EVIDENCE BRIEF

CVD: Management of acute
heart failure
(DCP4 ID: CVD05-02)
Cluster: Cardiovascular & related disorders

FairChoices
DCP Analytics Tool

Management of chronic heart failure (preserved|recovered EF) with diuretics, beta-blockers, ACE inhibitors, and mineralocorticoid antagonists

Authors: Pickersgill S, Watkins D, Coates MM, Ahmed S, Kaur G, Hirpesa GM, Økland JM, Haaland ØA, Johansson KA

Description of condition and intervention

The chronic heart failure is the condition that heart has unable to pumping the blood through the body. The common symptom of this health problem is shortness of breath, fatigue, and tiredness on feet, ankles, and abdomen. The ACE inhibitors, angiotensin-converting enzyme (ACE) inhibitors, beta-blockers, mineralocorticoid receptor antagonists, diuretics, ivabradine, sacubitril valsartan, and hydralazine with nitrate. The ACE inhibitors and beta blockers are the first line treatment which helps to decrease mortality and morbidity (Shah, 2017). ACE help relax the veins and arteries to lower blood pressure. The bisoprolol, carvedilol, and metoprolol are the three types of beta-blockers which approved to treat CHF. The loop diuretics, furosemide, torsemide and bumetanide is used to treat patients with CHF. In this evidence brief, we present the effect and cost of the following intervention being analysed in FairChoices:DCP Analytical tool:

Management of chronic heart failure (preserved|recovered EF) with diuretics, beta-blockers, ACE inhibitors, and mineralocorticoid antagonists

International guidelines

Organization	Indications/recommendations
ESC, 2021	Guidelines for the diagnosis and treatment of ACHF

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Intervention attributes

Type of interventions

Curative

Delivery platform
This intervention may be delivered at referral and speciality hospital.

Equity

In addition to considerations like cost-effectiveness and health systems factors, dimensions of equity can be relevant for priority setting. The opportunity for a long and healthy life varies according to the severity of a health condition that individuals might have, so there are inequities in individuals' opportunities for long and healthy lives based on the health conditions they face. Metrics used to estimate the severity of illness at an individual level can be used to help prioritize those with less opportunity for lifetime health. FairChoices: DCP Analytics Tool uses Health adjusted age of death (HAAD), which is a metric that estimates the number of years lived from birth to death, discounting years lived with disability. A high HAAD thus represents a disease less severe in terms of lifetime health loss, while a low HAAD represents a disease that is severe on average, causing early death or a long period of severe disability. It is also possible to estimate the distribution of HAAD across individuals with a health condition. FairChoices shows for each intervention an average HAAD value of the conditions that are affected by respective interventions that have health effects. Additionally, a plot shows HAAD values for around 290 conditions (Johansson KA et al 2020). All incident cases irrespective of gender, income group are eligible to receive the intervention.

Time dependence
High level of urgency. Treatment outcomes may be highly affected by some hours of delay.

Population in need of interventions
Treated population:

IHD: Prevalence of heart failure due to ischemic heart disease, age 30-95+

HHD: Prevalence of hypertensive heart disease for age 30-95+

Myocarditis: Prevalence of heart failure due to myocarditis in those age 0-95+

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Alcoholic cardiomyopathy: Prevalence of alcoholic cardiomyopathy for age 15-95+

Other cardiomyopathy: Prevalence of other cardiomyopathy for age 0-95+

Treated fraction: all prevalent cases included.

Affected population: We assumed 25% of IHD deaths are attributable to heart failure of which 50% are with preserved ejection fraction. Heart failure is assumed to be the intervention point and mechanism of death for HHD. We assumed that 80% of HHD heart failures are with preserved ejection fraction. Heart failure with reduced ejection fraction is assumed to be the intervention point and mechanism of death for cardiomyopathies. For the proportion of each of these sub-groups who have preserved EF we assume only effects on mortality of mineralocorticoid receptor antagonists (MA). For the remaining proportion with reduced EF, we assume effects of MA, ACEi, and beta-blockers.

