Supplemental Material
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# Supplemental Appendices

## S1.1 PRISMA Checklist

### PRISMA 2009 Checklist

| Section/topic                  | # | Checklist item                                                                                           | Reported on page |
|-------------------------------|---|----------------------------------------------------------------------------------------------------------|------------------|
| **TITLE**                     |   |                                                                                                           |                  |
| Title                         | 1 | Identify the report as a systematic review, meta-analysis, or both.                                       | 1                |
| **ABSTRACT**                  |   |                                                                                                           |                  |
| Structured summary            | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | 2                |
| **INTRODUCTION**              |   |                                                                                                           |                  |
| Rationale                     | 3 | Describe the rationale for the review in the context of what is already known.                             | 3-4              |
| Objectives                    | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS). | 2-5              |
| **METHODS**                   |   |                                                                                                           |                  |
| Protocol and registration     | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number. | 4                |
| Eligibility criteria          | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. | 4-5              |
| Information sources           | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched. | 4                |
| Search                        | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | Online appendix S2 |
### Study selection
State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).

### Data collection process
Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.

### Data items
List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.

### Risk of bias in individual studies
Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.

### Summary measures
State the principal summary measures (e.g., risk ratio, difference in means).

### Synthesis of results
Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I²) for each meta-analysis.

## Section/topic | # | Checklist item |
|----------------|---|----------------|
| Risk of bias across studies | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). |
| Additional analyses | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. |

## RESULTS

### Study selection
Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.

### Study characteristics
For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.

### Risk of bias within studies
Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).

### Results of individual studies
For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.

### Synthesis of results
Present results of each meta-analysis done, including confidence intervals and measures of consistency.
| Risk of bias across studies | 22 | Present results of any assessment of risk of bias across studies (see Item 15). | 8-13, Figure 2-7, online figures S1a-c, S2a-c |
|----------------------------|----|-------------------------------------------------|-----------------------------------------------|
| Additional analysis        | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]). | 8-13, online figures S1a-c, S2a-c, |

**DISCUSSION**

| Summary of evidence        | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). | 13-15 |
|----------------------------|----|-------------------------------------------------------------------------------------------------|-------|
| Limitations                | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias). | 15-17 |
| Conclusions                | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. | 17    |

**FUNDING**

| Funding                    | 27 | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review. | 1     |

*From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097*
### S1.2 MOOSE Checklist

From: Donna F. Stroup, PhD, MSc; Jesse A. Berlin, ScD; Sally C. Morton, PhD; Ingram Olkin, PhD; G. David Williamson, PhD; Drummond Rennie, MD; David Moher, MSc; Betsy J. Becker, PhD; Theresa Ann Sipe, PhD; Stephen B. Thacker, MD, MSc; for the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) Group. *Meta-analysis of Observational Studies in Epidemiology. A Proposal for Reporting* JAMA. 2000;283(15):2008-2012. doi: 10.1001/jama.283.15.2008

| Reporting of background should include | Comments |
|---------------------------------------|----------|
| **Problem definition** | Non-cardiovascular comorbidity has been associated with outcomes in non-select heart failure populations but the evidence has not been synthesised and precise estimates are unclear. Severity of comorbidity is an important consideration for prognostic models but this evidence has not been collated. |
| **Hypothesis statement** | (i) The risk estimates for chronic disease comorbidities will differ by disease for individual outcomes (ii) Comorbidity severity and severity change is associated with different heart failure outcomes but has not been included in current prognostic models |
| **Description of study outcomes** | Quality of life All-cause hospital admission All-cause mortality |
| **Type of exposure or intervention used** | Non-cardiovascular comorbidity and severity indicators |
| **Type of study designs used** | Cohort studies and secondary analysis of RCT, prognostic factor and model studies |
| **Study population** | Non-select chronic or de novo heart failure |

### Reporting of search strategy should include

| Qualifications of searchers (eg librarians and investigators) | The credentials of the investigators are indicated in the authors list. |
|---------------------------------------------------------------|---------------------------------------------------------------------|
| **Search strategy, including time period used in the synthesis and key words** | Search strategy detailed on pg.4 and online Appendix S2 |
| **Effort to include all available studies, including contact with authors** | We used online databases for unpublished studies and contacted experts in the field of heart failure prognosis |
| **Databases and registries searched** | MEDLINE, EMBASE, and the Cochrane databases. |
| **Search software used, name and version, including special features used (eg explosion)** | We did not employ a search software. RefWorks was used to merge retrieved citations and eliminate duplications |
| **Use of hand searching (eg reference lists of obtained articles)** | We performed reference list and citation searches and hand searching of key journals |
| **List of citations located and those excluded, including justification** | Details of the literature search process are outlined in the flow chart (online Appendix S2). The citation list is available |
Method of addressing articles published in languages other than English

Upon request

Method of handling abstracts and unpublished studies

We excluded studies that were only available as abstracts if a full report could not be retrieved.

Description of any contact with authors

We contacted authors from the prior renal reviews where sub-group severity effect estimates had not been reported.

### Reporting of methods should include

| Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested | Detailed inclusion and exclusion criteria were described in the methods section. |
| --- | --- |
| Rationale for the selection and coding of data (eg sound clinical principles or convenience) | We selected data in relation to study source, eligibility, methods, participants, exposure, outcomes, results and analysis. |
| Documentation of how data were classified and coded (eg multiple raters, blinding and interrater reliability) | Details of data extraction were described in the methods section. In brief, extraction was performed independently and in duplicate and consensus was achieved with an arbitrator where necessary. |
| Assessment of confounding (eg comparability of cases and controls in studies where appropriate) | We restricted the synthesis to the maximally adjusted estimates from individual studies and recorded the confounders adjusted for each individual estimate. |
| Assessment of study quality, including blinding of quality assessors, stratification or regression on possible predictors of study results | We used the QUIPS tool to assess risk of bias independently and in duplicate with two reviewers. We tested inter-rater reliability using Cohen’s Kappa. Sensitivity analyses removing studies with high risk sub-domains were performed. |
| Assessment of heterogeneity | We used sensitivity analysis using apriori identified effect modifiers where heterogeneity was indicated by $I^2$ $\geq$ 40%, $p^2$ $\leq$ 0.1 and Galbraith plots. |
| Description of statistical methods (eg complete description of fixed or random effects models, justification of whether the chosen models account for predictors of study results, dose-response models, or cumulative meta-analysis) in sufficient detail to be replicated | Description of methods of meta-analyses, sensitivity analyses and assessment of publication bias are detailed in the methods. |
| Provision of appropriate tables and graphics | We included 7 figures to present the meta-analysis across 3 diseases and 4 renal severity sub-groups. We included 1 table of study characteristics. We limited other tables (study characteristics, quality scoring), figures (descriptive flow-chart, Galbraith, funnel and forest plots) to supplementary electronic access. |

### Reporting of results should include

| Graphic summarizing individual study estimates and overall estimate | Forest plots figures were used as described above (Figures 2-7). |
| --- | --- |
| Table giving descriptive information for each study included | Online tables 1.1-3.2 |
| Results of sensitivity testing (eg subgroup analysis) | Detailed throughout results. Online figures S1a-c and S2a-c |
| Indication of statistical uncertainty of findings | 95% confidence intervals were presented with all summary estimates, as well as p values for overall effects and $\chi^2$. $R^2$ were also reported. |

### Reporting of discussion should include
| Qualitative assessment of bias (e.g., publication bias) | Funnel plots and Egger tests were reported (Online figures S2a-c) |
|------------------------------------------------------|---------------------------------------------------------------|
| Justification for exclusion (e.g., exclusion of non-English language citations) | Provided in the discussion. We excluded general prognosis and model studies that had not reported a comorbidity exposure as independently significant as non-significant exposures are often not reported by investigators. These studies were of interest to investigate how comorbidity had been included. We did not include these studies in meta-analysis. |
| Assessment of quality of included studies | We included in the discussion the approach we took to identify and measure heterogeneity and publication bias |
| **Reporting of conclusions should include** | |
| Consideration of alternative explanations for observed results | Detailed discussion on the relevance of the findings included |
| Generalization of the conclusions (e.g., appropriate for the data presented and within the domain of the literature review) | We acknowledge that the predominance of hospital studies limits the generalizability of the findings. |
| Guidelines for future research | Discussion of clinical and research implications are included |
| Disclosure of funding source | Pg.1 |

Transcribed from the original paper within the Support Unit for Research Evidence (SURE), Cardiff University, United Kingdom. February 2011.
S2  Search strategy

Prognosis

MEDLINE(1)

Predict*[tiab] OR Predictive value of tests[mh] OR Scor*[tiab] OR Observer*[tiab] OR Observer variation[mh] OR “Stratification” OR “ROC Curve”[Mesh] OR “Discrimination” OR “Discriminate” OR “c-statistic” OR “c statistic” OR “Area under the curve” OR “AUC” OR “Calibration” OR “Indices” OR “Algorithm” OR “Multivariable”

EMBASE(2)

exp disease course/ OR risk* .mp. OR diagnos*.mp.OR follow-up.mp.OR ep.fs.OR outcome.tw.

CINAHL (adapted from EMBASE)

“Disease course”.af OR risk*.af OR diagno*.af OR follow-up.af OR exp EPIDEMIOLOGY/ OR outcome.tx

All prognosis search strings were combined using the Boolean operator AND with

Population*

"heart failure".ti. OR "ventricular dysfunction".ti. OR "cardiac edema".ti. OR "heart edema".ti. OR Cardiomyopathy.ti. OR "Cardiac failure".ti. OR "Myocardial failure".ti. OR "Heart decompensation".ti. OR "ventric* failure".ti. OR "Ventricular ejection fraction".ti. OR "Cor Pulmonale".ti. OR "diastolic dysfunction".ti. OR "systolic dysfunction".ti. OR "congestive heart disease".ti.

