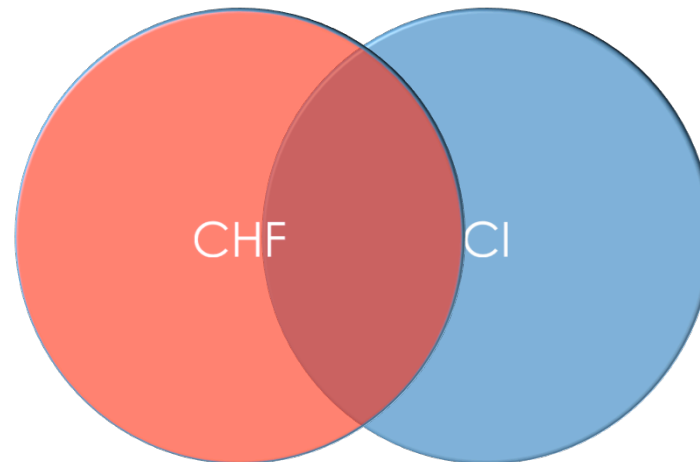


Cognition, CHF and Complex Care



Geriatric Division Rounds

June 27, 2017

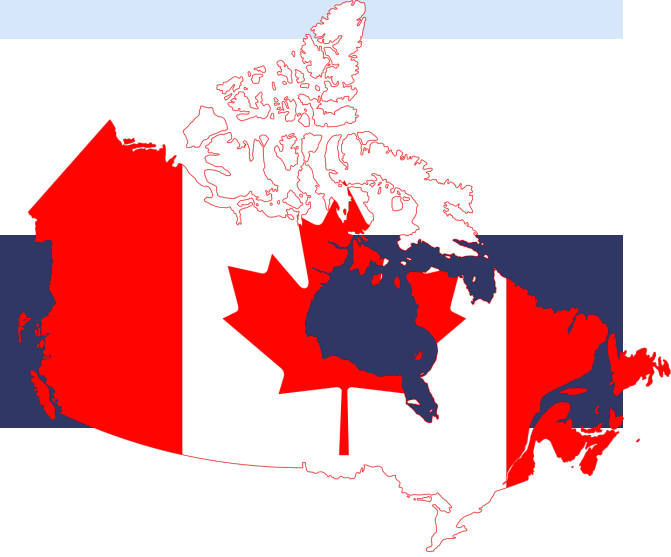
Marion MacKay-Dunn

PGY4, Geriatrics

Objectives

- Discuss cognitive impairment (CI) as a comorbidity of congestive heart failure (CHF)
 - Common
 - Correlation/Causation
 - Consequences
- Recognize complex care needs of this cohort

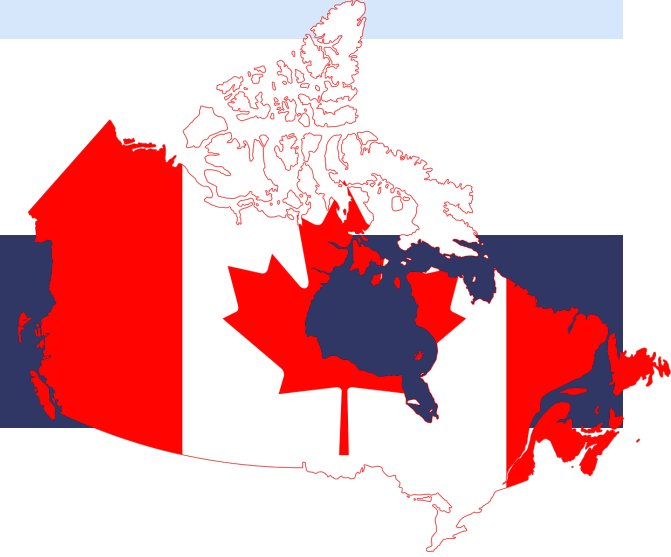
CHF in Canada



1% of Canadians

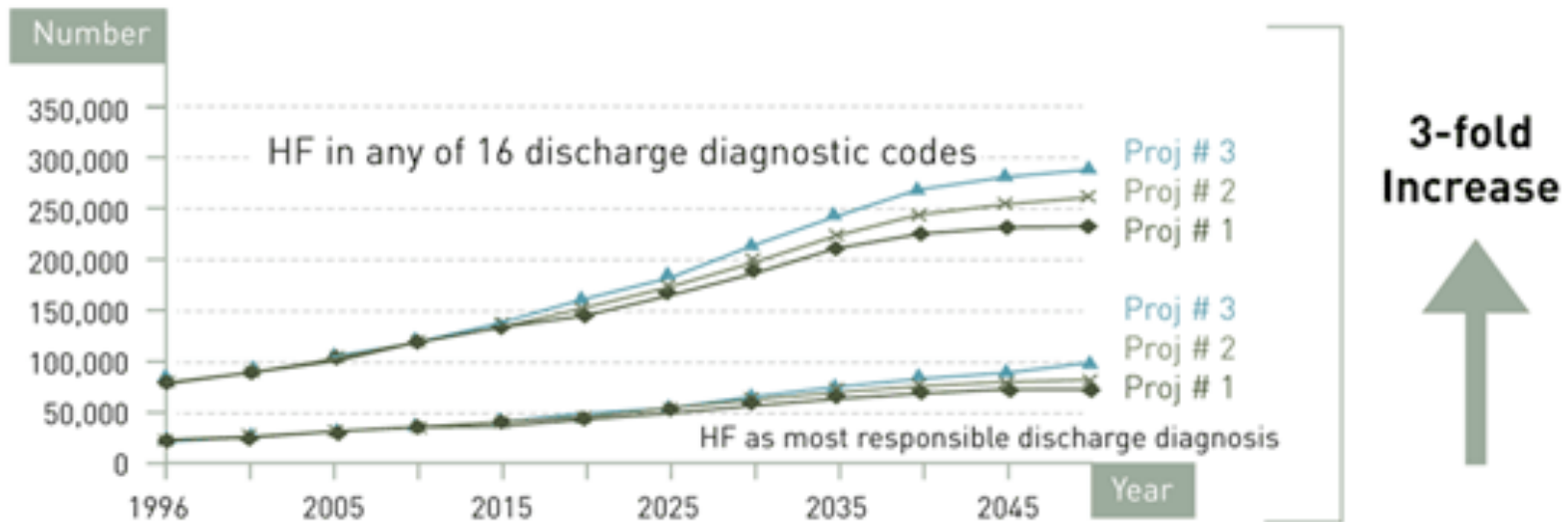
Chow C-M et al. Can J Cardiol 2005;21(14):1265-71.

CHF in Canada



1% of Canadians
.....and counting!

Chow C-M et al. Can J Cardiol 2005;21(14):1265-71.

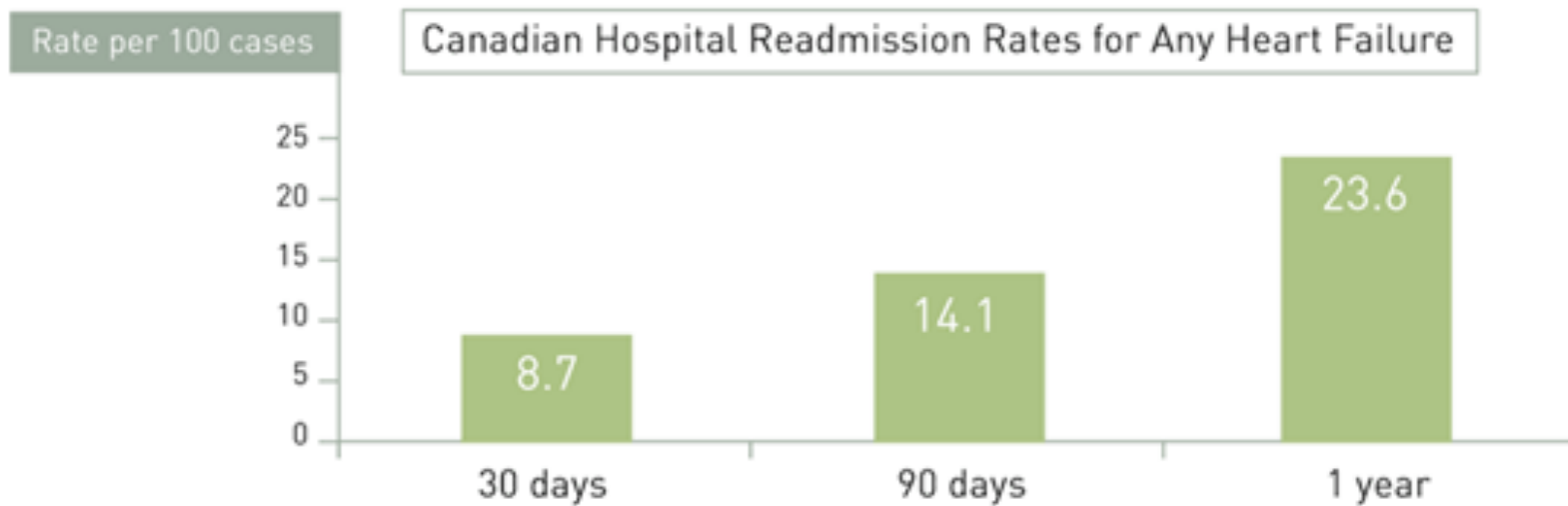


Johansen et al. Can J Cardiol 2003;19(4):430-5.

Leading cause for hospital admission,

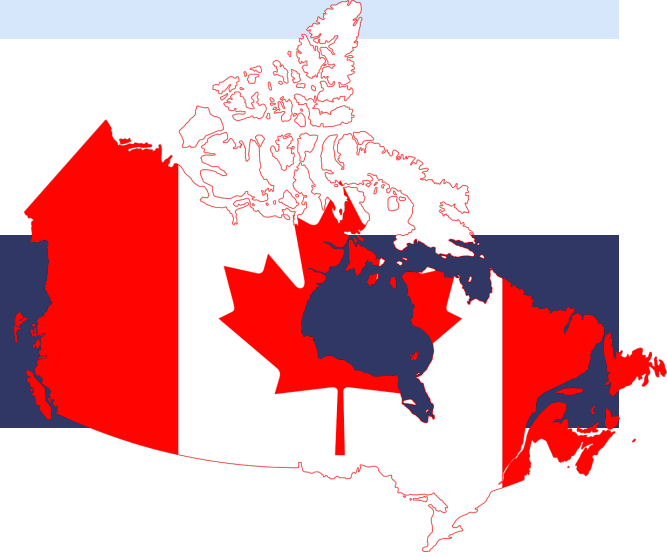


Leading cause for hospital admission
...and re-admission.



