,† Marie-France Poulin, MD,† DeJuran Richardson, PhD,*§|| Lynda H. Powell, PhD*§

JACC: HEART FAILURE CME



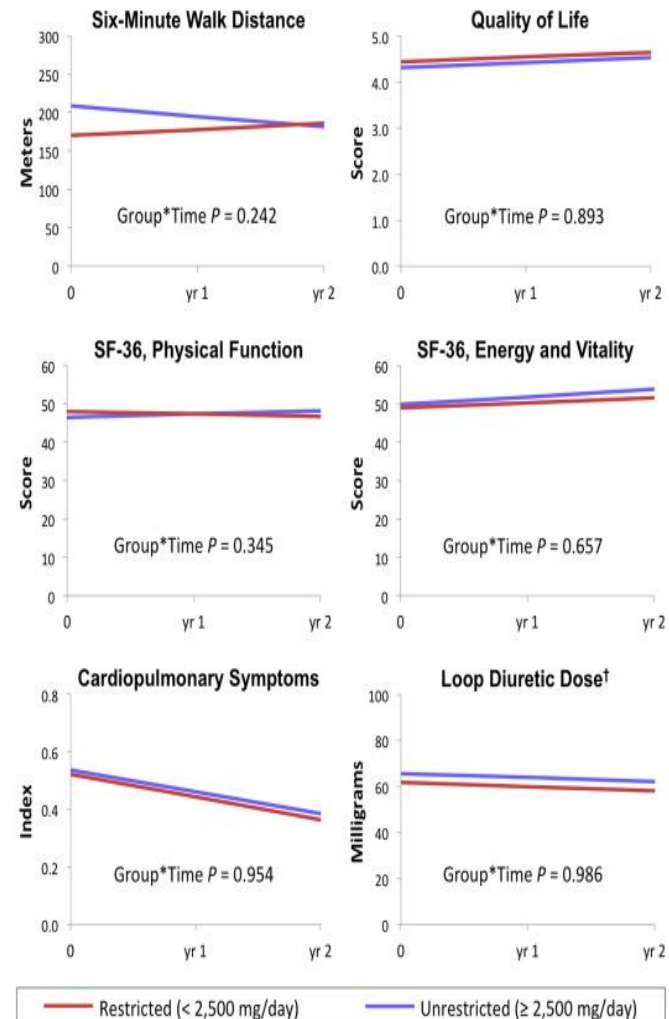
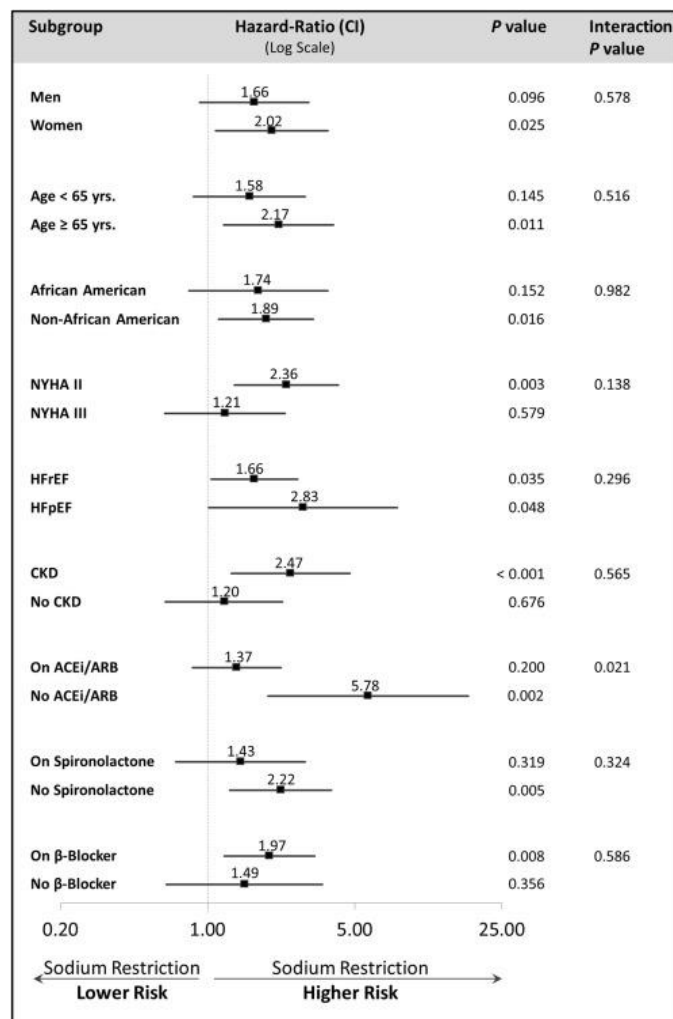