*A validated search string for heart failure was identified initially that used a mixture of controlled vocabulary words and free text headings (heart failure.mp. OR ventricular dysfunction, left.sh. OR cardiomyopathy.mp. OR left ventricular ejection fraction.mp). When combined with the prognosis and outcomes string it resulted in over 23,000 citations in EMBASE alone. Random check of 500 articles demonstrated low precision with only 29% focused on the heart failure population. Heart failure was often an exposure or an outcome rather than the focus of the study. Following this initial search a heart failure string focused to the title of articles was then designed.

Controlled vocabulary terms and their subheadings (thesaurus terms) from each database were reviewed to develop a list of possible descriptors for the population that might appear in an article title. This list was then reviewed and added to by two heart failure clinical experts. The search was then rerun using the new population string focused to the title and 1% of the surplus articles from the original search, now screened out, were checked for appropriate exclusion. None of the excluded studies checked were relevant to this review.
Outcomes

"mortalit**.ti,ab. OR survival.ti,ab. OR "Admission**.ti,ab. OR "Readmission**.ti,ab. OR "rehospitalization**.ti,ab. OR "hospitalization**.ti,ab. OR 20 or 21 OR "death**.ti,ab. OR "quality of life".ti,ab. OR health.ti,ab. OR "Kansas City Cardiomyopathy Questionnaire".ti,ab. OR KCCQ.ti,ab. OR "Minnesota Living with Heart Failure Questionnaire".ti,ab. OR "Short form".ti,ab. OR sf-36.ti,ab. OR sf36.ti,ab. OR sf12.ti,ab. OR sf-12.ti,ab. OR euroqol.ti,ab. OR eq-5d.ti,ab. OR "Heart Failure Symptom Scale".ti,ab.

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(2) Wilczynski N, Haynes R. Optimal Search Strategies for Detecting Clinically Sound Prognostic Studies in EMBASE: An Analytic Survey. Journal of the American Medical Informatics Association 2005; 12(4):481-485

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S3 Objective information assessed during quality appraisal

| QUIPs Domains (3)                      | Objective information assessed                                                                 |
|---------------------------------------|------------------------------------------------------------------------------------------------|
| Study participation                   | Baseline population discussed in some detail                                                   |
|                                       | Sample described by key characteristics                                                       |
| Study attrition                       | Loss to follow-up <10%                                                                           |
| Prognostic factor measurement         | Description of chronic disease prognostic factor                                              |
|                                       | Method of missing data used                                                                       |
| Outcome Measurement                   | Outcome measure/event is described                                                              |
| Study confounding                     | Confounders (or predictors for models) reported                                                |
|                                       | Confounders (or predictors for models) discussed/ rationale given                              |
| Statistical analysis and reporting    | Adjusted AND unadjusted effects reported                                                         |
|                                       | Interactions examined                                                                             |
|                                       | Linearity for continuous predictors assessed                                                    |
|                                       | Proportional Hazards assumptions tested where relevant                                          |
| Statistical analysis and reporting    | Predictor selection                                                                              |
| Additional model factors considered   | Correlations tested                                                                              |
|                                       | More than 10 events per variable                                                                 |
|                                       | Clinical tool developed                                                                          |
|                                       | Internal validation performed                                                                    |
|                                       | Discrimination assessed                                                                          |
|                                       | Calibration performed                                                                             |
|                                       | External validation                                                                              |

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Comorbidity and prognosis in heart failure populations: A systematic review

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097
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### Supplemental tables

**S1.1 Study characteristics: ‘chronic disease focus’ prognostic factor studies**

| Trial/Database | Recruitment Period | Study Follow-up Period | Follow-up Mean(SD)/Median (IQR)* (R) | Heart Failure Clinical definition | Inclusions | Exclusions | Setting | Sample size (no. in analysis if different) | Centres/hospitals | Country |
|----------------|--------------------|------------------------|--------------------------------------|----------------------------------|------------|------------|--------|------------------------------------------|-----------------|---------|
| **DIABETES**   |                    |                        |                                      |                                  |            |            |        |                                          |                 |         |
| Ahmed 2007     | DIG                | 1991-93                | 4.8y                                 | 38m*                             | Symptoms/signs or objective evidence | >=76y, Serious CM, high Cr, recent acute cardiac event/intervention | RCT                | 4112 | Multicentre (n=302) | USA and Canada |
| Berry 2008     |                    | 2000                   | 33m                                  | 27(21-33)mƚ                      | Discharge code OR prescription + symptoms/signs or objective evidence | HF admission | Recent acute cardiac event/intervention | Hospital | 454  | Single | UK       |
| Burger 2005    | VMAC               | 1999-00                | 6m                                   | Signs/ symptoms                  | Decompensated HF requiring diuretics | Low bp, high risk death | RCT                | 498   | Multicentre (n=55) | USA       |
| de Boer 2010   | SENIORS            | 2000-02                | 6-9y                                 | 7.5y                             | Discharge code                           | <70y, significant renal dysfunction | RCT                | 2128 | Multinational (n=11) | Europe    |
| Flores-Le Roux 2011 | REP               | 1979-99                | 20y                                  | 5(4.6)y                          | Discharge and Framingham criteria        | Incident HF | Hospital/Community | 655   | Regional | USA     |
| Gerstein 2008  |                  | 1999-01                | 36.7m*                               | Clinical diagnosis               | NYHA 2-4                                      | Recent acute cardiac event/intervention, high Cr, low bp, serious cardiac CM | RCT | 2412 | Multinational (n=26) | Multiple  |
| Study | Citation | Study Period | Follow-up | Clinical diagnosis | Diagnosis Method | Hospital Code | Multicentre | Country |
|-------|----------|--------------|-----------|--------------------|------------------|---------------|-------------|----------|
| Greenberg 2007 | OPTIMIZE-HF | 2003-04 | 6-9m | Clinical diagnosis | Recent acute cardiac event/intervention | Hospital 5791 | Multicentre (n=91) | USA |
| Gustafsson 2004 | DIAMOND | 1993-95 | 5-8y | Symptoms/signs or objective evidence | NYHA 3-4 | RCT 5491 | Multicentre (n=34) | Denmark |
| Issa 2010 | REMADHE | 1999-07 | 3.6(2.2)y | Boston criteria | HF for >=6m | RCT 456 | Single | Brazil |
| MacDonald 2008 | Scottish morbidity data | 1986-03 | 1y AND 5y | Discharge code | De novo HF | Hospital 55173 (MEN) 61383 (WOMEN) | Countrywide | UK |
| **COPD** | | | | | | | | |
| Breidthardt 2011 | VMAC | 1999-00 | 6m | Signs/ symptoms | Decompensated HF requiring diuretics | RCT 467 | Multicentre (n=55) | USA |
| Campbell 2009 | DIG | 1991-93 | 4.8y | Symptoms/signs or objective evidence | >=76y, Serious CM, high Cr, recent | RCT 4798 | Multicentre (n=302) | United States and |
| Study (Year) | Study Code | Duration | Definition | Comparator | Study Design | Sample Size | Location |
|-------------|------------|----------|------------|------------|--------------|-------------|----------|
| Damman 2009 | COACH      | 2002-07  | 18m        | Decompensated HF requiring diuretics | Recent acute cardiac event/intervention | RCT 1023  | Multicentre (n=17) Canada |
| Go 2006     | Kaiser Permanente | 1996-02 | 2.1(0.8-3.9)y* | Discharge code | Hospital/Community 59772 (55170 known) Regional United States |
| Gotsman 2010 |            | 2001-02  | 6.5y       | Symptoms/signs and/or reduced LVF | Heamodialysis | Hospital 355 Single Israel |
| Hamaguchi 2009 | JCARE-CARD | 2004-05  | 2.4(0.7)y  | Framingham criteria | Decompenated HF | Hospital 2013 (1617) Multicentre (n=164) Japan |
| Hillege 2006 | CHARM      | 1999-01  | 34.4(1-45.2)mL Clinical diagnosis | NYHA 2-4 | Acute cardiac event or intervention, high CR, low bp, serious cardiac CM | RCT 2680 Multicentre (n=26) United States |
| Ismailov 2007 |          | 1995 and 2000 | 5 y Framingham criteria | Recent acute cardiac event/intervention | Hospital 4350 Multicentre (n=11) United States |
| Kimura 2010 |            | 2000-04  | 5 y 26.4(19.9)mL Framingham criteria | NYHA 2-4 | Recent acute cardiac event/intervention, heamodialysis, serious cardiac CM | Hospital 711 Single Japan |
| Kociol      | OPTIMIZE-HF | 2003-04  | 1 y Discharge code |           | Hospital 20063 (15792) Multicentre (n=259) United States |
| Maeder 2012 | TIME-CHF   | 2003-06  | 18m        | HF HA within 12 months, symptoms and BNP NYHA 2-4, admission within 12 mnths | <60y, High CR, serious CM, serious cardiac CM, BMI>35, recent acute cardiac event/intervention | RCT 566 Multicentre (n=15) Switzerland/Germany |
| Olandoski 2012 |         | 2005-06  | 4y 19.7(10.6)m Clinical diagnosis Incident admission with HF | | Hospital 328 Regional Brazil |
| Study | Time Period | Follow Up | Study Design | Case Definition | Hospital | N | Single/Multicentre | Country |
|-------|-------------|-----------|--------------|----------------|----------|---|--------------------|---------|
| Petretta 2007 | 2002-05 | 15.2 (0.3-45.6) ml | Framingham criteria | Recent acute cardiac event/intervention, list for device. Serious CM, serious cardiac CM, high CR, dialysis | Hospital | 153 | Single | Italy |
| Takagi 2010 | 2002-05 | 20.3 (1-54.2) ml | not specified | Acute HF | Hospital | 194 | Single | Japan |
| Testani 2011 | 2004-09 | 2.6 (1.2-4.2) y* | Clinical diagnosis | BNP>100 pg/mL | Hospital | 903 | Single | United States |
| Waldum 2010 | 2000-06 | 5 y, 9 m* | ESC guidelines | NYHA 1-4 | Hospital | 3605 | Multicentre (n=24) | Norway |