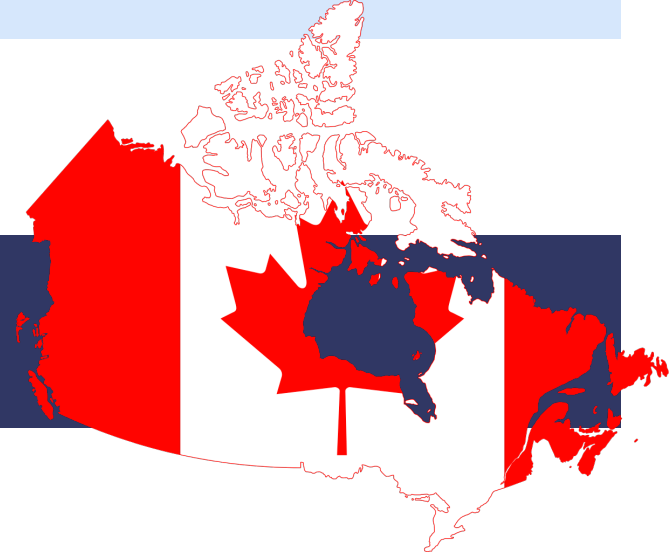
Lee DS et al. Can J Cardiol 2004;20(6):599-607

CHF, Consequences



- ▣ Leading cause of death and disability
 - ▣ 1-year mortality 33%, increases with age

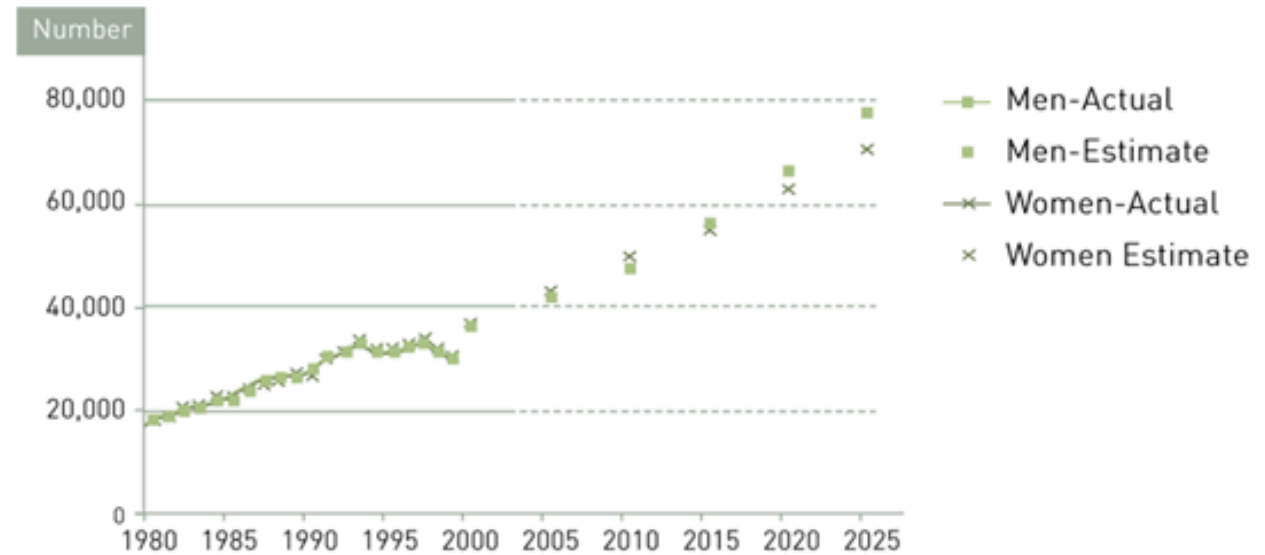
CHF, Consequences



- ▣ Leading cause of death and disability
 - ▣ 1-year mortality 33%, increases with age
- ▣ ~10/ 100 hospitalized patients >65 years die in hospital d/t CHF each year
 - ▣ ~13/100 hospitalized patients over 75 years

Lee DS et al. Can J Cardiol 2004;20(6):599-607.

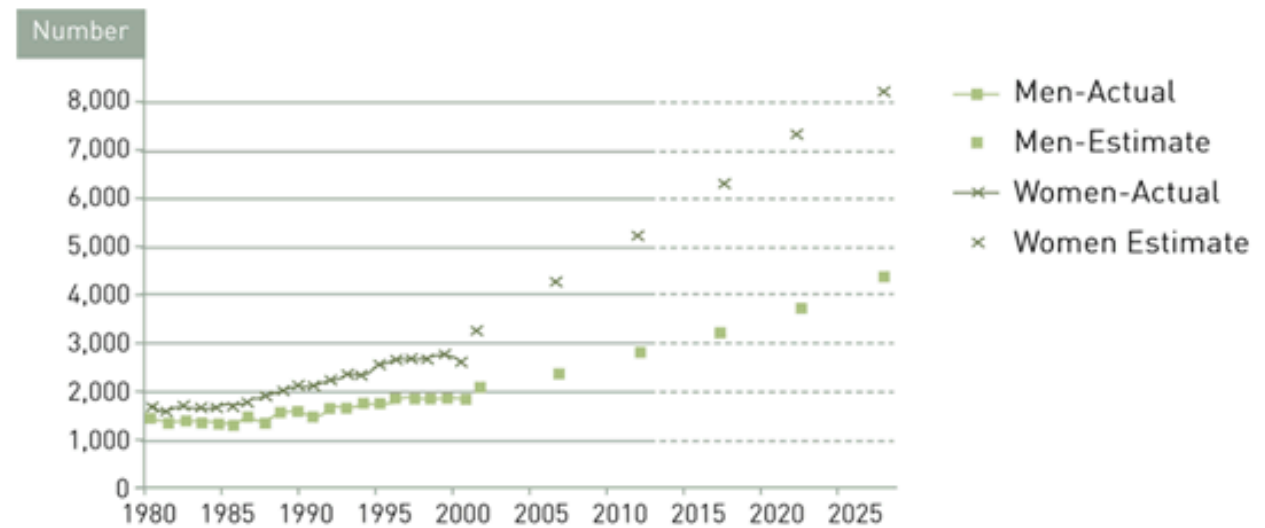
Number of Hospitalizations for CHF (actual and projected) in Canada 1980-2025



#trending

Heart and Stroke Foundation of Canada

Number of CHF Deaths (actual and projected) in Canada, 1980-2025



Heart and Stroke Foundation of Canada

CHF, Consequences



- ▣ 1-2% prevalence w/in developed nations
 - ▣ >10% age 70+ years

- ▣ #1 cause of unplanned admissions in elderly

Cannon et al. 2015. Alzheimer's Research & Therapy 7-22.

Geriatric Giants

- ▣ Immobility

Geriatric Giants

- ▣ Immobility
- ▣ Iatrogenesis

Geriatric Giants

- ▣ Immobility
- ▣ Iatrogenesis
- ▣ Incontinence

Geriatric Giants

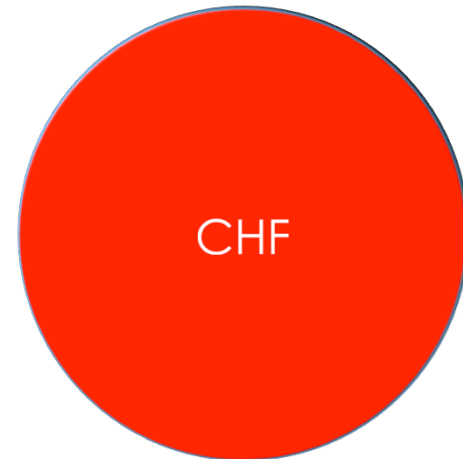
- ▣ Immobility
- ▣ Iatrogenesis
- ▣ Incontinence
- ▣ Instability

Geriatric Giants

- ▣ Immobility
- ▣ Iatrogenesis
- ▣ Incontinence
- ▣ Instability
- ▣ Impaired Cognition

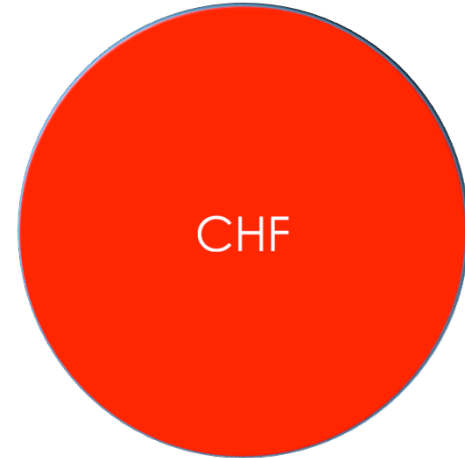
CHF, the new Geri Giant?

- ▣ Immobility
- ▣ Iatrogenesis
- ▣ Incontinence
- ▣ Instability
- ▣ Impaired Cognition
- ▣ ***...Impaired Heart Function?***

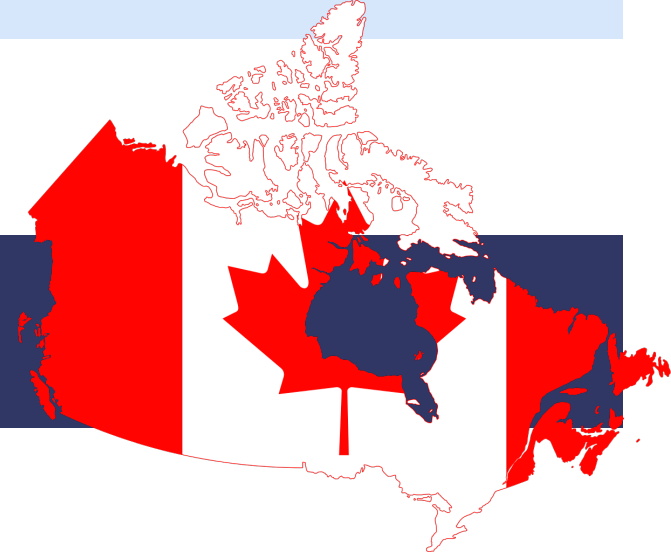


CHF, the new Geri Giant?