Figure 3. Impact of Sodium Restriction on Death or Heart Failure Hospitalization by Subgroups of the Propensity-Matched CohortACEi = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; CI = 95% confidence interval; CKD = chronic kidney...

JACC: Heart Failure, Volume 4, Issue 1, 2016, 24–35

<http://dx.doi.org/10.1016/j.jchf.2015.08.007>

Figure 4. Impact of Sodium Restriction on Time-Varying Outcome Measures in the Propensity-Matched CohortThe p values represent test of significance of between-groups difference in the trajectory of time-varying outcome measures (group * time interaction), adju...

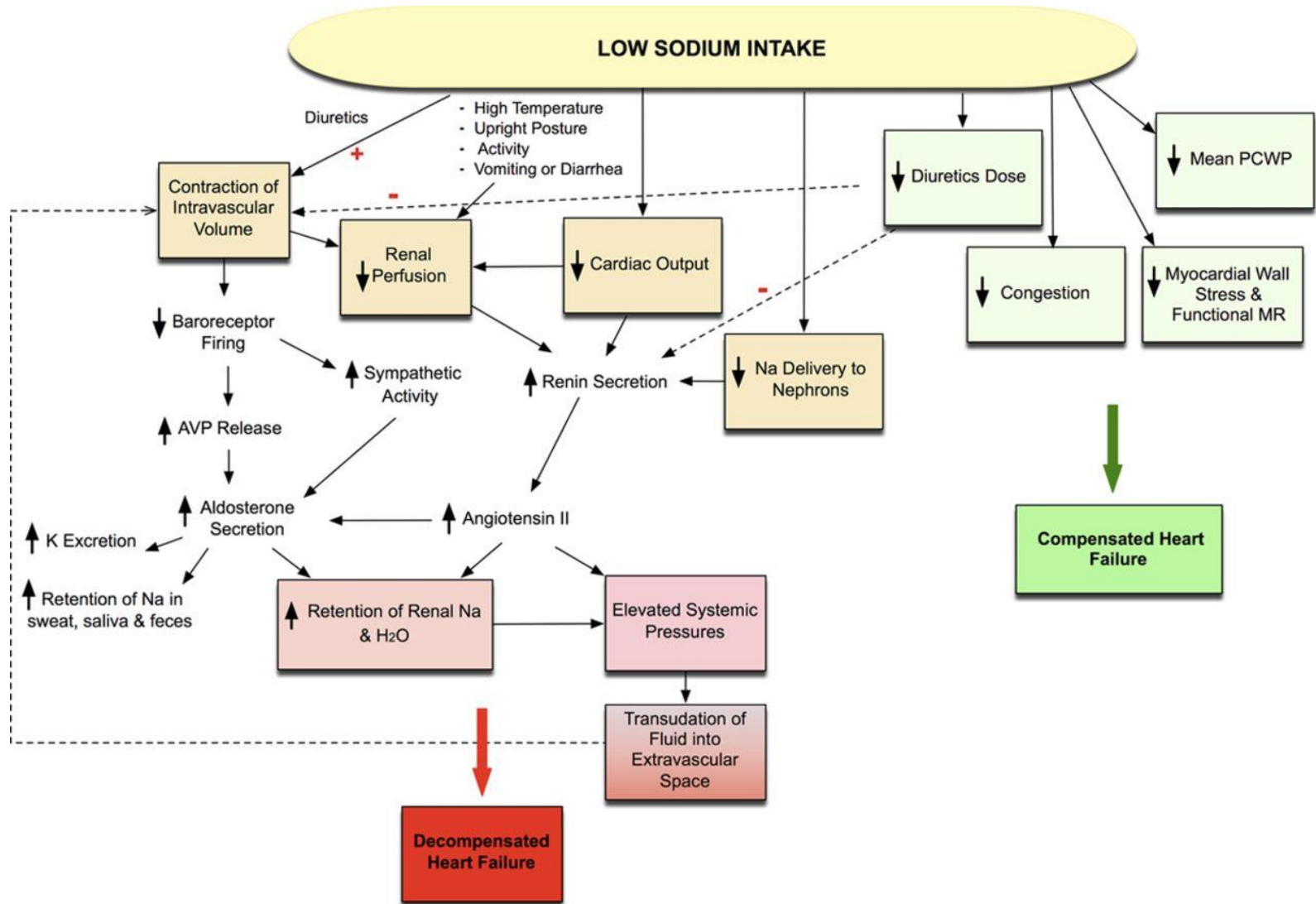
TABLE 2 Impact of Sodium Restriction on Heart Failure Outcomes