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| Study | Time Period | Follow Up | Study Design | Case Definition | Hospital | N | Single/Multicentre | Country |
|-------|-------------|-----------|--------------|----------------|----------|---|--------------------|---------|
| Davis 2008 | 1979-00 | 1 y | Framingham criteria | Incident Cases | Hospital | 955 | Single | United States |

Follow up is expressed as mean(SD), median (IQR)* or median (range) y or months (m).
### S1.2 Population characteristics: ‘chronic disease focus’ prognostic factor studies

| Study | Year | Age Mean(SD/ Median) | Gender (% male) | Systolic HF (% with EF <40% or study defined) | Caucasians (%) | EF Mean(SD/Median) (IQR)* (R)† | NYHA Stages (% 3/4) | Study indicator | Unit of chronic disease exposure measurement | No. included in study | Prevalence | Outcome/s‡ secondary |
|-------|------|----------------------|-----------------|-----------------------------------------------|----------------|-----------------------------|------------------|---------------|-----------------------------------------------|-----------------------|------------|---------------------|
| **DIABETES**                                                                                           |
| Ahmed 2007 |     | 64(11) | 73 | 87 | 32(13) | 36 | Type | Clinical record | 2056 | 29 | AC Mortality/Hospital admission |
| Berry 2008 |     | 72(13) | 49 | 70 | Type | Clinical record/Prescription/admission glucose >11 | 110 | 24 | AC Mortality |
| Burger 2005 |    | 62(14) | 69 | 87 | 27(14) | 84 | Type | Patient reported/Prescription/Diet therapy | 236 | 47 | AC Mortality |
| de Boer 2010 |   | 76(5) | 63 | 64(<=35%) | 36(12) | 41 | Type | Clinical record/Prescription | 555 | 26 | AC Mortality† |
| Flores-Le Roux 2011 | | 72(10) | 51 | 46(18) | Type | All then stratified by treatment | Undiagnosed(blood test)/Clinical record/Prescription/Diet... | 63 | 149 | 16 | 37 | AC Mortality |
| From 2006 | | 77(12) | 46 | 47(13) | Type | Blood test/Prescription | 128 | 19 | AC Mortality |
| Gerstein 2008 | | 66 | 67 | 46 | 64 | Severity | HBA1C (per 1% higher in all sample) | 907 | 38% | diabetes | AC Mortality‡ |
| Greenberg 2007 | | 73(14) | 48 | 49 | 74 | 39(18) | Type | All: Clinical record/Prescription Insulin treated | 2464 | 42 | 17 | AC Mortality |
| Gustafsson 2004 | | 73* | 60 | 47(<=35%) | 100 | 63 | Type | Clinical record/ Patient reported | 900 | 16 | AC Mortality |
| Issa 2010 | | 50(11) | 70 | 35(11) | 43 | Severity | Fasting glucose <=5.5 mmol/L (guideline and evidence driven cut point) | 124 (diabetes) | 27 | AC Mortality |
| MacDonald 2008 | | 72(12) | 100 | Type | Discharge code | 7356 | 13 | AC Mortality |
|  | | 77(11) | 0 | 33(11.7) | 52 | Type | GOLD guidelines | 7805 | 13 | AC Mortality |
| **COPD**                                                                                               |
| De Blois 2010 | | 70(12) | 71 | 83 | 33(11.7) | 52 | Type | GOLD guidelines | 699 | 17 | AC Mortality |
| First Name   | Year | Gender | Age | Type of Measure | Severity/Change | Number of Deaths | Number of Causes | Outcome   |
|-------------|------|--------|-----|-----------------|-----------------|------------------|-----------------|-----------|
| Iversen     | 2010 |        | 72  | Type and Severity | Self reported | 107              | 22              | AC Mortality|
|             |      |        | 63  | FEV1 <80%        | Discharge code  | 182              | 35              |           |
|             |      |        |     | FEV1 50-79%      |                 | 92               | 18              |           |
|             |      |        |     | FEV1 <49% per 10% of predicted |                | 90               | 17              |           |
| Lainscak    | 2009 | 73(10) | 48  | Type            |                 | 106              | 17              | AC Mortality|
| Macchia     | 2007 | 80(75-87)* | 50  | Prescriptions/ Discharge codes |               | 241              | 24              | AC Mortality|
| Rusinaru    | 2008 | 75(12) | 51  | Type            | Clinical record/ Patient reported AND prescription | 156              | 20              | AC Mortality|
|             |      |        | 55 (<50%) |                |                 |                  |                 |           |
|             |      |        | 92(16) |                |                 |                  |                 |           |
|             |      |        | 90(17) |                |                 |                  |                 |           |
| Aronson     | 2010 | 62(15) | 68  | Severity change | Increase CR (>=0.5 mg/dL) Reduction eGFR (>=25%) | 115              | 25              | AC Mortality|
|             |      |        |     | (0-30days).     | (in-hosp)       | 159              | 34              |           |
|             |      |        |     | (stratified by transient and persistent change) |             |                  |                 |           |
| Breidthardt | 2011 | 79(71-85)* | 55  | Severity        | "eGFR<60 eGFR30-59 eGFR <=30" | 2399             | 50              | AC Mortality / Hospital admission|
|             |      |        | 76  |                |                 | 2284             | 48              |           |
|             |      |        | 32(13)|                |                 | 115              | 2               |           |
| Campbell    | 2009 | 65(9)  | 76  | Severity change | Increase Cr >26.5umol/L in-hosp 0-6m 6-12m | 106              | 11              | AC Mortality / Hospital admission|
|             |      |        |     |                 | (or >25%)        | 101              | 16              |           |
|             |      |        |     |                 | (or >25%)        | 43               | 9               |           |
| Damman      | 2009 | 71(11) | 62  | Severity change | Increase eGFR >60 (ref) eGFR 45-59 eGFR 30-44 eGFR 15-29 eGFR <15 Dialysis | 29240             | 53              | AC Mortality|
|             |      |        |     |                 | (or >25%)        | 13241            | 24              |           |
|             |      |        |     |                 | (or >25%)        | 5958             | 11              |           |
|             |      |        |     |                 | (or >25%)        | 1821             | 3               |           |
|             |      |        |     |                 | (or >25%)        | 331              | 0.6             |           |
|             |      |        |     |                 | (or >25%)        | 221              | 0.4             |           |
| Go          | 2006 | 72(12) | 57  | Severity        | eGFR <53 eGFR <35 eGFR per ml/min | 237              | 67              | AC Mortality / Hospital readmission|
|             |      |        | 57  | (all pre admission – steady state measure)* |             | 118              | 33              |           |
| Gotsman     | 2010 | 74(12) | 53  | Severity        | eGFR <53 eGFR <35 eGFR per ml/min | 237              | 67              | AC Mortality / Hospital readmission|
|             |      |        | 64  | (All discharge values) |             | 118              | 33              |           |
| Study            | N(%) | Elevation | Reflectance | Severity Measures                                                                 | AC Mortality |
|------------------|------|-----------|-------------|------------------------------------------------------------------------------------|--------------|
| Hamaguchi 2009   | 72(13)| 59        | 44(16)      | Severity (All baseline values)                                                     | AC Mortality |
|                  |      |           |             | *eGFR>=60                                                                          | 478          |
|                  |      |           |             | eGFR>30-59                                                                         | 831          |
|                  |      |           |             | eGFR <30ml or dialysis                                                              | 308          |
| Hilge 2006       | 65(12)| 67        | 39(16)      | Severity (All baseline values)                                                     | AC Mortality |
|                  |      |           |             | (decrease from 75)                                                                  | 577          |
|                  |      |           |             | (decrease from 75)                                                                  | 519          |
|                  |      |           |             | eGFR >90                                                                           | 618          |
|                  |      |           |             | eGFR 89.9-75                                                                        | 547          |
|                  |      |           |             | eGFR 74.9-60                                                                        | 419          |
|                  |      |           |             | eGFR 59.9-45                                                                        |              |
|                  |      |           |             | eGFR <45                                                                           |              |
|                  |      |           |             | eGFR per 10ml/min                                                                  |              |
|                  |      |           |             | eGFR per 20ml/min                                                                  |              |
| Ismailov 2007    | 76   | 43        | 94          | Severity (All admission values)                                                    | AC Mortality |
|                  |      |           |             | *eGFR >60                                                                          | 763          |
|                  |      |           |             | eGFR 45-59                                                                         | 725          |
|                  |      |           |             | eGFR 30-44                                                                         | 569          |
| Kimura 2010      | 69(14)| 56        | 40(15)      | Severity                                                                              | AC Mortality |
| Kociol 2010      | 80*  | 44        | 36          | 90                                    | Increase Cr  | AC Mortality / Readmission |
|                  |      |           |             | (in hosp)                                                                           | 3581         |
|                  |      |           |             | >=0.3mg/dL                                                                          | 18           |
| Maeder 2012      | 77(8)| 60        | 81.6 (<45%) | 35(13)                               | Increase Cr  | AC Mortality               |
|                  |      |           |             | of >0.5 mg/dL                                                                       | 124          |
|                  |      |           |             | (baseline - 6 mths)                                                                 | 22           |
| Olandoski 2012   | 68(12)| 46        | x           | Severity change                                                                     | AC Mortality |
|                  |      |           |             | (over a month in 1 year pre or post hosp admission)                                 | 105          |
|                  |      |           |             | reduction in eGFR of >=1%                                                            | 32           |
| Petretta 2007    | 64(19-87)†| 72   | 77          | 34                                    | Type         | AC Mortality               |
| Takagi 2010      | 69(13)| 71        | 36(11-81)† | Type                                  | eGFR <60     | AC Mortality               |
| Testani 2011     | 63(16)| 54        | 34          | 29(15-45)*                            | Severity change | AC Mortality               |
|                  |      |           |             | (any time)                                                                          | Increase eGFR >=20% | 279          |
|                  |      |           |             | (persisting at discharge)                                                          | Increase eGFR >=20% | 163          |
| Waldun 2010      | 71(12)| 70        | 72.8        | 33(12)                                | Type         | AC Mortality               |
|                  |      |           |             | eGFR per 5ml/min increase                                                           |              |