- ▣ Immobility
 - ▣ Iatrogenesis
 - ▣ Incontinence
 - ▣ Instability
 - ▣ Impaired Cognition
 - ▣ ...Impaired Heart Function?
 - ▣ >80% CHF hospitalizations are >65yrs
 - ▣ HTN & CHD increases with age, RFs increase CHF
- Bader et al. 2017

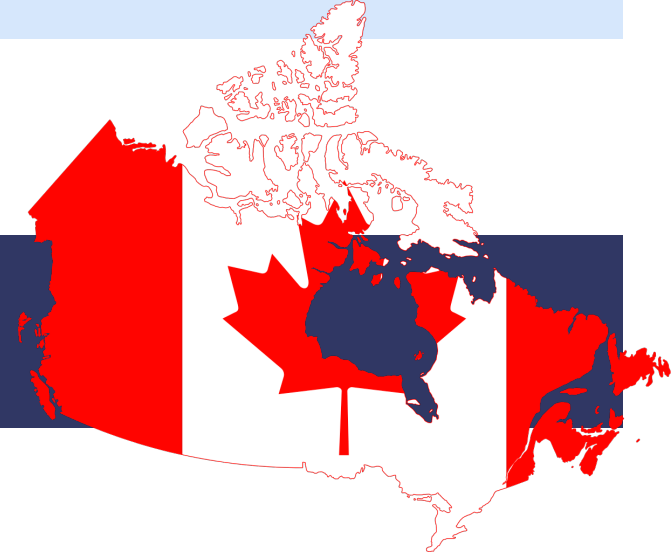


CI in Canada



- ▣ ~1 % >45 years in the community
- ▣ 5% aged > 80years

CI in Canada

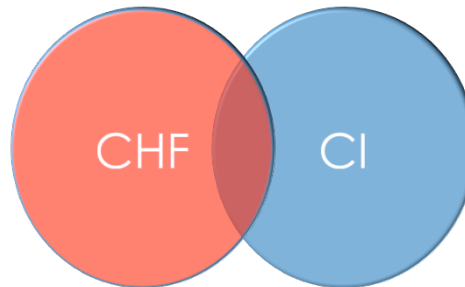


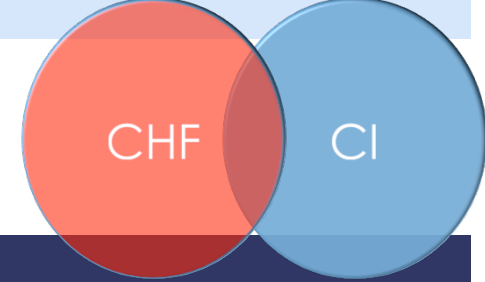
- ▣ ~1 % >45 years in the community
 - ▣ 5% aged > 80years
- ▣ 45% of 45+years living in LTC
 - ▣ 56% age 80+years

CHF & CI in Elderly

- Cognitive impairment is common in the elderly with CHF
 - CI in 25-75% CHF*

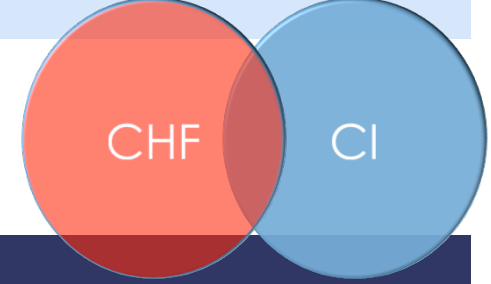
Ampadu & Morley International Journal of Cardiology 2015; 178 (12-23)





CHF & CI in Elderly

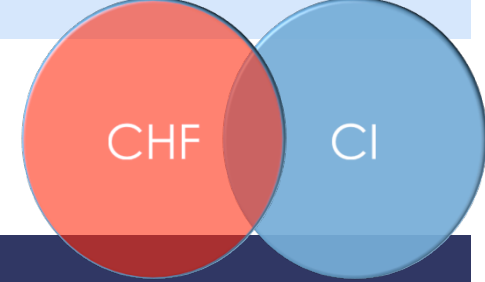
- The Cardiovascular Health Study 2015
 - Prospective longitudinal study in U.S.
 - community population
 - incident CHF 1990-2002 until 2008
 - n=5888 X=79 years



CHF & CI in Elderly

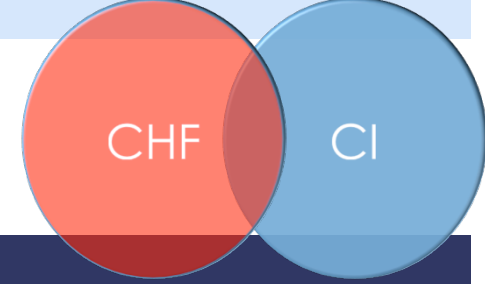
- The Cardiovascular Health Study 2015
 - 3MSE screen
 - CI in 1 in 5 patients with CHF

2015 Murad et al. HACC Heart Fail. July 3(7):542-550



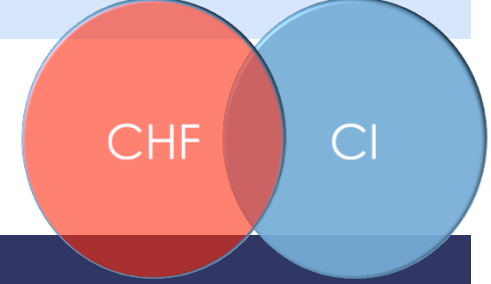
CHF & CI in Elderly

- The Cardiovascular Health Study 2015
 - CI increases mortality HR 1.33 (1.02-1.73)
 - 19% at 1 year,
 - 56% at 5 year,
 - 83% at 10 years



CHF & CI in Elderly

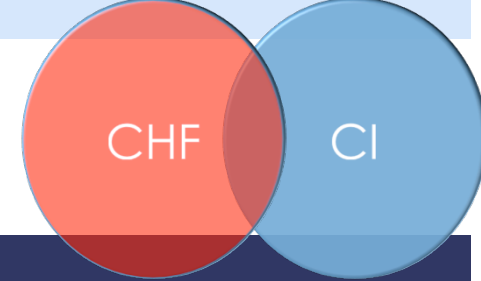
- The Cardiovascular Health Study 2015
 - CI increases mortality HR 1.33 (1.02-1.73)
 - 19% at 1 year,
 - 56% at 5 year,
 - 83% at 10 years
 - Increase mortality seen w/ comorbidities, impaired function & cognition



Congestion/Cognition Comorbid

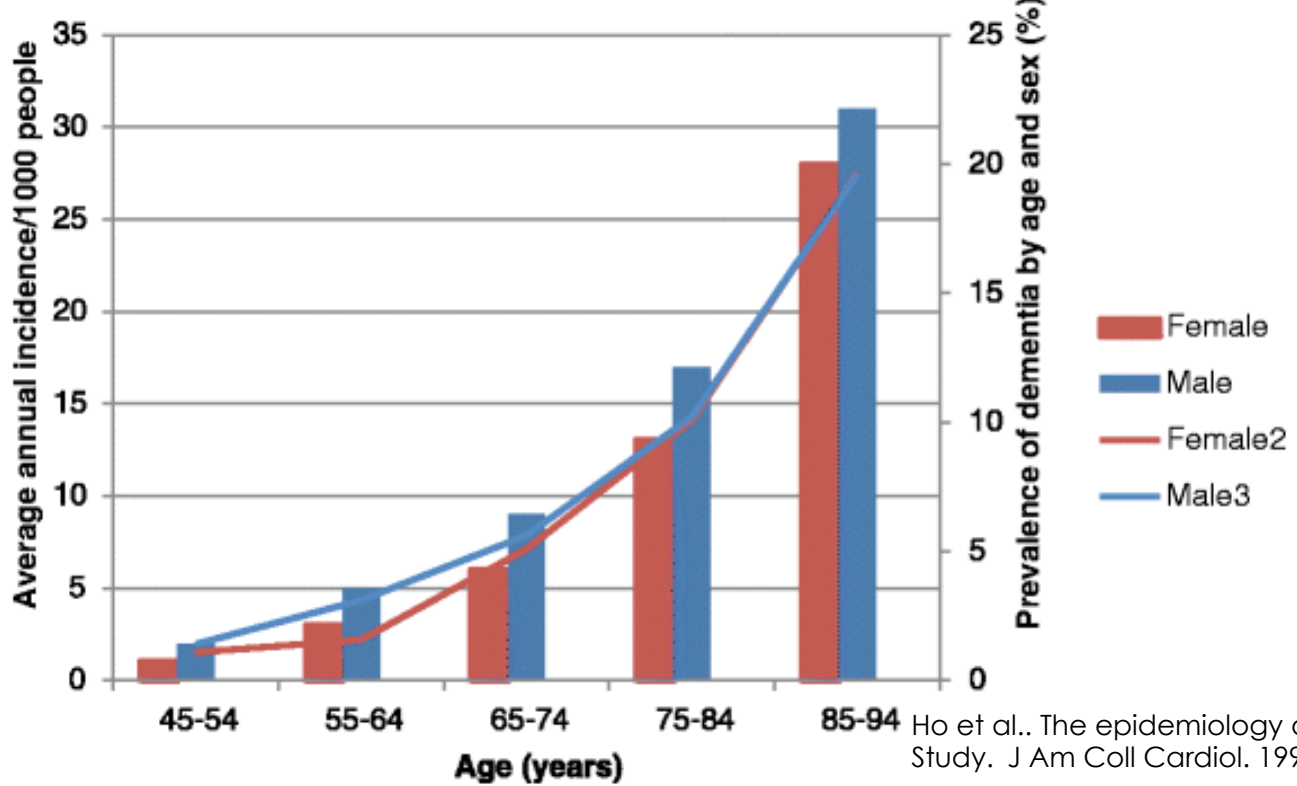
- ▣ Recent Systematic Review of 17 large studies
 - ▣ n = 29 456 X= 75.6yrs
 - ▣ ~1/3 of patients with CHF had CI
 - ▣ MCI 32%, 31% Any CI

Yohannes et al. 2017 Journal of Post-Acute and Long Term Care Medicine



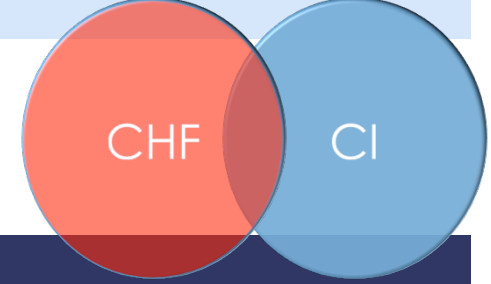
Incidence...Coincidence?

Graph showing incidence of HF and prevalence of dementia in 2 community based populations



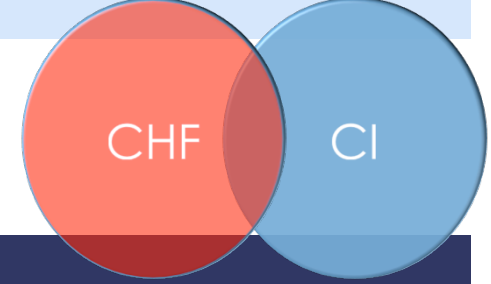
Ho et al.. The epidemiology of heart failure: The Framingham Study. J Am Coll Cardiol. 1993;Suppl 4:A6-A13.