(Source: NCD Countdown appendix)

Disease state addressed

IHD

HHD

Myocarditis

Alcoholic cardiomyopathy

Other Cardiomyopathy

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Intervention effect and safety

Table 1: Effect and safety of treatment of chronic heart failure

Effect of intervention		Certainty of evidence
Mortality (due to condition)	Effect on mortality from pharmacologic intervention was based on DCP Vol 5 (Table 10.3) for diuretics, beta-blockers, ACEi and MAs. Diuretic efficacy: We assume diuretic effects on mortality are being driven by reduced hospitalization and in-hospital death. Therefore, we assume that the benefit of diuretic therapy is conferred via the acute heart failure intervention. Death rates for beta blockers compared to controls were 458/5657 (8.0%) and 635/4951 (12.8%) respectively, giving an odds ratio of 0.63.23 RR= 0.63 / ((1-(635/4951)) +((635/4951) *0.63) = 0.661 Death rates for ACE inhibitor group were 611/3870 (15.8%) patients compared to controls 709/3235 (21.9%), indicating a statistically significant reduction in mortality (OR, 0.77; 95% confidence interval [CI], 0.67 to 0.88).24 RR = 0.77/ ((1-(709/3235)) +((709/3235) *0.77)) = 0.811 Aldosterone blockade reduced all-cause mortality was reduced in heart failure patients (RR = 0.75, 95% CI 0.67-0.84).25 RR = 0.75/((1-(354/1495))+((354/1495)*0.75)) = 0.797 IHD mortality reduction: 25%*50%*(1-(0.661*0.881*0.797)) + 25%*50%*(1-0.797) = 9.2% HHD mortality reduction: 80%*(1-0.797) + 20%*(1-(0.661*0.881*0.797)) = 27.0% Myocarditis mortality reduction: 1-(0.661*0.881*0.797) = 53.6% Alcoholic cardiomyopathy: 1-(0.661*0.881*0.797) = 53.6% Other Cardiomyopathy: 1-(0.661*0.881*0.797) = 53.6%	See appendix

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Model assumptions

Table 2: Summary of model parameters and values used in FairChoices – DCP Analytical Tool

Category	Model parameter	Notes
Intervention	Management of chronic heart failure (CHF)	
Cost parameters		
Treated population		
Gender	Both male & female	
Age	0-99 years	
Treated fraction	See population in need section for details	
Effect parameters		
Affected population		
Affected gender	Both male & female	
Affected fraction age	0 to 99 years	
Affected fraction	See population in need section for details	
Comparison	No intervention	
Mortality reduction (RRR) IHD HHD Myocarditis Alcoholic cardiomyopathy Other cardiomyopathy	0.09 0.27 0.54 0.54 0.54	See table 1

Intervention cost

We used cost calculations from the NCD count down that calculated medication costs using the Management Sciences for Health database in conjunction with information from the WHO Model Essential Medicines List, lab and outpatient costs from a cost-effectiveness modeling study conducted in Tanzania (https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-016-1409-3)

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and echo costs come from a study from Brazil
(https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0210502).

For management of heart failure with reduced ejection fraction and based on the recommended treatment guidelines, we assume that the cost per patient per year was 98.79 USD in 2012 in low-income countries (LIC) as per the costs detailed below.
- 25% of patients on ARB ($0.115 per tab or $42 per year)
- 75% of patients on ACEi ($0.026 per cap or $9.5 per year)
- 100% of patients on beta-blockers ($0.046 per tab, or $23 per year)
- 38% of patients on MA ($0.0442 per tab or $16.13 per year)
- 100% of patients on diuretics ($0.0237 per cap or $8.7 per year)
- 2 lab tests ($4.07 each) ○ 4 outpatient visits per year ($7.15 each)
- 1 cardiac echo per year ($6.60) 26

For managing heart failure with preserved ejection fraction and based on the recommended treatment guidelines, we assume that the cost per patient per year was 58.17 USD in 2012 in LIC as per the costs detailed below.
- 0% of patients on ARB ($0.115 per tab or $42 per year)
- 0% of patients on ACEi ($0.026 per cap or $9.5 per year)
- 0% of patients on beta-blockers ($0.046 per tab, or $23 per year)
- 38% of patients on MA ($0.0442 per tab or $16.13 per year)
- 100% of patients on diuretics ($0.0237 per cap or $8.7 per year)
- 2 lab tests ($4.07 each)
- 4 outpatient visits per year ($7.15 each)
- 1 cardiac echo per year ($6.60) 26

References

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NCD Countdown appendix

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Appendix

Literature Review for effectiveness & safety

This literature search is an example of Level 1 search for intervention inputs taken from DCP3 or generated in an ad hoc manner (e.g., quick google search found one study of cervical cancer screening cost-effectiveness that was used to create an effectiveness parameter for that intervention).

Level of evidence of efficacy studies:

1. low (expert opinions, case series, reports, low-quality case control studies)
2. moderate (high quality case control studies, low quality cohort studies)
3. high (high quality cohort studies, individual RCTs)
4. very high (multiple RCTs, meta-analysis, systematic review, clinical practice guidelines)