‡ refers to AC Mortality ‡
### RHEUMATOID ARTHRITIS

| Davies 2008 | 77(12) | 45 | 51 (<50%) | 44 | Type | 1987 American College of Rheumatology criteria | 103 | 11 | AC Mortality |
|-------------|--------|----|-----------|----|------|---------------------------------|-----|----|-------------|

Percentages are expressed as mean(SD), Median (IQR)* or Median (Range)*. All outcomes are all-cause (AC). Ejection fraction (EF), New York Heart Association (NYHA). Outcomes are all primary study outcomes except ‡ where the study outcome was secondary.
S2.1 Study characteristics: ‘general’ prognostic factor studies

| Trial/Dataset | Recruitment Period | Study Follow-up length | Follow-up Mean(SD)/Median (IQR)* (R) | Heart Failure Clinical definition | Inclusions | Exclusions | Setting | Sample size (no. in analysis if different) | Centres/hospitals | Country |
|---------------|--------------------|------------------------|--------------------------------------|---------------------------------|------------|------------|--------|--------------------------------------|------------------|---------|
| Ahluwalia 2012 | Medicare 2001-02 | 5 y                    | Discharge code                       | <=65y                            | Hospital   | Community  |        | 9166 9166                           | National         | USA     |
| Ahmed 2006    | DIG 1991-93       | 4.8y                   | Symptoms/signs or objective evidence | WOMEN                           | RCT        |            |        | 1926                               | Multicentre (n=302) | USA and Canada |
| Aranda 2009   | Medicare 2002-04 | 6-9 m                  | Discharge code                       | Hospital                          |            |            |        | 28919 (27646)                       | National         | USA     |
| Barsheshet 2010 | HSIS 2003      | 4 y                    | Symptoms/ objective evidence at rest | Hospital                          |            |            |        | 1182 (>75y group) 1154 (<75y group) | Multicentre (n=25) | Israel   |
| Chaudhry 2010 | Medicare 1998-99 or 2000-01 | 5y       | Discharge code                       | <65y, heamodialysis              | Hospital   | Community  |        | 62330                               | Multistate (n=6)  | USA     |
| Chaudhry 2013 | CHS 1989-99      | 20y                    | Clinical history Incident             | Cancer                            | Hospital/ Community | 758 | Regional | USA                                  |
| Dunlay 2009   | REP 1987-06      | 19y                    | Discharge Code + Framingham criteria | Incident                          | Hospital/ Community | 1077 | Regional | USA                                  |
| Fernandez-Berges 2013 |          | 2000-09               | 1y                                    | Discharge Code                   | Hospital   |            |        | 2220                               | Single           | Spain   |
| Fonerarow 2008 | OPTIMIZE-HF      | 2003-04                | 6-9m                                  | Clinical diagnosis. Symptoms/signs | Hospital   |            |        | 5791                               | Multicentre (n=91) | USA     |
| Garty 2007    | HSIS 2003        | 1y                     | Symptoms/signs and objective evidence | AHA stage B-D                      | Hospital   |            |        | 4102                               | Multicentre (n=117) | Israel   |
| Gorelik 2009  |                    | 47.5m                  | Modified Framingham Decompensated HF, NYHA 2-4 | <60yrs, Serious cardiac CM, cancer, | Hospital   |            |        | 473                                | Single           | Israel   |
| Study  | Year | Follow Up | Study Characteristics | Criteria/Reference | Case Definition | Hospital Site | Number of Patients | Country/Region |
|--------|------|-----------|-----------------------|-------------------|-----------------|--------------|-------------------|----------------|
| Gotsman 2008 | 2001-02 | 1 y | Symptoms/signs and objective evidence | Clinical diagnosis of HF + echoe | Hospital | 289 | Single | Israel |
| Hamaguchi 2011 | JCARE-CARD 2004-05 | 2.1(0.9)y | Framingham criteria | Decompensated HF <80yrs | Hospital | 765(620) | Multicentre (n=164) | Japan |
| Harjola 2010 | EHFS 2004-05 | 1 y | ESC guidelines HF admissions | High output HF | Hospital | 2981 | Multinational (n=30) | Europe |
| MacIntyre 2000 | Scottish morbidity data 1986-95 | 1-10y | Discharge code | De Novo HF | Hospital | 31040(MEN) 35507(WOMEN) | Countrywide | United Kingdom |
| Mahjoub 2008 | 2000 | 5y | Framingham criteria amended by ESC | De Novo HF >=80yrs, serious cardiac CM | Hospital | 305 | Multicentre (n=11) | France |
| Mogensen 2011 | DIAMOND and ECHOES 1993-96 2001-02 | 8 y | Symptoms/signs or objective evidence NYHA 2-4 | Recent acute cardiac event/intervention | Hospital | 8507 | Multicentre (n=43) | Denmark, Norway and Sweden |
| Mosterd 2001 | Rotterdam study 1990-93 | 4.8-8.5y 6.1y | Symptoms, signs and objective evidence | <55yrs, COPD | Community | 181 | Regional | Netherlands |
| Pons 2010 | 2001-08 | 36(16.6-64.5)m* | Clinical diagnosis | De novo HF, women Serious cardiac CM | Hospital | 960 | Single | Spain |
| Rusinaru 2009 | 2000 | 5y | Framingham criteria amended byESC | De novo HF, women Serious cardiac CM | Hospital | 389 (306) | Multicentre (n=11) | France |
| Shiba 2004 | CHART 2000-03 | 1.88(0.92)y | Framingham criteria | De novo HF | Hospital | 1154 (684) | Multicentre (n=26) | Japan |
| Tribouilloy 2010 | 2000 | 7yrs | Framingham criteria amended byESC | De novo HF Serious cardiac CM | Hospital | 735 | Multicentre (n=11) | France |

Follow up is expressed as mean(SD), median (IQR)* or median (range)‡ years (y) or months (m).
## S2.2 Population characteristics: ‘general’ prognostic factor studies