Cannon et al. 2015 Alzheimer's Research & Therapy 2-22



Congestion, Cognition: Consensus

- ▣ CHF is common in the elderly
 - ▣ HFrEF (CAD), HFpEF (HTN)



Congestion, Cognition: Consensus

- ▣ CHF is common in the elderly
 - ▣ HFrEF (CAD), HFpEF (HTN)
- ▣ CI is common in the elderly
 - ▣ Delirium, MCI, AD, VaD

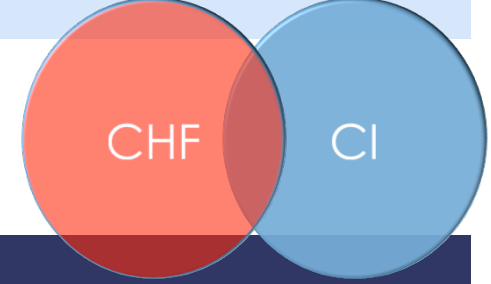


CHF

CI

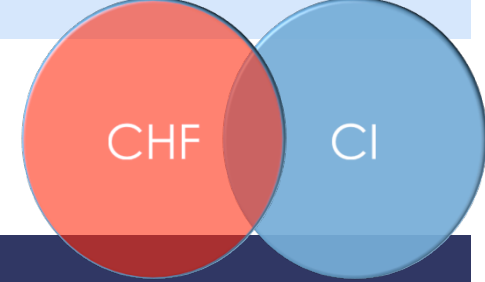
Congestion, Cognition: Consensus

- ▣ CHF is common in the elderly
 - ▣ HFrEF (CAD), HFpEF (HTN)
- ▣ CI is common in the elderly
 - ▣ Delirium, MCI, AD, VaD
- ▣ Both high morbidity & mortality & resource use
 - ▣ Increases with age
 - ▣ Expected doubling



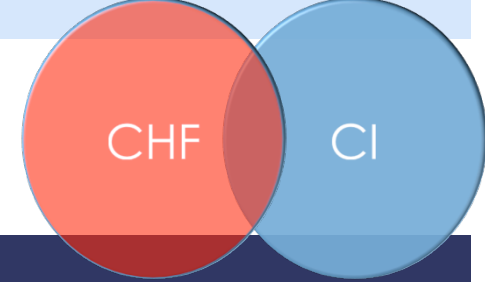
CHF & CI: Counting

- ▣ Inpatient “Decompensated” HF
 - ▣ Cross-Sectional Data
 - ▣ Zuccala 1997 Italian study
 - ▣ n=57 X=77yrs
 - ▣ → 53% CI (MMSE <24)



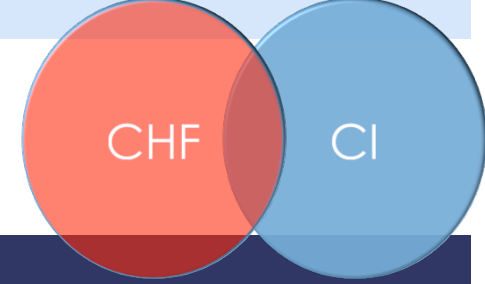
CHF & CI: Counting

- ▣ Inpatient “Decompensated” HF
 - ▣ Cross-Sectional Data
 - ▣ Dodson 2013 American Study
 - ▣ n=282 X=80yrs
 - ▣ → 46.8 % CI (MMSE <24)
 - ▣ 25% mild (21-24),
 - ▣ 22% moderate/severe CI (<21)



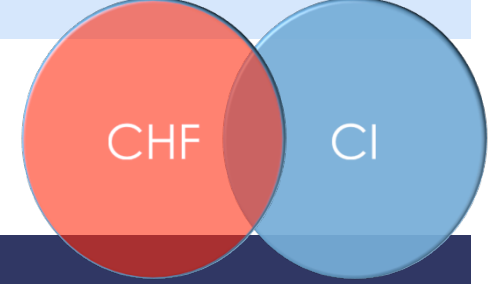
CHF & CI: Counting

- ▣ Inpatient HF: Case-Control
 - ▣ Trojano 2003
 - ▣ n=149 HF NYHA-II, 159 NYHA-II/IV w/ 207 controls
 - ▣ X>65 years
 - ▣ → HF had deficits attention, verbal fluency, learning on neuropsychological testing



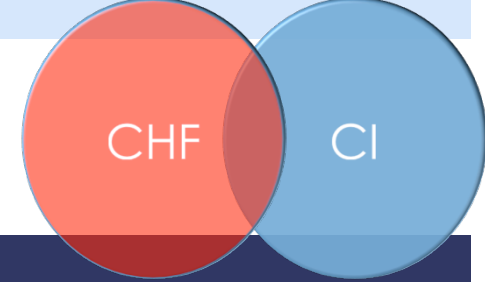
CHF & CI: Counting

- ▣ Inpatient HF: Case-Control
 - ▣ Zuccala 2005
 - ▣ n=1511 HF w/ 11790 controls
 - ▣ X=79 years
 - ▣ → HF 35% CI vs 29% controls (Hodkinson Abbrev. Mental test)



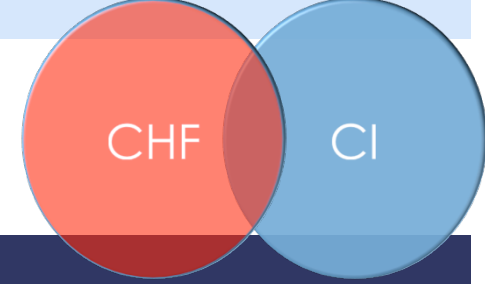
CHF & CI: Counting

- ▣ Are inpatients decompensated IE. DELIRIUM vs. CI?



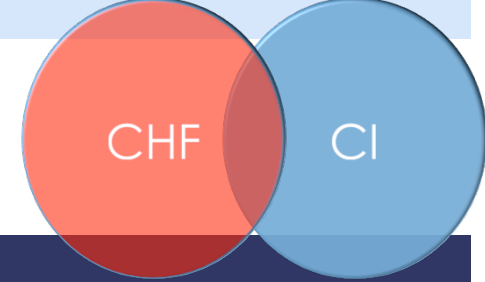
CHF & CI: Counting

- ▣ Outpatient “Stable” HF
 - ▣ Riegel 2002 Cross-Sectional
 - ▣ n=42
 - ▣ X=75 years
 - ▣ → 29% CI



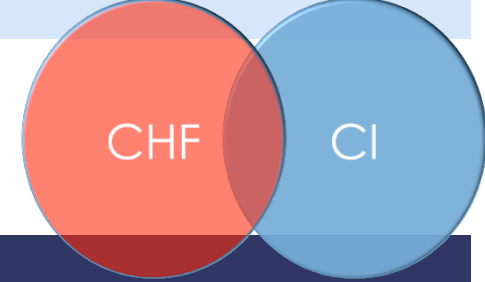
CHF & CI: Counting

- ▣ Outpatient “Stable” HF
 - ▣ Hoth 2008 Case-Control
 - ▣ n=31 HF vs. 31 CAD controls
 - ▣ x=69 years
 - ▣ → HF showed > impaired exec function



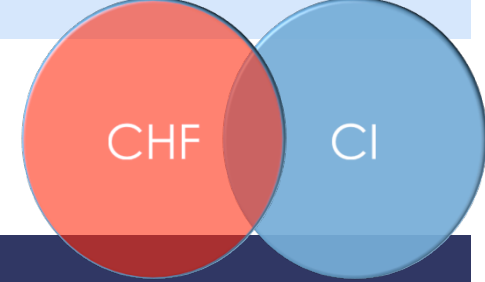
CHF & CI: Counting

- ▣ Outpatient “Stable” HF
 - ▣ Sauve 2009 Case-Control
 - ▣ n= 50 HF vs. 50 Healthy
 - ▣ →46% CI
 - ▣ 4x increase risk CI



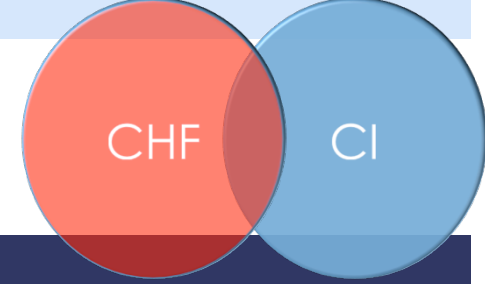
CHF & CI: Counting

- ▣ Outpatient “Stable” HF
 - ▣ Vogels 2007 Case-Control
 - ▣ n=62 HF vs. 53 CAD controls & 42 Healthy controls
 - ▣ x=>50 years
 - ▣ → HF had multi-domain impairment vs. healthy
 - ▣ → HF had impaired memory and mental speed vs CAD control



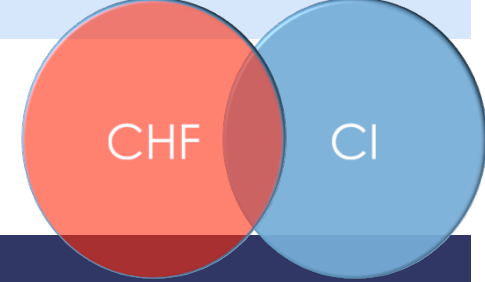
CHF & CI: Counting

- ▣ Outpatient “Stable” HF Case-Control
 - ▣ Almeida 2012
 - ▣ n= 35 HF vs. 56 CAD controls & 64 Healthy controls
 - ▣ x =68 years
 - ▣ → HF lower in memory and processing speed



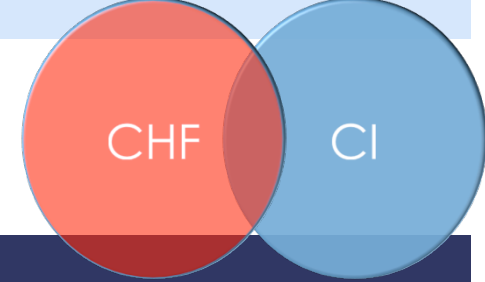
CHF & CI: Counting

- ▣ Prospective Data
 - ▣ Outpatient Decompensated vs. Stable CHF
 - ▣ Kindermann 2012
 - ▣ n=20 decomp HF vs. n=20 stable HF & n=20 Healthy
 - ▣ X=60 years



CHF & CI: Counting

- ▣ Prospective Data
 - ▣ Outpatient Decompensated vs. Stable CHF
 - ▣ Kindermann 2012
 - ▣ → decompensated HF: lower memory, executive function, processing speed
 - ▣ → stable HF: still lower intelligence and episodic memory



CHF & CI: Counting

- ▣ Prospective Data
 - ▣ Outpatient Decompensated vs. Stable CHF
 - ▣ Kindermann 2012
 - ▣ ?Worse HF control = ?Worse Cognition

CHF, CI & Causation

- ▣ Heart Failure...Brain Failure?