Events	Crude Even Rates			Unadjusted Risk		Adjusted Risk*	
	Total	Restricted	Unrestricted	HR (95% CI)	p Value	HR (95% CI)	p Value
Entire cohort, N = 833							
Death	163 (19.6)	30 (20.7)	133 (19.3)	1.09 (0.73–1.62)	0.676	1.19 (0.76–1.85)	0.448
Cardiac death	105 (12.6)	16 (11.0)	89 (12.9)	0.86 (0.51–1.47)	0.589	1.03 (0.58–1.83)	0.928
HF hospitalization	199 (23.9)	44 (30.3)	155 (22.5)	1.44 (1.03–2.01)	0.033†	1.44 (1.002–2.06)	0.049†
Death or HF hospitalization	303 (36.4)	62 (42.8)	241 (35.0)	1.32 (0.995–1.74)	0.054	1.37 (1.01–1.86)	0.042†
PS-Matched cohort, N = 260							
Death	38 (14.6)	24 (18.5)	14 (10.8)	1.83 (0.94–3.53)	0.074	1.69 (0.87–3.31)	0.123
Cardiac death	23 (8.8)	14 (10.8)	9 (6.9)	1.62 (0.70–3.73)	0.257	1.54 (0.66–3.58)	0.319
HF hospitalization	68 (26.2)	42 (32.3)	26 (20.0)	1.82 (1.11–2.96)	0.015†	1.68 (1.02–2.75)	0.040†
Death or HF hospitalization	89 (34.2)	55 (42.3)	34 (26.2)	1.85 (1.21–2.84)	0.004†	1.72 (1.12–2.65)	0.014†

Values are n (%) unless otherwise indicated. HR and CI were derived from Cox proportional hazard models. *In the entire cohort analyses adjustment was for the PS; in the propensity-matched cohort analysis adjustment was for covariates with >10% absolute standardized difference between the propensity-matched groups (Figure 1). †Statistically significant.

CI = confidence interval; HF = heart failure; HR = hazard ratio (restricted vs. unrestricted); PS = propensity score.

Effects of sodium intake in heart failure (HF).



Javed Butler et al. Circ Heart Fail. 2015;8:636-645

Dietary sodium modulation of aldosterone activation and renal function during the progression of experimental heart failure

Wayne L. Miller*, Daniel D. Borgeson, J. Aaron Grantham, Andreas Luchner, Margaret M. Redfield, and John C. Burnett Jr