| Study            | Year | Age Mean (SD/Median (IQR))*(R) | Gender (%) Male | Systolic/ (% with EF <40% (or study defined)) | Causcasian (%) | EF Mean (SD)/Median (IQR)*(R) | NYHA Stages (% 3/4) | Chronic disease | Study indicator | Unit of chronic disease exposure measurement | No. included in study | Prevalence | Outcome/s               |
|------------------|------|--------------------------------|-----------------|-----------------------------------------------|----------------|-----------------------------|---------------------|-----------------|----------------|-----------------------------------------------|-----------------------|------------|-------------------------|
| Ahluwalia 2012   |      | 81(75-86)* 81(75-86)*          | 41 41           | x 86 85                                       | X              | Diabetes COPD Renal disease Arthritis Dementia Cancer- Lung Cancer- Colorectal Cancer- Endometrial | Type                | Discharge codes | 7739 6129 5035 5399 4266 214 234 20 | 42 33 27 29 23 1 1 0.1 | AC Mortality |
| Ahmed 2006       |      | 66(12) 0 79 (<45%) 82 35(14)    |                | Diabetess Renal dysfunction                    | Type           | Not specified eGFR per ml | 650                 | 34              | Mortality Hospital admission               |
| Aranda 2009      |      | x 44 x 83 X                     |                | Diabetes                                      | Type           | Not specified               | x                   | 37              | Readmission                              |
| Barsheshet 2010  |      | 82 (78-87)* 67 (59-72)*        | 47 63           | 48 53                                         | Renal dysfunction Diabetes | Type eGFR <60 Clinical record/ blood test/prescription | 1361 1207           | 58 52            | AC Mortality                              |
| Chaudhry 2010    |      | 80 42 . 87 X                    |                | Diabetes Dementia Cancer (any) COPD           | Type           | Clinical record              | 24745 6046 1496 21192 | 40 10 2 34 | AC Mortality                              |
| Chaudhry 2013    |      | 80(6) 50 43 (<45%) 87 X        | 30              | Renal disease Diabetes                        | Type           | eGFR<60 Patient report/ Prescription/ Blood test | 280 193            | 37 26            | Hospital admission                         |
| Dunlay 2009      |      | 77(13) 46 46(18)                |                | COPD Diabetes                                  | Type           | Clinical record National diabetes | 253 232            | 24 21            | Hospital admission                         |
| Study                  | Year | Criteria | Type of Disease | Clinical record | Death Rate | Mortality |
|------------------------|------|----------|-----------------|-----------------|------------|-----------|
| Fernandez-Berges 2013  | 76(10) | 47 | Diabetes, Renal disease | Clinical record | 970 390 | 44 18 |
| Fonarow 2008           | 72(14) | 51 53 78 37(17) | Renal dysfunction | Worsening Pre-admission | Clinical record | 509 9 |
| Garty 2007             | 73(12) | 57 52 | Renal failure, COPD | Type | Cr=>1.5mg/dl Clinical record | 1672 803 | 41 20 |
| Gorelik 2009           | 73(10) | 57 61 (<50%) 41(14) | Renal dysfunction, Cancer – any | Severity | eGFR <60 (admission) Clinical record: Non advanced | 70 12 |
| Gotsman 2008           | 73(12) | 53 64 | Diabetes, Chronic renal disease | Type | Clinical record | 122 110 | 42 38 |
| Hamaguchi 2011         | 85(4) | 45 | Renal dysfunction | Severity | eGFR per ml/min decrease (baseline) | Mortality |
| Harjola 2010           | 72(62-79)* | 62 65 (<45%) 38(15) | Diabetes | Type | Clinical record | 987 33 |
| MacIntyre 2000         | 72* | 78* | 100 0 | Arthritis, Cancer – any, Renal failure, Diabetes, Lung Disease | Type | Admission code (prior to HF admission) | 3383 3330 454 1760 4818 | 5 5 1 3 7 |
| Mahjoub 2008           | 86(5) | 37 39(<50%) 52(16) | Cancer – any | Type | Clinical record | 37 12 |
| Mogensen 2011          | 72(11) | 60 55(<45%) | Diabetes, COPD, Renal dysfunction | Type | Clinical record/ Px Clinical record/ Px eGFR<30 | 1361 1948 970 | 16 23 11 |
| Mosterd 2001          | 77(8) | 40 | Diabetes | Type | Blood test/ Prescription | 32 18 |
| Pons 2010              | 69* | 71 | 31 39 | Diabetes | Type | Not specified | 377 39 |
| Rusinaru 2010          | 78(11) | n/a | Cancer | Type | Clinical record | 34 9 |
| Year   | Study        | 2004 | 2009 | 2010 |
|--------|--------------|------|------|------|
|        | Shiba        | 68(13)| 67   | 52   |
|        |              | 49(16)| 16   | 43 (~50%) |
|        | Tribouilloy  | 75(12)| 51(16)| 51(16) |
|        | Type         | Diabetes | Type | Cancer |
|        | Type         | Type   | Type | Type   |
|        | Clinical record | 106 | 106 | 106 |
|        | Clinical record | 19 | 19 | 19 |
|        | Mortality    | 27    | 27   | 27 |

Percentages are expressed as mean(SD), Median (IQR)* or Median (Range)ƚ. All outcomes are all-cause (AC). Ejection fraction (EF), New York Heart Association (NYHA). Outcomes are all primary study outcomes except † where the study outcome was secondary.
### S3.1 Study characteristics: prognostic model studies

| Trial/Database | Recruitment Period | Study Follow-up length | Follow-up Mean(SD)/Median (IQR)* (R)† | Heart Failure Clinical definition | Inclusions | Exclusions | Setting | Sample size (no. in analysis if different) | Centres/hospitals | Country |
|----------------|--------------------|------------------------|---------------------------------------|----------------------------------|------------|------------|---------|------------------------------------------|------------------|---------|
| Barlera 2013   | GISSI-HF 2002-05   | 4y                     | 3.9y*                                 | ESC guidelines                  | NYHA 2-4   | Recent acute cardiac event/intervention, serious CM | RCT               | 6975                                      | Multicentre (n=357) | Italy   |
| Bouvy 2003     | 18m                | Discharge code         |                                       | High risk of death              | RCT        | 152                    | Multicentre (n=7) |                                  | Netherlands      |
| Huynh 2006     | 1990-94 14y        | 2.5y*                  | Objective evidence OR signs/symptoms and response to diuresis | <70yrs, high risk of death      | RCT        | 282                    | Single            |                                  | United States    |
| Krumholz 2000  | Medicare 1994-95   | 6m                     | Discharge code, symptoms or objective evidence | <65yrs, serious cardiac CM, in-hospital death | Hospital | 1129 (derivation) | Multicentre (n=9) |                                  | United States    |
| Lee 2003       | EFFECT 1999-01     | 1y                     | Discharge code and modified Framingham criteria | HF admission                    | RCT        | 2624                   | Multicentre (n=34) |                                  | Canada           |
| Martinez-Selles 2010 | HOLA 1996 | 10y        | 5.2(4.2)y                           | Symptom and (Sign or objective evidence) | Recent acute cardiac event/intervention | Hospital | 701                    | Single            | Spain           |
| O'Connor 2008  | OPTIMIZE-HF 2003-04 | 60-90days             | 2.4(0.7)m                           | Clinical diagnosis               | HF admissions | Hospital | 5791(4402) | Multicentre (n=91) | United States   |
| Pocock 2006    | CHARM 1999-01      | 38m*                   | Clinical diagnosis                  | NYHA 2-4                         | Acute cardiac event or intervention, high CR, low bp, serious cardiac CM | RCT        | 7599                   | Multinational (n=26) | Multiple |
| Pocock         | MAGIC              | 2.5y*                  | Hospital                             | 39372                             |            |            |         |                                          | Multiple         |
| Year | Database | Start Year | Duration | Methodology | Outcome 1 | Hospital Type | Sample Size | Setting | Country |
|------|----------|------------|----------|-------------|-----------|---------------|-------------|---------|---------|
| 2013 | Senni 2006 | 2003 | 1yr | ESC guidelines | In-hosp death, heart surgery | Hospital/Community | 292 (derivation) | Multicentre (n=3) | Italy |
| 2013 | Senni 2013 | 2002-06 | 1 yr | Symptoms, signs and objective evidence | In-hosp death, cancer | Hospital | 2016 (derivation) | Multicentre (n=8) | Europe |
| 2012 | Wang 2012 | VHA | 2009-10 | Discharge codes | Chronic HF | Hospital/Community | 198640 | National | United States |

Follow up is expressed as mean(SD), median (IQR)* or median (range)† years (y) or months (m).
## S3.2 Population characteristics: prognostic model studies

| Study          | Age Mean (SD) | Gender (% male) | Systolic/ LVF (% with EF <40%) (or study defined) | Causcasian (%) | EF Mean (SD)/Median (IQR)* (R)† | NYHA Stages (% stage 3 or 4) | Chronic disease | Study indicator | Unit of chronic disease exposure measurement | No. included in study | Prevalence | Outcome/s   |
|----------------|---------------|-----------------|--------------------------------------------------|----------------|-------------------------------|------------------------------|----------------|---------------|---------------------------------------------|----------------------|------------|-------------|
| Barlera 2013   | 67(10)        | 78              |                                                  |                |                               |                              | Diabetes, COPD, Renal dysfunction | Type           | Clinical record, Clinical examination eGFR per unit decrease<60 | 1974, 1533           | 28, 22     | AC Mortality |
| Bouvy 2003     | 70(37-91)†    | 34              |                                                  |                |                               |                              | Diabetes, Renal dysfunction | Type           | Clinical record                             | 43, 19               | 28, 22     | AC Mortality |
| Huynh 2006     | 79(6)         | 37              | 63 (<45%)                                        | 45             | 43(14)                        |                              | Dementia                     | Type           | Clinical record                             | 13, 19               | 5, 5       | AC Mortality |
| Krumholz 2000  | 78(8)         | 41              | 44                                               | 92             |                               |                              | Diabetes                     | Type           | Clinical record                             | 412                  | 36         | Readmission |
| Lee 2003       | 76 (11)       | 50              | 53                                               |                |                               |                              | Dementia, COPD, Liver cirrhosis, Cancer | Type           | Clinical record                             | 225, 543, 34, 34, 234 | 9, 21, 4, 9, 9 | AC Mortality |
| Martinez-Selles 2010 | 72(12)       | 45              |                                                  |                |                               |                              | COPD                         | Type           | Clinical record                             | 188                  | 27         | AC Mortality |
| O'Connor 2008  | 72(14)        | 51              | 53                                               | 78             | 37(17)                        |                              | Liver disease, Reactive airways disease | Type           | Clinical record                             | 126, 498             | 2, 9       | AC Mortality |
| Pocock 2006    | 66(11)        | 68              |                                                  |                | 39(15)                        |                              | Diabetes                     | Type           | Clinical record stratified by treatment | 707                  | 9          | AC Mortality |
| Pocock 2013    | 67(11)        | 67              | 91                                               | 36(14)         | 44                            |                              | Diabetes, COPD               | Type           | Varies across studies                       | 8919, 4035           | 23, 10     | AC Mortality |
| Senni 2006     | 71(13)        | 62              | 61                                               |                | 38(13)                        |                              | COPD, Diabetes with target organ | Type, severity | Clinical record                             | 45, 40               | 15, 14     | AC Mortality |
| Senni 2013 | 68 (58-76)* | 70 | 90 (<50%) | 35 (27-40)* | 34 | Diabetes with target organ damage | Renal dysfunction (moderate to severe) | Cancer (metastatic or >2 tumors) |
|-----------|-------------|----|-----------|-------------|----|-----------------------------------|-------------------------------------|---------------------------------|
|           |             |    |           |             |    | Severity                           | Clinical record                     |                                 |
|           |             |    |           |             |    |                                    |                                     |                                 |
|           |             |    |           |             |    |                                    |                                     |                                 |
| Wang 2012 | 73          | 98 |           |             |    | Renal failure                      | Clinical record                     |                                 |
|           |             |    |           |             |    | COPD                               |                                     |                                 |
|           |             |    |           |             |    | Dementia                           |                                     |                                 |
|           |             |    |           |             |    | Cancer*                            |                                     |                                 |
|           |             |    |           |             |    | Liver cirrhosis                    |                                     |                                 |
|           |             |    |           |             |    |                                    |                                     |                                 |