CHF, CI & Causation

- ▣ Heart Failure...Brain Failure?
 - ▣ “Cardiogenic dementia”

CHF, CI & Causation

- ▣ Heart Failure...Brain Failure?
 - ▣ “Cardiogenic dementia”
 - ▣ Cardio-Cerebral syndrome?

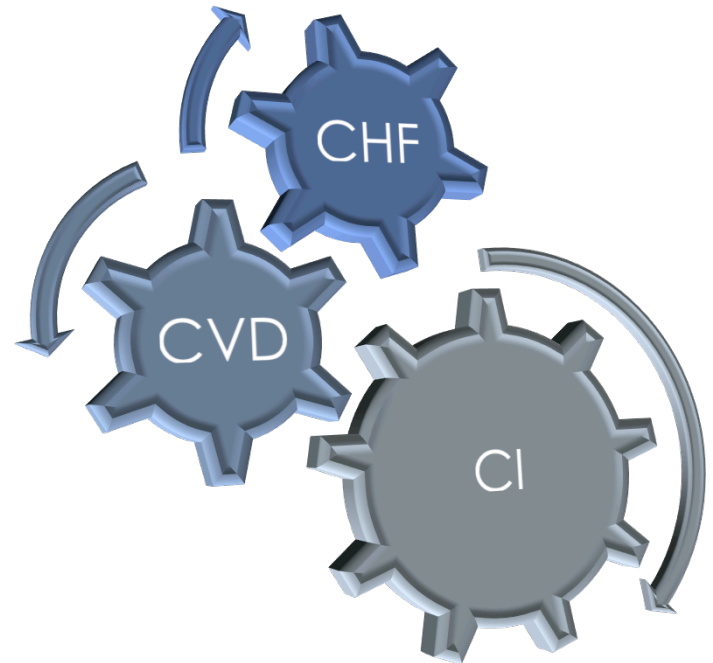
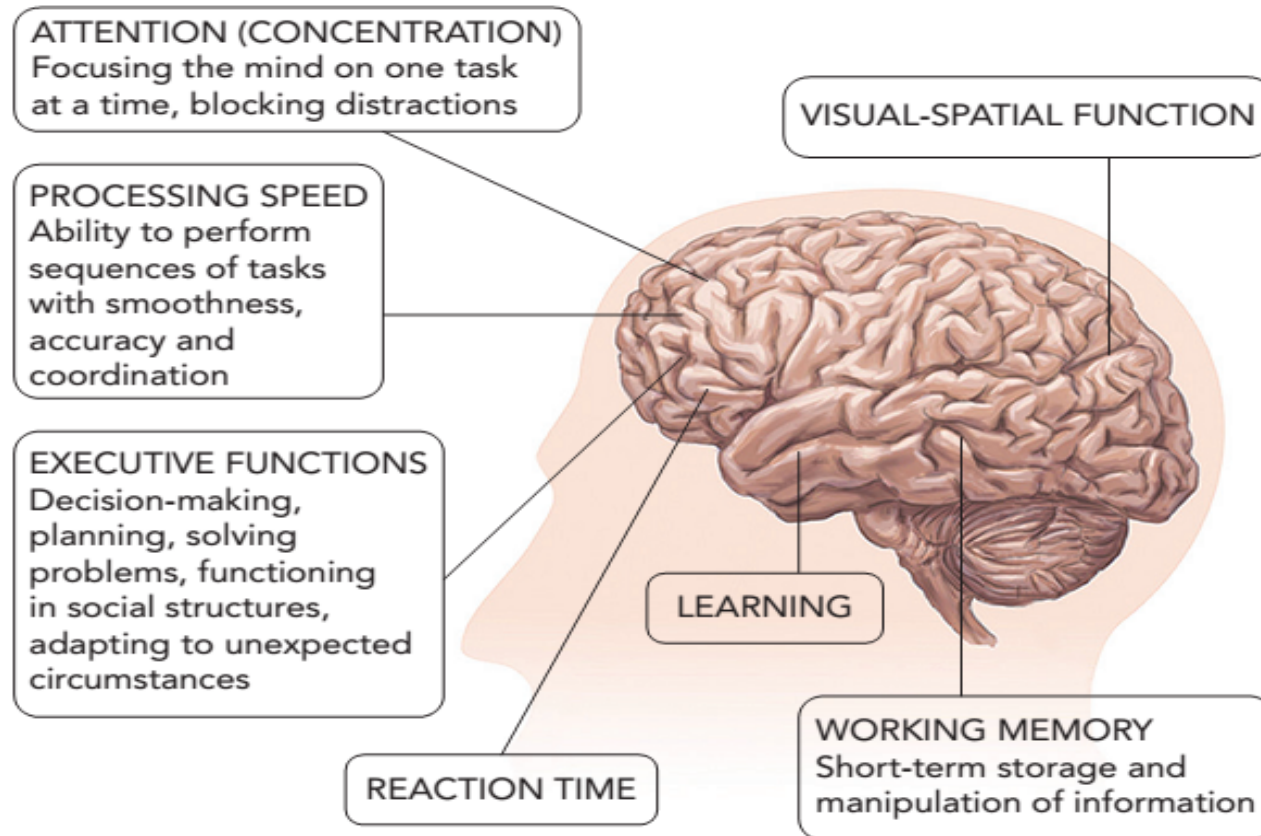


Figure 4: Cognitive Domains Typically Affected in Heart Failure Patients



Impaired EF and Cognition?

- ▣ EF < 30 predicts MMSE < 24

Zuccala et al. 1997



Impaired EF and Cognition?

- ▣ EF<30 predicts MMSE <24

Zuccala et al. 1997

- ▣ NYHA IV and MMSE <24 (OR 4.1)

Debette et al. 2007

- ▣

- ▣

- ▣

- ▣

- ▣

- ▣

Impaired EF and Cognition?

- ▣ EF<30 predicts MMSE <24 Zuccala et al. 1997
- ▣ NYHA IV and MMSE <24 (OR 4.1) Debette et al. 2007
- ▣ NYHA III-IV MOCA <26 vs NYHA 1-II Harkness et al. 2011
- ▣
- ▣
- ▣
- ▣
- ▣

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- ▣ NYHA III-IV MOCA <26 vs NYHA 1-II Harkness et al. 2011
- ▣ CI increases with NYHA class Trojano et al. 2003
- ▣
- ▣
- ▣
- ▣

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- ▣ HFrEF symptoms & EF w/ CI severity Cannon et al. 2015
- ▣
- ▣
- ▣

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- ▣ HFrEF symptoms & EF w/ CI severity Cannon et al. 2015
- ▣ Asymptomatic low EF w/ CI Callegari et al. 2002
- ▣
- ▣

Impaired EF and Cognition?

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- ▣ CI increases with NYHA class
Trojano et al. 2003
- ▣ HFrEF symptoms & EF w/ CI severity
Cannon et al. 2015
- ▣ Asymptomatic low EF w/ CI
Callegari et al. 2002
- ▣ BNP inversely w/ MMSE
Feola et al. 2007
- ▣

Impaired EF and Cognition?

- EF < 30 predicts MMSE < 24
Zuccala et al. 1997
- NYHA IV and MMSE < 24 (OR 4.1)
Debette et al. 2007
- NYHA III-IV MOCA < 26 vs NYHA I-II
Harkness et al. 2011
- CI increases with NYHA class
Trojano et al. 2003
- HFrEF symptoms & EF w/ CI severity
Cannon et al. 2015
- Asymptomatic low EF w/ CI
Callegari et al. 2002
- BNP inversely w/ MMSE
Feola et al. 2007
- BNP predicts dementia rating scale
Gunstead et al. 2006

Low Brain Flow

- Low sBP linked with CI in CHF

Zuccala 2001

- After controlling for CVA, R MCA arterial flow linked with MMSE scores

Jesus et al 2006

Low Flow Fallout

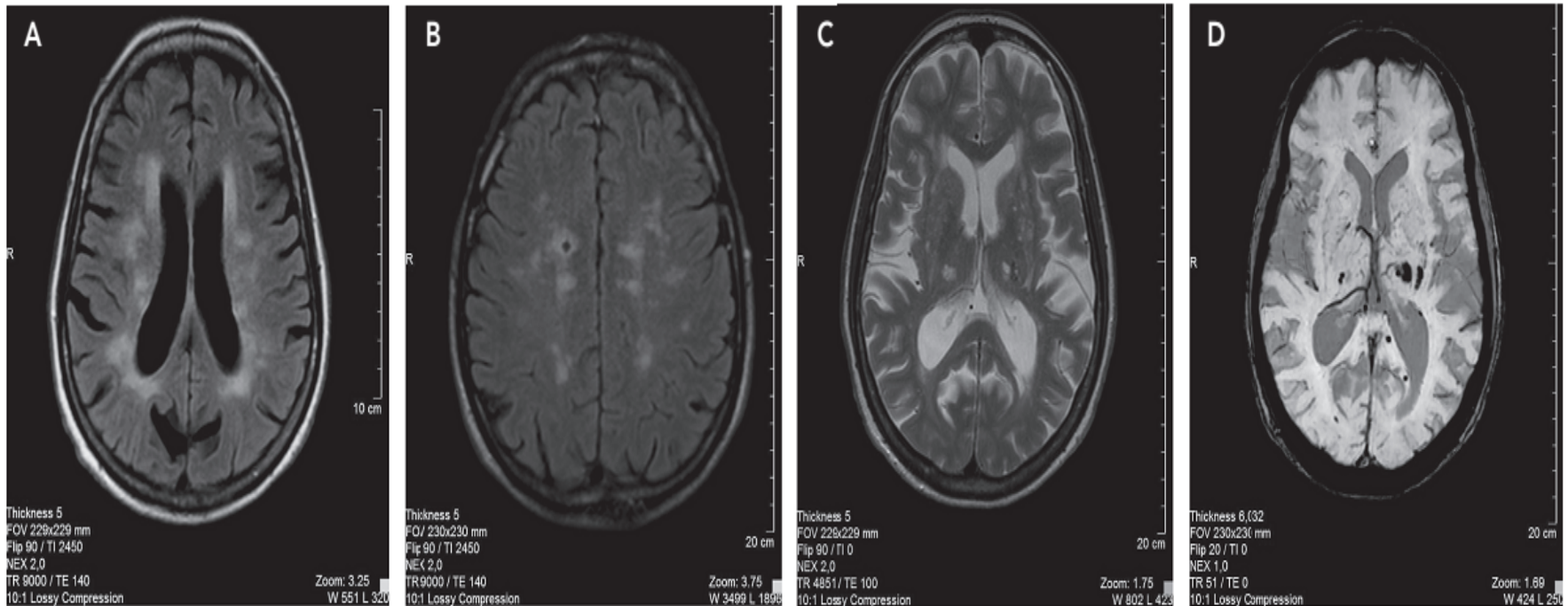
- Cerebral blood flow decreased by 30 % w/ MAP <60mmHg or 80 % of baseline
- Cerebral hypoperfusion 2ndary to Low CO → neuroglycopenia, neuronal damage
- White matter hyperintensities “small vessel ischemia” seen with vascular dementia
- Impaired cerebral autoregulation and ?AD secondary to protein misfolding Beta amyloid, impaired clearance of Abeta and phosphorylated tau, oxidative stress and shortage of ATP