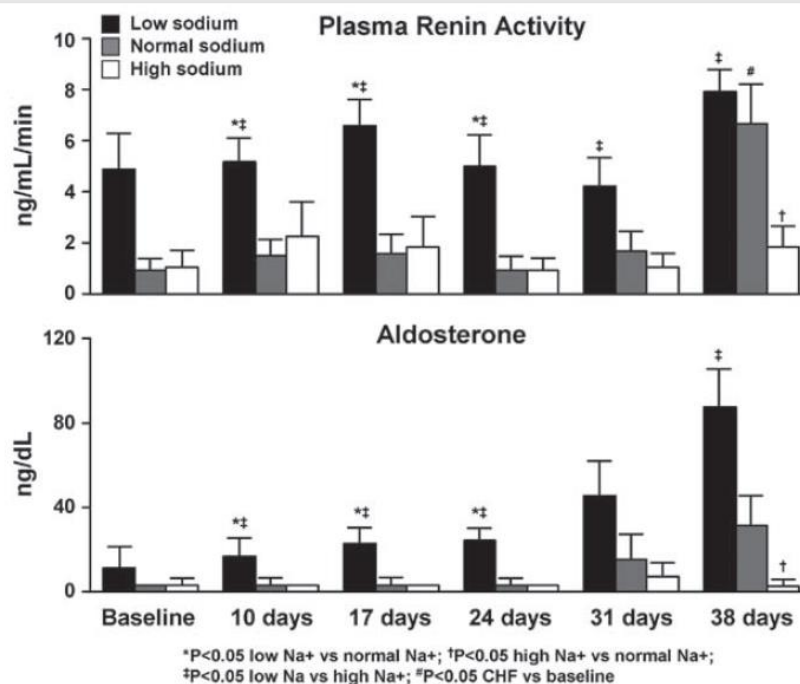


Figure 3 Modulating actions of dietary sodium on plasma rennin activity and aldosterone activation in experimental heart failure.



Reduced Dietary Sodium Intake Increases Heart Rate. A Meta-Analysis of 63 Randomized Controlled Trials Including 72 Study Populations

Niels A. Graudal^{1*}, Thorbjørn Hubeck-Graudal² and Gesche Jürgens³

TABLE 2 | Mean heart rate effect of sodium reduction stratified by blood pressure quartiles of the American population.

Systolic BP percentile, mmHg	Number of studies (participants)	Heart rate, MD (95%CI) (beats/min)	Z (p)
0–25 %, <110	3 (304)	0.91 [0.37, 1.45]	3.28 (0.001)
25–50 %, 110–119	18 (1204)	2.18 [1.26, 3.11]	4.62 (0.00001)
50–75 %, 119–131	20 (1472)	1.99 [0.72, 3.27]	3.06 (0.002)
75–100 %, ≥131	31 (2452)	1.41 [0.75, 2.07]	4.21 (0.0001)