Percentages are expressed as mean(SD), Median (IQR)* or Median (Range)*. All outcomes are all-cause (AC). Ejection fraction (EF), New York Heart Association (NYHA). Outcomes are all primary study outcomes except ‡ where the study outcome was secondary.
## S4.1 Study Risk of bias assessment

| Study participation | Study attrition | Prognostic factor measurement | Outcome Measurement | Study confounding |
|---------------------|-----------------|------------------------------|---------------------|-------------------|
| Baseline population level of detail provided | Sample described | Risk level | Loss to follow-up | Risk level | Chronic disease exposure description | Method of missing data | Risk level | Outcome measure description | Risk level | Confounders (or predictors for models) reported | Risk level |
| Ahmed 2007 | Brief | Yes | Med | NR | Med | Yes | NR | Med | Yes | Low | Yes | No | Low |
| Berry 2008 | Brief | Yes | Med | <10% | Low | Yes | Full case analysis | Med | Yes | Low | Yes | No | Med |
| Burger 2005 | Brief | Yes | Med | <10% | Low | Yes | NR | Med | Yes | Med | Yes | No | Med |
| de Boer 2010 | Brief | Yes | Med | NR | Med | Yes | NR | Med | Yes | Med | Yes | No | Med |
| Flores-Le Roux 2011 | Brief | Yes | Med | <10% | Low | Yes | NR | Med | Yes | Low | Yes | No | Med |
| From 2006 | Detailed | Yes | Low | <10% | Low | Yes | Single imputation | Low | Yes | Low | Yes | No | Med |
| Gerstein 2008 | Brief | Yes | Med | <10% | Low | Yes | No missing data | Low | Yes | Low | Yes | No | Med |
| Greenberg 2007 | Detailed | Yes | Med | <10% | Low | Yes | NR | Med | Yes | Low | Yes | No | Med |
| Gustafsson 2004 | Detailed | Yes | Low | <10% | Low | Yes | Full case analysis | Med | Yes | Low | Yes | No | Med |
| Issa 2010 | Brief | Yes | High | <10% | Low | Yes | NR | Med | Yes | Med | Yes | No | Med |
| MacDonald 2008 | Detailed | Yes | Low | NR | Low | Yes | Full case analysis | Med | Yes | Low | Yes | No | Med |
| De Blois 2010 | Brief | Yes | Med | >10% | Med | Yes | No missing data | Low | Yes | Med | Yes | No | Low |
| Iversen 2010 | Detailed | Yes | Low | <10% | Low | Yes | Full case analysis | Low | Yes | Low | Yes | No | Med |
| Lainscak 2009 | Brief | Yes | High | <10% | Low | Yes | NR | High | Yes | Low | Yes | No | Med |
| Macchia 2007 | Brief | yes | Med | NR | Low | Yes | NR | Med | Yes | low | Yes | No | High |
| Rusinaru 2008 | Detailed | Yes | Low | <10% | Low | Yes | Full case analysis | Med | Yes | low | Yes | No | Low |
| Renal | Aronson 2010 | Brief | Yes | Med | <10% | Low | Yes | Single imputation | Low | Yes | Low | Yes | No | Med |
| Study                        | Brief | Yes | Med | <10% | Low | Yes | NR  | Med | Yes | No missing data | Low | Yes | Low | Yes | No | Med |
|-----------------------------|-------|-----|-----|------|-----|-----|-----|-----|-----|-----------------|-----|-----|-----|-----|----|-----|
| Breidthardt 2011            | Brief | Yes | Med | >10% | High| Yes | No missing data | Low | Yes | Low | Yes | No | Med |
| Campbell 2009               | Brief | Yes | Med | <10% | Low | Yes | NR  | Low | Yes | Low | Yes | No | Low |
| Damman 2009                 | Brief | Yes | Med | <10% | Low | Yes | Single imputation | Low | Yes | Low | No | Yes | Low |
| Go 2006                     | Detailed | Yes | Low | NR  | Med | Yes | Full case analysis | Med | Yes | Low | Yes | Yes | Low |
| Gotsman 2010                | Brief | Yes | Med | <10% | Low | Yes | NR  | Low | Yes | Low | Yes | No | Med |
| Hamaguchi 2009              | Brief | Yes | Med | >10% | Low | Yes | NR  | Low | Yes | Low | Yes | No | Med |
| Hillege 2006                | Detailed | Yes | Low | NR  | Med | Yes | Single imputation | Med | Yes | Low | Yes | No | Med |
| Ismailov 2007               | Brief | Yes | Med | NR  | Med | Yes | NR  | Med | Yes | Low | Yes | No | Med |
| Kimura 2010                 | Brief | Yes | Med | <10% | Low | Yes | NR  | Low | Yes | No | Yes | No | Med |
| Kociol 2010                 | Detailed | Yes | Low | NR  | Low | Yes | Single imputation | Med | Yes | Low | Yes | No | Med |
| Maeder 2012                 | Brief | Yes | Med | <10% | Low | Yes | NR  | Low | Yes | No | Yes | No | Med |
| Olandoski 2012              | Brief | Yes | Med | NR  | Med | Yes | NR  | High | Yes | Med | No | No | High |
| Petretta 2007               | Brief | Yes | Med | NR  | Med | Yes | NR  | Low | No | No | No | No | High |
| Takagi 2010                 | None  | Yes | High| NR  | Med | Yes | NR  | Med | Yes | Low | Yes | No | High |
| Testani 2011                | Brief | Yes | Med | NR  | Med | Yes | Full case analysis | Med | Yes | Low | Yes | No | Med |
| Waldum 2010                 | Brief | Yes | Med | <10% | Low | Yes | Full case analysis | Med | Yes | Med | Yes | No | Med |
| Davis 2008                  | Brief | Yes | Low | NR  | Low | Yes | NR  | Med | Yes | Low | Yes | No | Med |

**Prognostic factors (general)**

| Study                        | Brief | Yes | Med | <10% | Low | Yes | NR  | Med | Yes | No missing data | Low | Yes | Low | Yes | No | Med |
|-----------------------------|-------|-----|-----|------|-----|-----|-----|-----|-----|-----------------|-----|-----|-----|-----|----|-----|
| Ahluwalia 2012              | Brief | Yes | Med | <10% | Low | Yes | No missing data | Med | Yes | Med | Yes | No | Med |
| Ahmed 2006                  | Brief | Yes | Med | NR  | Med | No  | NR  | Med | Yes | Low | Yes | No | Low |
| Aranda 2009                 | Brief | Yes | Med | NR  | High| Yes | NR  | Med | Yes | Med | No | No | High |
| Barsheeshet 2010            | Detailed | Yes | Low | NR  | Med | Yes | Full case analysis | Low | Yes | Low | Yes | Yes | Low |
| Chaudhry 2010               | Brief | Yes | Med | <10% | Low | No  | Missings catagorised | Med | Yes | Low | Yes | No | Med |
| Chaudhry 2013               | Detailed | Yes | Low | <10% | Low | Yes | Missings catagorised | Med | Yes | Low | Yes | Yes | Low |
| Dunlay 2009                 | Detailed | Yes | Low | <10% | Low | Yes | Multiple imputation | Med | Yes | Low | Yes | No | Med |
| Fernandez-Berges 2013       | Brief | Yes | Med | <10% | Low | No  | NR  | High | Yes | Med | Yes | Yes | Med |
| Fonarow 2008                | Detailed | Yes | Low | <10% | Low | Yes | NR  | Med | Yes | Low | Yes | No | Med |
| Garty 2007                  | Brief | Yes | Med | <10% | Low | No  | NR  | Med | Yes | Low | No | No | High |
| Gorelik 2009                | Brief | Yes | High| NR  | Med | Yes | NR  | Med | Yes | Low | Yes | No | Med |
| Gotsman 2008                | Brief | Yes | Med | NR  | Med | Yes | NR  | Med | yes | Low | Yes | No | Med |
| Study                  | Type    | Prognostic Model                | Prognostic Model | Methodology               | Case Handling | Missingness   | Result  | Type  |
|------------------------|---------|---------------------------------|------------------|---------------------------|---------------|---------------|---------|-------|
| Hamaguchi 2011         | Brief   | Yes                             | Med              | <10%                      | Low           | Yes           | NR      | Med   |
| Harjola 2010           | Brief   | Yes                             | Med              | <10%                      | Low           | Yes           | Single imputation | Low   | Yes   | No | Med   |
| MacIntyre 2000         | Detailed| Yes                             | Low              | <10%                      | Low           | Yes           | Full case analysis | Med   | Yes   | No | Med   |
| Mahjoub 2008           | Detailed| Yes                             | Low              | <10%                      | Low           | Yes           | Full case analysis | Med   | Yes   | No | Med   |
| Mogensen 2011          | Brief   | Yes                             | Low              | <10%                      | Low           | Yes           | NR      | Med   |
| Mosterd 2001           | Detailed| Yes                             | Med              | <10%                      | Low           | Yes           | Full case analysis | Med   | Yes   | No | High  |
| Pons 2010              | Brief   | Yes                             | Med              | <10%                      | Low           | Yes           | NR      | Med   |
| Rusinaru 2009          | Detailed| Yes                             | Low              | <10%                      | Low           | Yes           | Full case analysis | Med   | Yes   | No | Med   |
| Shiba 2004             | Detailed| Yes                             | Low              | <10%                      | Low           | Yes           | Full case analysis | High  | Med   | No | Med   |
| Tribouilloy 2010       | Detailed| Yes                             | Low              | <10%                      | Low           | Yes           | Full case analysis | Med   | Yes   | No | Med   |