Ampadu et al 2011

Excess Emboli & Ischemia

- ▣ VaD w/ Afib and CVA disease associated with CHF and/or CVD

Figure 3: Magnetic Resonance Imaging of Structural Brain Abnormalities in Patients with Cognitive Dysfunction



A: Confluent hyperintense changes in the periventricular white matter consistent with small vessel ischaemic changes associated with generalised brain volume loss. B: Multifocal chronic small vessel ischaemic changes, predominantly affecting frontal lobes, and associated with a lacunar infarct on the right side. C: Lacunar infarcts bilaterally in the thalami and small vessel ischaemic changes affecting frontal periventricular white matter and associated generalised brain volume loss. D: Haemosiderin staining bilaterally in the thalami and left occipital lobe due to microbleeds.

Asymptomatic Atrophy

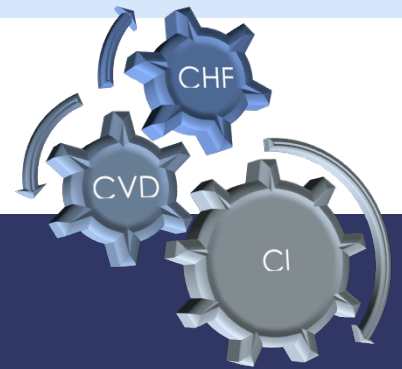
- Beer 2009 case-control
 - grey & white matters!
 - brain changes in clinically “normal” w/ CHF
 - >Right medial temporal lobe atrophy
 - Left medial temporal lobe atrophy and deep white matter hyperintensities showed moderate association with cognitive scores in CHF

OK EF... A-OK?

- ▣ Its not just HFrEF...
- ▣ Bratzke-Bauer et al. 2013
 - ▣ n=47 HFrEF n=33 HFpEF
 - ▣ → 23% HFrEF CI, 3% HFpEF CI

OK EF... A-OK?

- ▣ Its not just HFrEF...
- ▣ Bratzke-Bauer et al. 2013
 - ▣ n=47 HFrEF n=33 HFpEF
 - ▣ → 23% HFrEF CI, 3% HFpEF CI
- ▣ Huljts et al. 2013
 - ▣ n=491 HFrEF, 120 HFpEF
 - ▣ → 8% HFrEF severe CI, 13% HFpEF severe CI

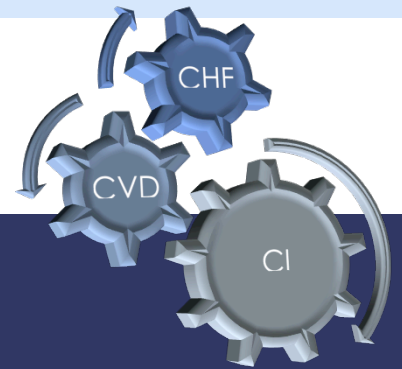


HEART & BRAIN

- ▣ Hypoxia
- ▣ Emotional (depression)
- ▣ Afib
- ▣ Renal (hyponatremia)
- ▣ TGL

Ampadu & Morley. 2015

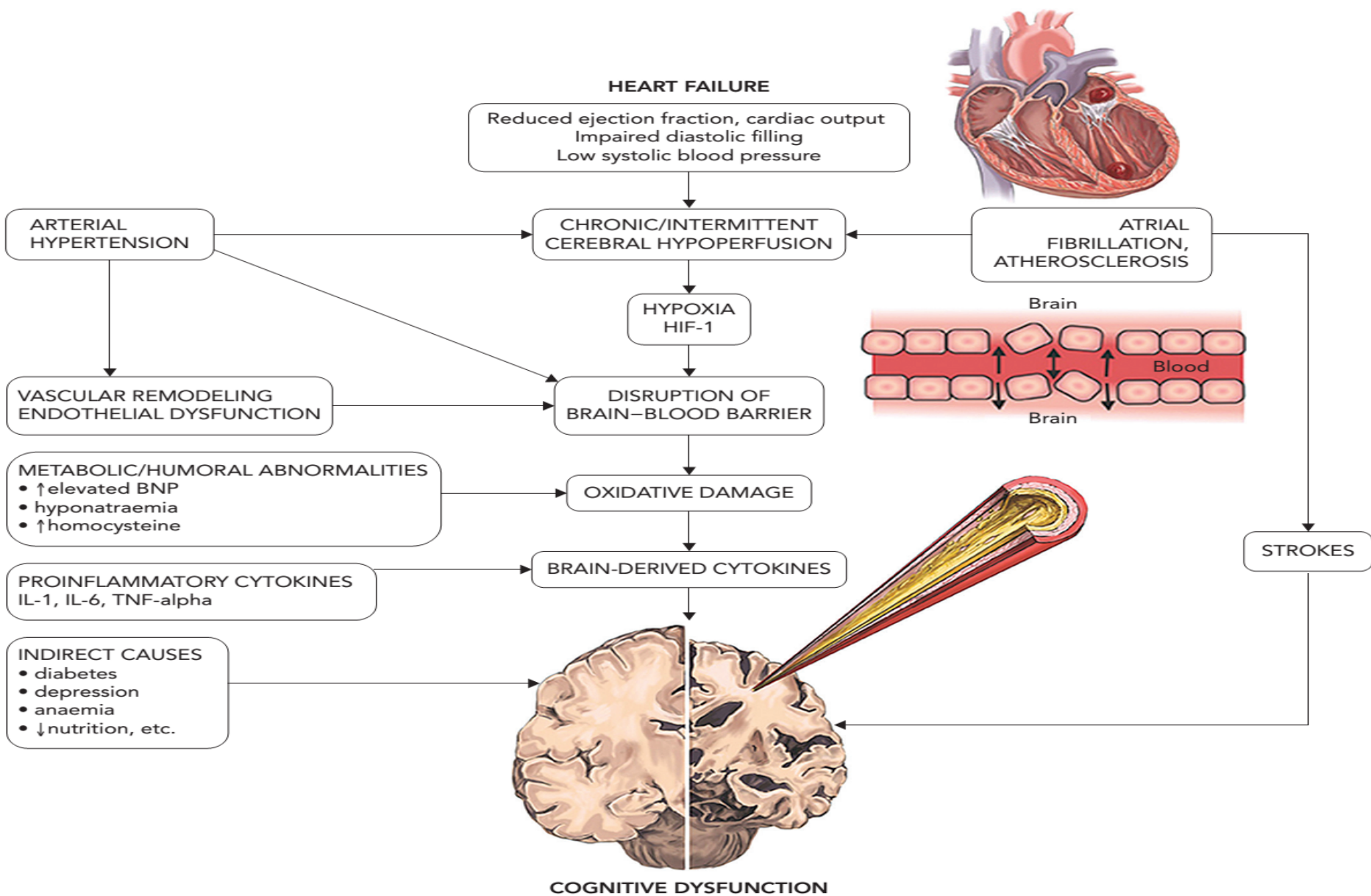
HEART & BRAIN



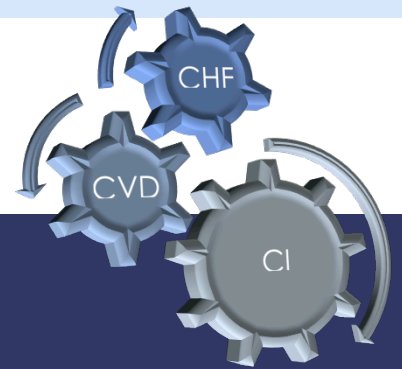
- ▣ Hypoxia
- ▣ Emotional (depression)
- ▣ Afib
- ▣ Renal (hyponatremia)
- ▣ TGL
- ▣ BNP (hyponatremia)
- ▣ Rhythm (Afib)
- ▣ Anemia
- ▣ Inflammation (cytokines)
- ▣ Nutrition (cachexia)

Ampadu & Morley. 2015

Figure 2: Pathogenic Links of Heart Failure and Cognitive Dysfunction



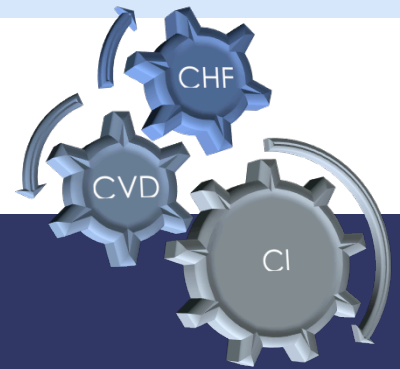
BNP = brain natriuretic peptide; HIF-1 = hypoxia inducible factor-1; IL-1 = interleukin-1; IL-6 = interleukin-6; TNF-alpha = tumour necrosis factor-alpha.