Low (80 mmol) vs High (120 mmol) Sodium

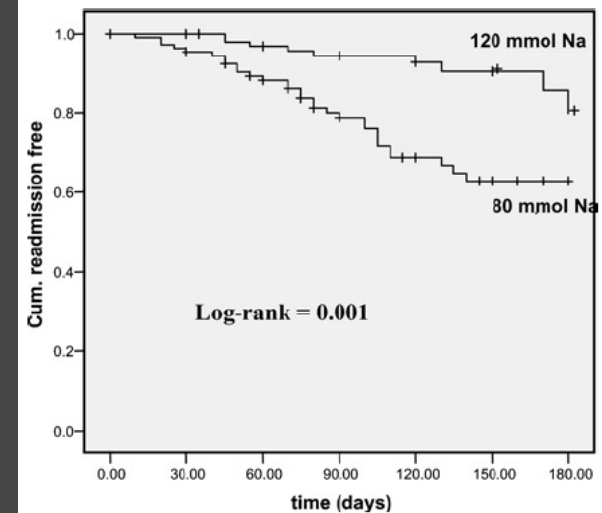
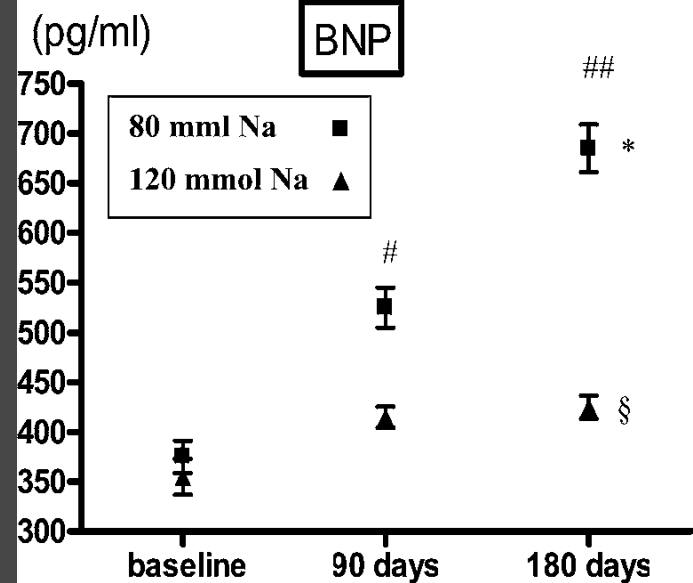
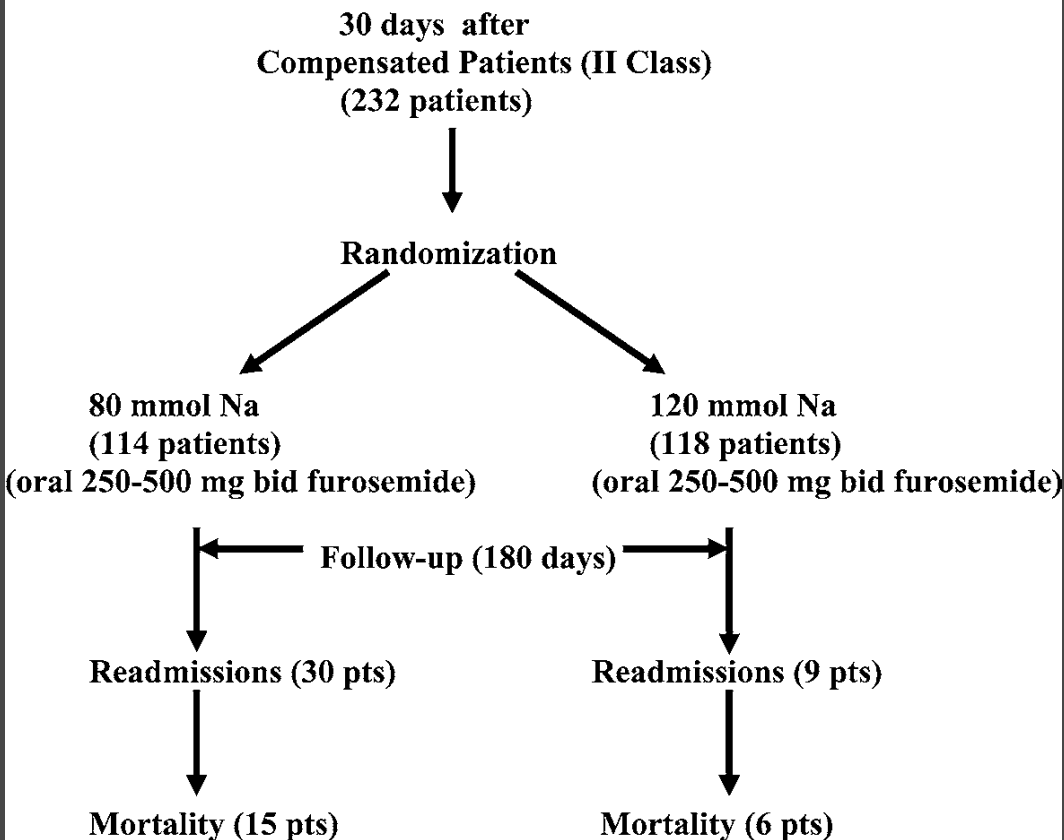


Figure 3 Kaplan-Meier cumulative event curves for the primary end point (readmissions) in the two groups during 180 days of follow-up

Paterna et al: Clinical Science (2008) 114, 221–230

Is low sodium (<1.8 mg/day) harmful?

Low-sodium vs normal-sodium diets in patients with systolic heart failure (HF)*

Outcomes	Number of trials (n)	Weighted event rates		At a median 584 d	
		Low sodium	Normal sodium	RRI (95% CI)	NNH (CI)
All-cause mortality	6 (2747)	23%	12%	95% (66 to 129)	8 (7 to 11)
Sudden death	6 (2747)	5.6%	3.3%	72% (21 to 144)	39 (24 to 98)
HF mortality	4 (2421)	17%	7.6%	123% (77 to 181)	10 (8 to 14)
HF readmissions	6 (2747)	43%	21%	110% (67 to 164)	5 (4 to 6)

**Abbreviations defined in Glossary. Weighted event rates, RRI, and CI calculated from relative risks and control event rates in article using a random-effects model.*

DiNicolantonio JJ, Di Pasquale P, Taylor RS, Hackam DG. Low sodium versus normal sodium diets in systolic heart failure: systematic review and meta-analysis. *Heart*. 2012 Aug 21. [Epub ahead of print].