**Prognostic models**

| Study                  | Type    | Prognostic Model                | Prognostic Model | Methodology               | Case Handling | Missingness   | Result  | Type  |
|------------------------|---------|---------------------------------|------------------|---------------------------|---------------|---------------|---------|-------|
| Barlera 2013           | Brief   | Yes                             | Med              | <10%                      | Low           | Yes           | Multiple imputation | Low   | Yes   | No | Low   |
| Bouvy 2003             | Brief   | Yes                             | Med              | <10%                      | Low           | No            | Single imputation | Med   | Yes   | Yes | Med   |
| Huynh 2006             | Brief   | Yes                             | High             | <10%                      | Low           | No            | Full case analysis | Med   | Yes   | No | Med   |
| Krumholz 2000          | Brief   | Yes                             | Med              | NR                        | Med           | No            | Missings catagorised | Med   | Yes   | No | Low   |
| Lee 2003               | Detailed| Yes                             | Low              | <10%                      | Low           | Yes           | Full case analysis | Med   | Yes   | Yes | Low   |
| Martinez-Selles 2010   | Brief   | Yes                             | Med              | NR                        | Med           | No            | NR      | Med   |
| O'Connor 2008          | Detailed| Yes                             | Low              | <10%                      | Low           | No            | Full case analysis | Med   | Yes   | No | Med   |
| Pocock 2006            | Detailed| Yes                             | Low              | NR                        | Med           | Yes           | NR      | Med   |
| Pocock 2013            | Brief   | Yes                             | Med              | NR                        | Med           | No            | Multiple imputation | Med   | Yes   | No | Med   |
| Senni 2006             | Brief   | Yes                             | Med              | <10%                      | Low           | Yes           | Single imputation | Low   | Yes   | Yes | Med   |
| Senni 2013             | Brief   | Yes                             | Low              | <10%                      | Low           | Yes           | Full case analysis | Med   | Yes   | Yes | Low   |
| Wang 2012              | Brief   | Yes                             | Med              | NR                        | Med           | Yes           | Single imputation | Med   | Yes   | No | Med   |

NR Not reported
### S4.2 Study Risk of bias assessment cont’d

| Study                          | Adjusted AND unadjusted effects reported | Interactions examined | Linearity for continuous predictors assessed | Proportional Hazards assumptions tested | Predictor selection | Risk level |
|--------------------------------|------------------------------------------|-----------------------|---------------------------------------------|----------------------------------------|---------------------|------------|
| Ahmed 2007                     | Yes                                      | Yes                   | N/A                                         | NR                                     | Full model          | Low        |
| Berry 2008                     | Yes                                      | NR                    | NR                                          | NR                                     | Selected by significance level + stepwise | Med        |
| Burger 2005                    | No                                       | NR                    | NR                                          | NR                                     | Full model          | Low        |
| de Boer 2010                   | Yes                                      | Yes                   | N/A                                         | NR                                     | Full model          | Low        |
| Flores-Le Roux 2011            | No                                       | NR                    | No                                          | NR                                     | Pre-specified predictors | Med        |
| From 2006                      | No                                       | Yes                   | N/A                                         | NR                                     | Full model          | Low        |
| Gerstein 2008                  | No                                       | NR                    | NR                                          | Yes                                    | Full model          | Med        |
| Greenberg 2007                 | No                                       | Yes                   | Yes                                         | NR                                     | Stepwise            | Med        |
| Gustafsson 2004                | Yes                                      | Yes                   | Yes                                         | Yes                                    | Pre-specified predictors | Low        |
| Issa 2010                      | No                                       | Yes                   | No                                          | NR                                     | Selected by significance level | Med        |
| MacDonald 2008                 | No                                       | Yes                   | No                                          | NR                                     | Full model          | Med        |
| De Blois 2010                  | Yes                                      | NR                    | N/A                                         | NR                                     | Selected by significance level | Med        |
| Iversen 2010                   | Yes                                      | Yes                   | yes                                         | Yes                                    | Backward selection  | Low        |
| Lainscak 2009                  | Yes                                      | NR                    | NR                                          | NR                                     | Selected by significance level | Med        |
| Macchia 2007                   | Yes                                      | NR                    | NR                                          | NR                                     | Selected by significance level | Med        |
| Rusinaru 2008                  | Yes                                      | NR                    | NR                                          | NR                                     | Backward selection  | Med        |
| Aronson 2010                   | Yes                                      | NR                    | NR                                          | NR                                     | Selected by significance level | Med        |
| Breidthardt 2011               | Yes                                      | NR                    | N/A                                         | NR                                     | Selected by significance level | Med        |
| Campbell 2009                  | N/A                                      | Yes                   | N/A                                         | Yes                                    | N/A                 | Low        |
| Damman 2009                    | Yes                                      | NR                    | N/A                                         | NR                                     | Full model          | Med        |
| Go 2006                        | No                                       | Yes                   | N/A                                         | NR                                     | Pre-specified predictors | Low        |
| Study          | Model Selection | Prognostic Factors | Prognostic Factors (general) | Rheumatoid arthritis |
|---------------|-----------------|--------------------|-------------------------------|----------------------|
| Gotsman 2010  | No              | Yes                | NR                            | Pre-specified predictors | Med                |
| Hamaguchi 2009| Yes             | NR                 | NR                            | Pre-specified predictors | Med                |
| Hillege 2006  | Yes             | Yes                | Yes                           | Pre-specified predictors | Low, Low           |
| Ismailov 2007 | Yes             | NR                 | NR                            | Selected by significance level | Med, Med         |
| Kimura 2010   | No              | NR                 | NR                            | Selected by significance level | High, Med        |
| Kociol 2010   | No              | NR                 | NR                            | Full model            | Low                |
| Maeder 2012   | No              | Yes                | NR                            | Selected by significance level | Med, Med         |
| Olandoski 2012| No              | Yes                | No                            | Pre-specified predictors | High, High        |
| Petretta 2007 | Yes             | Yes                | Yes                           | Selected by significance level + stepwise | Med, Med        |
| Takagi 2010   | No              | NR                 | NR                            | Full model            | High, Med         |
| Testani 2011  | Yes             | Yes                | NR                            | Selected by significance level + backwards | Med, Med        |
| Waldum 2010   | No              | Yes                | Yes                           | Selected by significance level | Med, Med         |
| Davis 2008    | No              | NR                 | N/A                           | Full model            | High, Med         |
| Ahluwalia 2012| No              | Yes                | N/A                           | Yes                   | Full model         |
| Ahmed 2006    | No              | NR                 | NR                            | Full model            | Med, Med         |
| Aranda 2009   | No              | NR                 | NR                            | N/A                   | Full model         |
| Barsheshet 2010| No             | Yes                | NR                            | Selected by significance level | Med, Low         |
| Chaudhry 2010 | Yes             | NR                 | Yes                           | N/A                   | Stepwise           |
| Chaudhry 2013 | Yes             | NR                 | NR                            | N/A                   | Selected by significance level + backwards | Low, Low       |
| Dunlay 2009   | Yes             | Yes                | Yes                           | N/A                   | Full model         |
| Fernandez-Berges 2013 | Yes | NR | NR | NR | Selected by significance level | Med, Med |
| Fonarow 2008  | No              | NR                 | Yes                           | NR                   | Stepwise           |
| Garty 2007    | No              | NR                 | NR                            | N/A                   | Stepwise           |
| Gorelik 2009  | No              | NR                 | NR                            | Selected by significance level | High, Med        |
| Gotsman 2008  | No              | NR                 | NR                            | Pre-specified predictors | High, Med        |
| Hamaguchi 2011| No              | NR                 | NR                            | Pre-specified predictors | Med, Med         |
| Harjola 2010  | Yes             | NR                 | yes                           | Yes                  | Selected by significance level | Low, Low       |
| MacIntyre 2000| No              | Yes                | N/A                           | Yes                  | Full model         |
| Rheumatoid arthritis | | | | | |
| Study             | Direction | NR1 | NR2 | NR3 | NR4 | Methodology                                          | Risk of bias | Quality |
|-------------------|-----------|-----|-----|-----|-----|-----------------------------------------------------|--------------|---------|
| Mahjoub 2008      | No        | NR  | NR  | NR  | NR  | Selected by significance level + backwards          | Med          | Low     |
| Mogensen 2011     | No        | Yes | Yes | Yes | NR  | Backward selection                                   | Low          | Low     |
| Mosterd 2001      | No        | NR  | No  | NR  | NR  | Pre-specified predictors                             | High         | Med     |
| Pons 2010         | Yes       | NR  | NR  | NR  | NR  | Backward selection                                   | Med          | Med     |
| Rusinaru 2009     | No        | NR  | NR  | NR  | NR  | Pre-specified predictors                             | Med          | Med     |
| Shiba 2004        | No        | NR  | NR  | NR  | NR  | Backward selection                                   | High         | Med     |
| Tribuilloy 2010   | No        | NR  | Yes | Yes | NR  | Full model                                           | Med          | Med     |
|                   | **Prognostic models** |     |     |     |     |                                                     |              |         |
| Barlera 2013      | No        | Yes | Yes | Yes | NR  | Stepwise                                             | Low          | Low     |
| Bouvy 2003        | Yes       | NR  | NR  | N/A | N/A | Selected by significance level                       | Med          | Med     |
| Huynh 2006        | Yes       | NR  | NR  | NR  | NR  | Selected by significance level + forwards            | High         | Med     |
| Krumholz 2000     | No        | NR  | NR  | Yes | NR  | Stepwise                                             | Med          | Med     |
| Lee 2003          | Yes       | yes | yes | N/A | N/A | Selected by significance level                       | Low          | Low     |
| Martinez-Selles 2010 | No  | Yes | NR  | NR  | NR  | Selected by significance level + backwards          | Med          | Med     |
| O’Connor 2008     | Yes       | Yes | Yes | Yes | NR  | Stepwise                                             | Low          | Low     |
| Pocock 2006       | No        | Yes | Yes | Yes | NR  | Forward selection                                    | Low          | Low     |
| Pocock 2013       | No        | Yes | Yes | Yes | NR  | Forward selection                                    | Med          | Med     |
| Senni 2006        | No        | NR  | NR  | N/A | N/A | Selected by significance level                       | Med          | Med     |
| Senni 2013        | No        | Yes | NR  | N/A | N/A | Other e.g. LASSO, bootstrap                          | Low          | Low     |
| Wang 2012         | No        | Yes | Yes | N/A | N/A | Backward selection                                   | Med          | Med     |