CHF, CI & Consequences

- ▣ Zuccala et al. 2003
 - ▣ 81 hospitals in Italy w/ CHF admissions
 - ▣ n=968 X>70 years

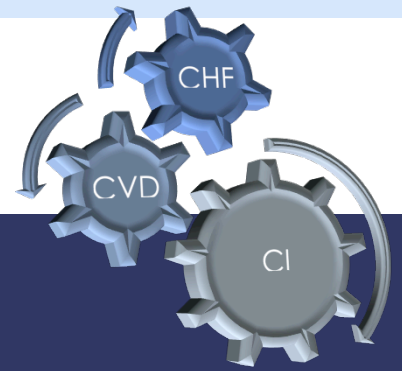
- ▣ CI INDEPENDENTLY associated with in-hospital mortality



CHF, CI & Consequences

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- ▣ CI INDEPENDENTLY associated with in-hospital mortality
 - ▣ Cognitive impairment 5x increase 1 year mortality in CHF (RR 4.9)
 - ▣ In-hospital death 18% CHF/CI vs 3% CHF alone
 - ▣ Out-of-hospital death was 27% CHF/CI vs. 15% CHF

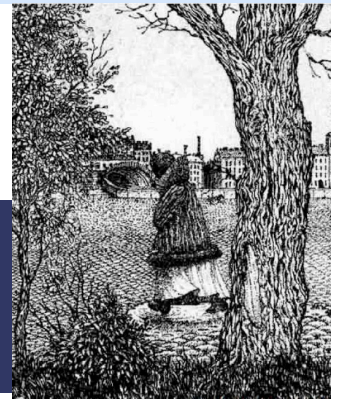


CHF, CI & Consequences

- ▣ Cannon 2015 Review
 - ▣ Poor outcomes with CI in CHF
 - ▣ Lengthier hospital stay
 - ▣ More in-hospital deaths
 - ▣ Increased 1 year mortality
 - ▣ Decreased function & increased institutionalization
 - ▣ Decreased medication adherence

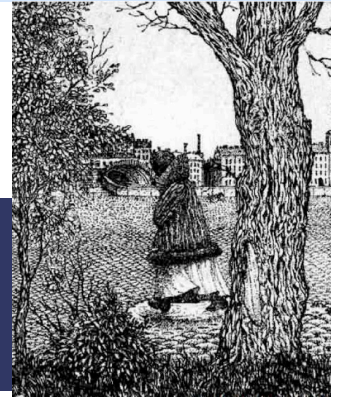


Can we spot it?



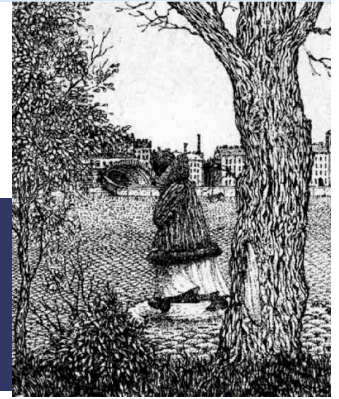
- ▣ Dodson et al. 2013 Am J Med
- ▣ Prospective cohort study
- ▣ n= 282, X=80 yrs **independent** hospitalized with CHF
- ▣ cognitive impairment in HALF! 46.8%
 - ▣ 25.2% mild (21-24), 21.6% mod-severe(<21)

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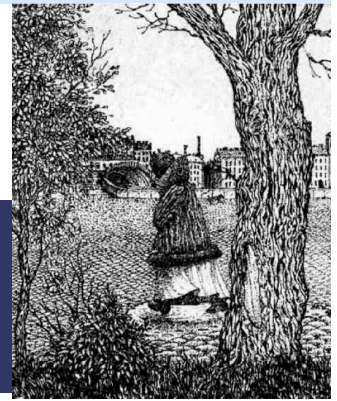
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- ▣ **ONLY DOCUMENTED BY MD in 22.7% (30 of 132)*****

What you don't know...



- We now know CI w/ CHF increases mortality or readmission at 6 mo vs. CHF alone
-But unrecognized CI is even worse!

What you don't know...

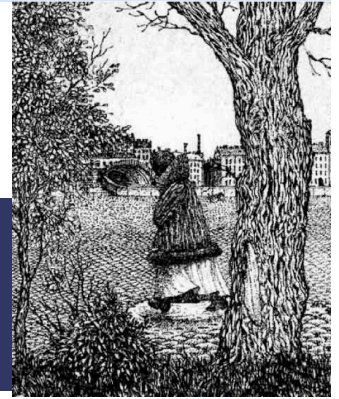


- ▣ Undocumented cognitive impairment significant risk
 - ▣ HR. 1.53; 95% CI, 1.06-2.20; P. 02

- ▣ Moderate-severe CI significantly more
 - ▣ adjusted HR, 1.60; 95% CI, 1.03-2.48; P. 04

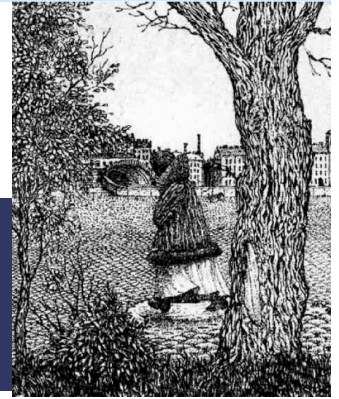
 - ▣ MCI trended to more but not statistically significant

What you don't know...



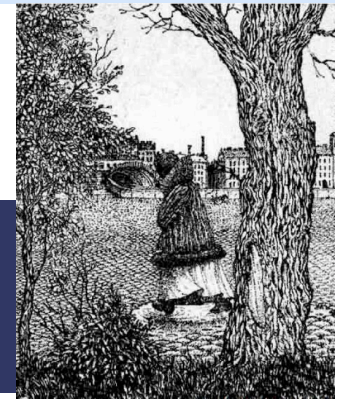
- ▣ ...can hurt you...
- ▣ Critical opportunity to intervene – *but* must first identify!

How to look



- ▣ MOCA > MMSE?
- ▣ N=93 inpatients for CHF
- ▣ X > 70 years, no known CI

How to look



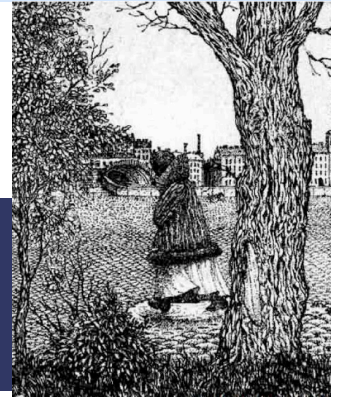
- ▣ MOCA > MMSE?

- ▣ N=93 inpatients for CHF
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- ▣ MOCA found more CI vs MMSE

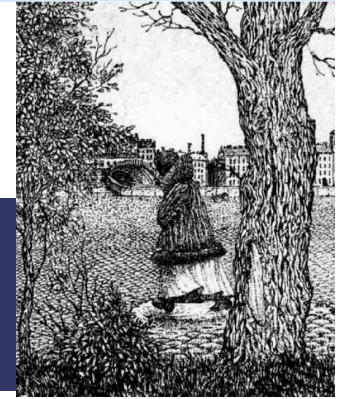
The MoCA classified 38 (41%) patients as cognitively impaired that were not classified by the MMSE.

How to look



- ▣ Takes less time to draw the time?
 - ▣ Clock Draw enough?

How to look



- ▣ Takes less time to draw the time?
 - ▣ Clock Draw enough?

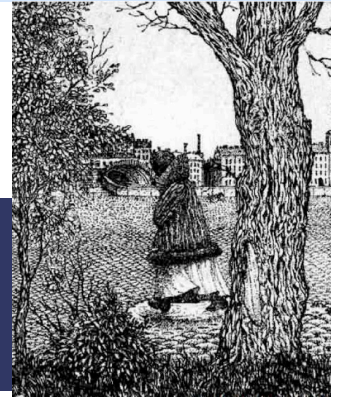
- ▣ Clock draw accurate Dx. CI in 50% of patients
 - ▣ Misses delayed recall and verbal learning

Am J Crit Care. 2002 Nov;11(6):520-8.

Cognitive impairment in heart failure: issues of measurement and etiology.

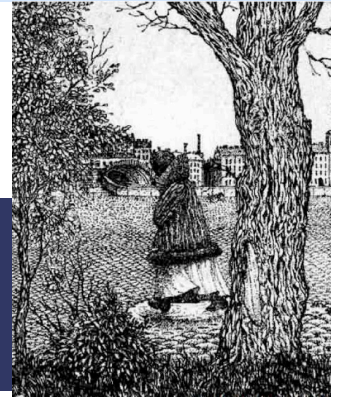
Riegel B1, Bennett JA, Davis A, Carlson B, Montague J, Robin H, Glaser D.

Seeing/Screening better?



- ▣ 2016 Academic Center w/ CHF/ Multidisciplinary Focus
 - ▣ X =70 years
 - ▣ HFpEF and HFrEF admissions
 - ▣ screened w/ Mini Cog pre-d/c

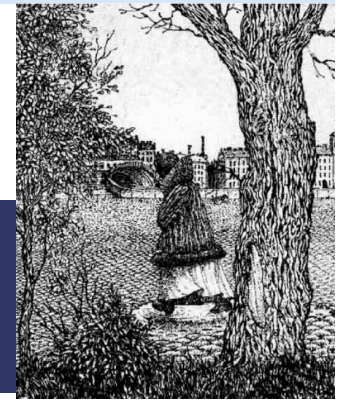
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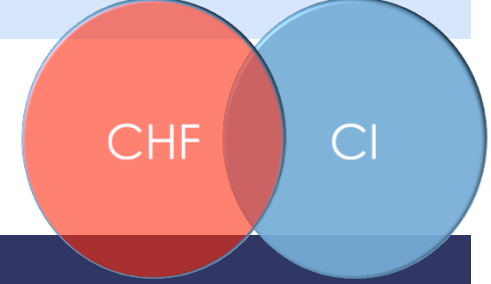
- ▣ Mini-Cog <4 diagnosed CI in 157 patients
 - ▣ 67.7% CI with HF, 62.5% CI without CHF

Seeing/Screening better?



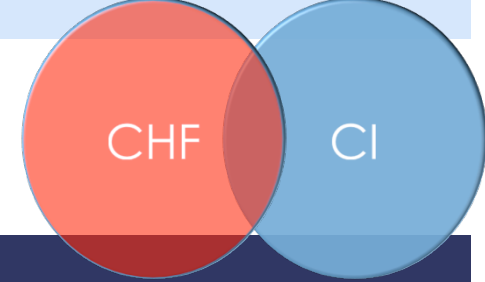
- ▣ 2016 Academic Center w/ CHF/ Multidisciplinary Focus
- ▣ HF and CI had a significantly higher 30-day readmission rate
- ▣ ***HF & CI w/ **caregiver education** had lower readmission rates than those without

Agarwal et al 2016 J Am Geriatr Soc



CHF & CI: Care Needs

- ▣ CI impacts ability to manage CHF
 - ▣ Management is critical aspect of CHF
 - ▣ Diet, Salt & Fluids, Medications, Weight monitoring
 - ▣ Direct impact on course, prognosis, function and QOL



CHF & CI: Care Needs

- MCI made the largest contribution to variance in self care amongst CHF inpatients, with age and depression also impacting

Cameron et al. Eur J Heart Fail. 2010 May;12(5):508-15

- Executive Dysfunction associated w/ reduced participation in Cardiac Rehab

Foster etl a. Am J Occup Ther. 2011 May-Jun;65(3):306-13.