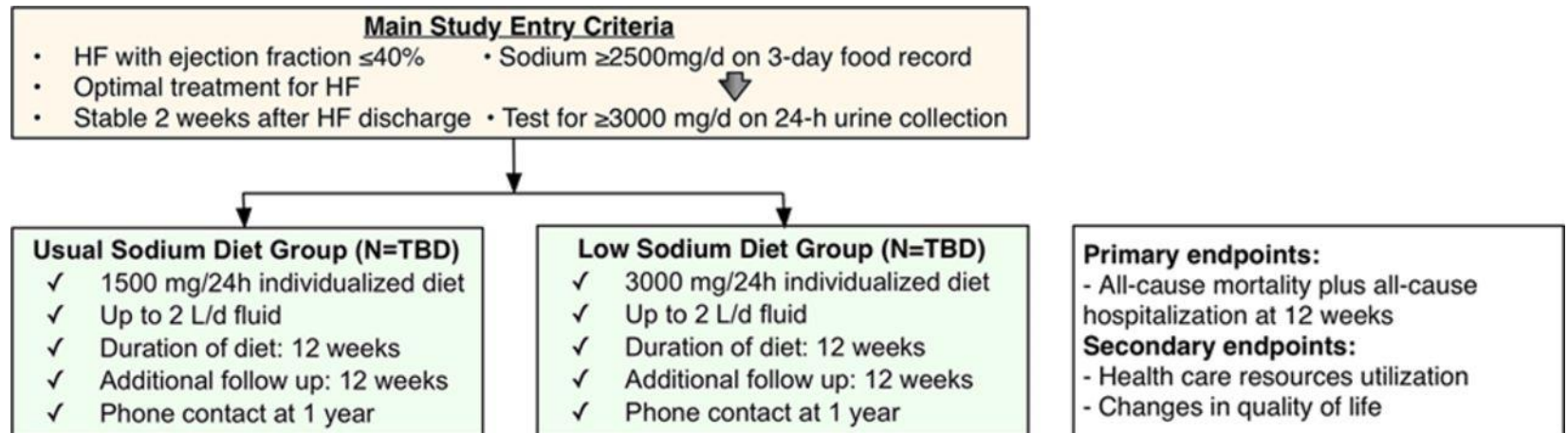
Deswal comment: 19 February 2013 | ACP Journal Club | Volume 158 • Number 4

Why the differences among studies?

- ADHF vs. chronic compensated HF
- Early HF to late disease
- Dietary recall by diaries vs. actual measure including urine
 - **24 hr recall is usual, not sufficient**
- Concomitant use of diuretics
 - **Fixed vs. variable dose**
 - **High dose vs. low**
- Fluid restriction
- Doses of evidence-based medical Rx
- Etiology of HF?
- Subpopulations, race, ethnicity



Outline of the proposed full-scale clinical trial.



Javed Butler et al. Circ Heart Fail. 2015;8:636-645

Clinical Recommendations

- “Currently, there are insufficient data to endorse any specific level of Na intake with certainty, and differences among the various HF subpopulations are not known.”
- Effects of sodium restriction in nonwhite HF patients and those with HF-PeF are unknown.
- The new AHA recommendations for 1500 mg/d Na appears to be appropriate for stage A and B HF, because of the data linking Na intake with HTN, risk factors, such as obesity.



Clinical Recommendations

- In Stage C and D HF there are insufficient data to support a fixed amount of daily Na.
- Agree that some degree of Na restriction in patients with stage C and D HF is reasonable, but more data are needed to support a specific sodium intake level.
- It should not be acceptable to make recommendations based on consensus but rather to generate the data needed to make a balanced scientific statement.
- Especially worrisome are the data that Na restriction can be harmful.



ACC Latin America
Conference 2016

Clinical Recommendations

- Flexible diuretic regimens.
- Avoid volume depletion that can trigger the RAAS response.
- “However, when the patient is euvolemic, with no edema and a normal central venous pressure, diuretics should be decreased or discontinued to avoid volume depletion and worsening renal function”
- *M. Commentary on Alti et al.*



ACC Latin America
Conference 2016

Thank you!