Future Focus

- ▣ HF gets worse → CI gets worse
- ▣ Opportunity?
 - ▣ Medically manage CV RF, CVD, CHF
 - ▣ Shaukat et al. 2015 suggest anti ACH in CHF making CI worse?
 - ▣ Anticipate Adherence issues
 - ▣ Address Advance Care plan

Future Focus

- ▣ CI gets worse → HF gets worse
- ▣ Opportunity?
 - ▣ Identify, optimize, mitigate risks
 - ▣ Consider comorbidities
 - ▣ Polypharm problems?
 - ▣ Do we stop the lasix? The Dig? The BB? –
 - ▣ Managing CHF to help CI as we do DM, HTN
 - ▣ Advance Care Plan
 - ▣ EXERCISE

Future Focus

- ▣HF gets better – CI gets better?
- ▣ ?Opportunity
 - ▣ *Prioritize HF med management w/in CI population
 - ▣ Resist temptation to deprescribe FULLY
 - ▣ Value in Rx for Adults = Elderly

It's All ACE(i)s



- Active Renin-Angiotensin-Aldosterone cascade negatively impacts cerebral perfusion
- Cascade of vasoconstriction (Hackman et al. 2007)
- Literature suggests ACEi maintain/increase cerebral perfusion while decreasing sBP (Paulson et al. 1984)

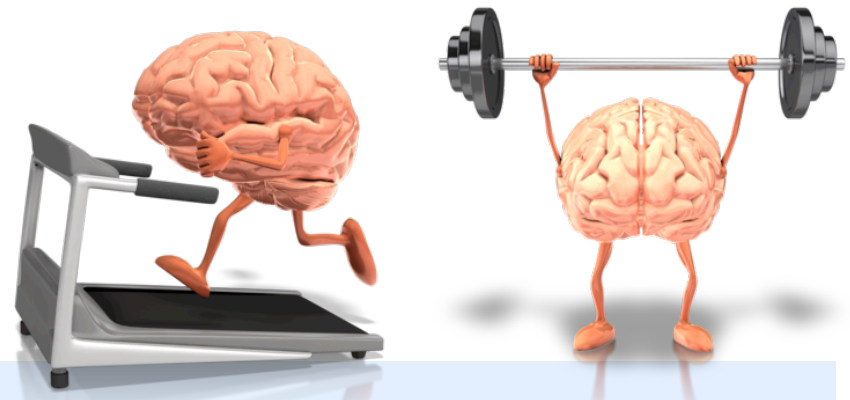
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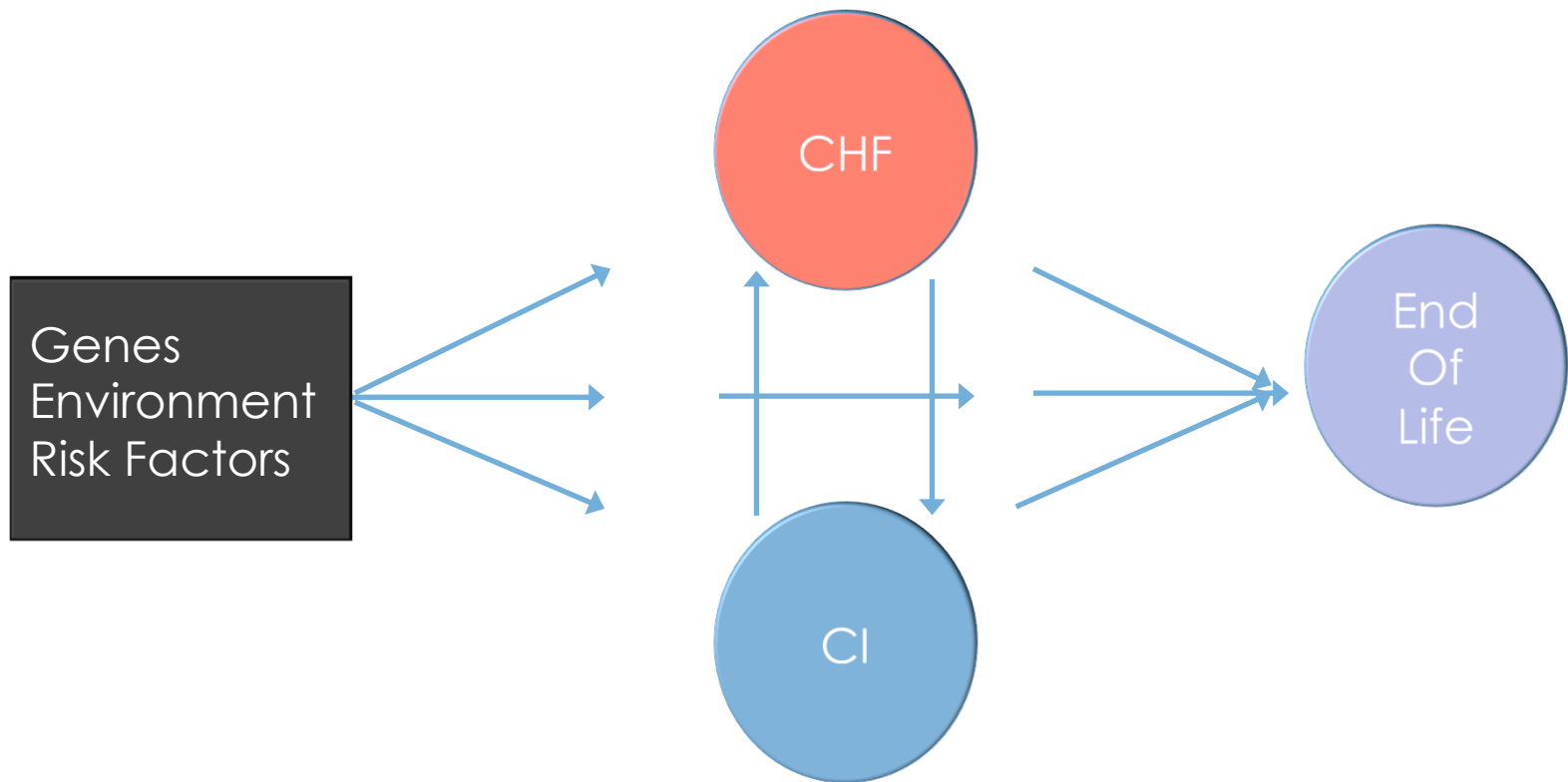
- Another reason ACEi may be priority when facing polyRx
 - Almeida and Tamai 2001: ACEi & cautious diuretics improved cognitive scores in CHF population over 6months (prospective, uncontrolled)
 - Zuccala et al 2005: retrospective data finds cognition improved after initiation of ACEi (dose response)

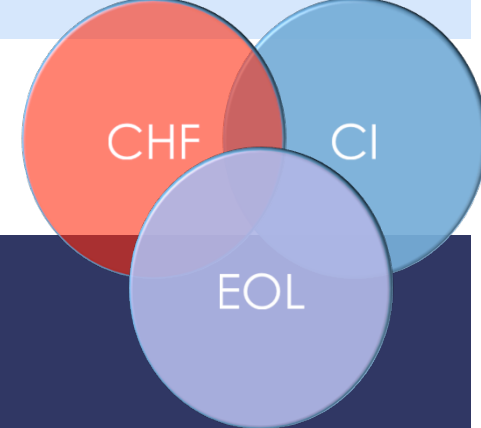
Mindful HF Management

- Exercise for CI & Cardiac Rehab
 - Lack of exercise with worse exec function, attention and less cerebral blood flow Alosco 2014
 - Improved performance with exercise training Tanne 2005
- ?CRT – evidence lacking



Complex Connections





Care Conclusions

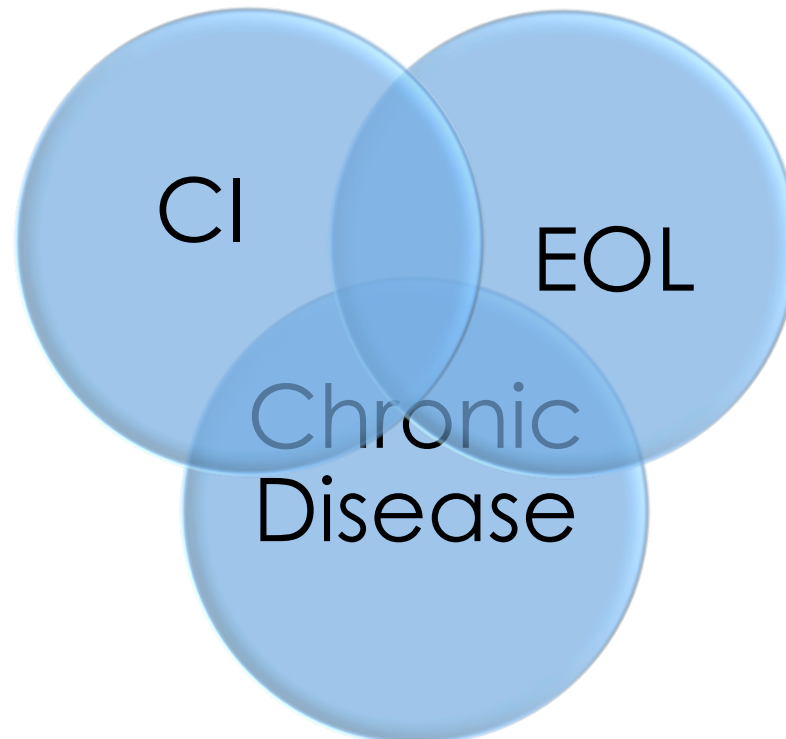
- Complex correlations vs. causations w/ comorbidities
- Comprehensive plans critical
- Multidisciplinary management
 - CHF focus on CI – part of HF clinic? What score to use?
Lower threshold for community resources
 - CI focus on CHF – prioritize management of CHF, lower threshold for community resources
- EOL & ACP in CHF Programs
 - Palliative pertinence; Capacity critical

Common Co-Morbidities

- Other Cs to consider with CI...
 - COPD (MCI 25%, ACI %32 - Yohannes et al. 2017)
 - CKD/ EDRD (~10% increase in CI for every 10 drop <60 GFR, HD>PD>CKD - Ivasere et al. 2017)
 - Cancer (Chemo – Moore 2014)

Cognition, Chronic Disease

- Complex care anticipating complications of CI





Geriatric Medicine

- Person > Presentation
- Complex > Complicated

Transitional Time

- New Vulnerability
 - Care providers leave last(ing) impression
 - Opportunity to impact QOL



Thank you. Questions?