NR Not reported
NA Not applicable
Additional assessments for prognostic model studies

| Study                | NR | Yes | Score | Yes | Yes | Yes | No |
|----------------------|----|-----|-------|-----|-----|-----|----|
| Barlera 2013         | NR | Yes | Score | Yes | Yes | Yes | No |
| Bouvy 2003           | NR | No  | Score | No  | Yes | Yes | No |
| Huynh 2006           | No | Yes | Score | Yes | Yes | No  | No |
| Krumholz 2000        | NR | Yes | Score | Yes | NR  | Yes | No |
| Lee 2003             | Yes| Yes | Score | Yes | Yes | Yes | No |
| Martinez-Selles 2010 | NR | Yes | Score | No  | Yes | Yes | No |
| O'Connor 2008        | NR | Yes | Score | Yes | Yes | NR  | Yes |
| Pocock 2006          | NR | Yes | Score | Yes | Yes | Yes | No |
| Pocock 2013          | NR | Yes | Score | Yes | NR  | Yes | No |
| Senni 2006           | NR | No  | Score | Yes | Yes | Yes | No |
| Senni 2013           | NR | Yes | Score | Yes | Yes | Yes | No |
| Wang 2012            | Yes| Yes | Score | Yes | Yes | Yes | No |
Supplementary figures

S1  Galbraith plots

a) DM in HF and all-cause mortality

b) COPD in HF and all-cause mortality
c) RD in HF and all-cause mortality

S2 Funnel plots

a) DM in HF and all-cause mortality with pseudo 95% confidence intervals
b) COPD in HF and all-cause mortality with pseudo 95% confidence intervals

Egger test (p=0.118)

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c) RD in HF and all-cause mortality with pseudo 95% confidence intervals

Egger test (p=0.56)
### a) DM in HF and all-cause mortality: ‘general’ prognostic factor studies

| Study                        | Sample size (n) | Diabetes (n) | Prevalence (%) | Adjusted | ES (95% CI) | Effect |
|------------------------------|-----------------|--------------|----------------|----------|-------------|--------|
| Ahmed et al (2006)          | 1926            | 650          | 34             | A, G, E  | 1.16 (1.11, 1.22) | HR     |
| Barsheshet et al (2010)     | 1154            | 706          | 61             | A, G, C, At, Sv, D, L, P, Ef | 1.43 (1.15, 1.77) | HR     |
| Barsheshet et al (2010) (>75 years) | 1182         | 501          | 42             | A, G, C, At, Sv, D, L, P, Ef | 1.28 (1.07, 1.53) | HR     |
| Chaudhry et al (2010)       | 62330           | 24745        | 40             | A, G, E, L, P, Ef | 1.28 (1.23, 1.34) | OR     |
| Fernandez-Borges et al (2013)| 2220           | 970          | 44             | A, R, C, D | 1.35 (1.11, 1.66) | HR     |
| Gotman et al (2008)         | 289             | 122          | 42             | A, G, S, C, L, Ef | 1.68 (1.03, 2.74) | HR     |
| Harjila et al (2010)        | 2981            | 987          | 33             | A, G, C, L, P, Ef | 1.38 (1.08, 1.76) | HR     |
| MacIntyre et al (2000) (Men) | 31400           | *            | A, S, C        |          | 1.55 (1.41, 1.70) | HR     |
| MacIntyre et al (2000) (Women) | 35507          | *            | A, S, C        |          | 1.50 (1.38, 1.62) | HR     |
| Mognersen et al (2011)      | 8507            | 1361         | 16             | A, G, R, C, Ef | 1.47 (1.37, 1.58) | HR     |
| Mosterd et al (2001)        | 181             | 32           | 18             | A         | 3.19 (1.80, 5.65) | HR     |
| Pons et al (2010)           | 960             | 377          | 40             | A, G, C, At, Sv, D, Ef | 1.80 (1.27, 2.51) | HR     |
| Rusinaru et al (2009)       | 389             | 106          | 27             | A, G, R, C, Sv, Ef | 2.05 (1.41, 3.00) | HR     |
| Shiba et al (2004)          | 1154            | 223          | 19             | A, S, C, Sv, L | 1.94 (1.26, 2.99) | HR     |
| Tribouilloy et al (2010)    | 735             | 181          | 25             | A, G, R, C, D, L | 1.53 (1.22, 1.92) | HR     |

Figure S3a Adjusted variables: age(A), gender(G), ethnicity(E), social(S), risk factors(R), comorbidities(C), aetiology(At), heart failure severity(Sv), drugs(D), laboratory(L), physical(P), ejection fraction(Ef)

*not reported

### b) DM in HF and all-cause mortality: prognostic model studies

| Study                        | Sample size (n) | Diabetes (n) | Prevalence (%) | Adjusted | ES (95% CI) | Effect |
|------------------------------|-----------------|--------------|----------------|----------|-------------|--------|
| Barlera et al (2013)         | 6975            | 1974         | 28             | A, G, R, C, Sv, L, P, Ef | 1.34 (1.22, 1.48) | HR     |
| Bouvy et al (2003)           | 152             | 43           | 28             | A, G, C, D, P | 2.37 (1.15, 4.85) | OR     |
| Pocock et al (2006) (Other)  | 7599            | 2164         | 29             | A, G, R, C, Sv, P, Ef | 1.50 (1.34, 1.68) | HR     |
| Pocock et al (2006) (Insulin group) | 7599      | 707          | 9              | A, G, R, C, Sv, P, Ef | 1.80 (1.56, 2.08) | HR     |
| Pocock et al (2013)          | 39372           | 8919         | 23             | A, G, R, C, Sv, D, P, Ef | 1.42 (1.37, 1.48) | HR     |
| Senni et al (2006)           | 292             | 40           | 14             | A, C, Sv, D, Ef | 2.41 (0.28, 8.80) | LogOR   |
| Senni et al (2013)           | 2016            | 304          | 15             | A, C, Sv, D, Ef | 1.62 (1.40, 1.80) | OR     |

Figure S3b Adjusted variables: age(A), gender(G), ethnicity(E), social(S), risk factors(R), comorbidities(C), aetiology(At), heart failure severity(Sv), drugs(D), laboratory(L), physical(P), ejection fraction(Ef)
c) DM in HF and all-cause hospital admissions: ‘general’ prognostic factor and model studies

| Study | Sample size (n) | Diabetes (n) | Prevalence (%) | Adjusted variables | ES (95% CI) | Effect |
|-------|----------------|--------------|----------------|--------------------|-------------|--------|
| Ahmed et al (2006) | 1926 | 650 | 34 | A,G,E,C,At,Sv,D,L,P,Ef | 1.44 (1.27, 2.63) | HR |
| Aranda et al (2009) | 28919 | 10700 | 37 | * | 1.13 (1.07, 1.20) | OR |
| Chaudhry et al (2013) | 758 | 193 | 26 | A,G,S,C,Sv,D,Ef | 1.36 (1.13, 1.64) | HR |
| Dunlay et al (2009) | 1077 | 232 | 21 | A,G,C,Ef | 1.53 (1.31, 1.79) | HR |

Prognostic model

| Study | Sample size (n) | Prevalence (%) | Adjusted variables | ES (95% CI) |
|-------|----------------|----------------|--------------------|-------------|
| Krumholz et al (2000) | 1129 | 412 | 36 | Sv,L | 1.17 (0.99, 1.39) | HR |

Figure S3c Adjusted variables: age(A), gender(G), ethnicity(E), social(S), risk factors(R), comorbidities(C), aetiology(At), heart failure severity(Sv), drugs(D), laboratory(L), physical(P), ejection fraction(Ef)

*not reported

d) COPD in HF and all-cause mortality: ‘general’ prognostic factor and model studies

| Study | Sample size (n) | COPD (n) | Prevalence (%) | Adjusted variables | ES (95% CI) | Effect type | C-statistic |
|-------|----------------|---------|----------------|--------------------|-------------|-------------|-------------|
| Ahluwalia et al (2012) (Community) | 9166 | 1866 | 20 | A.G,E,C | 1.70 (1.58, 1.82) | HR |
| Ahluwalia et al (2012) (Hospital) | 9166 | 4363 | 47 | A.G,E,C | 1.24 (1.19, 1.31) | HR |
| Garty et al (2007) | 4102 | 803 | 20 | A,G,C,Sv,D | 1.25 (1.04, 1.50) | OR |
| Mogensen et al (2011) | 8507 | 1948 | 23 | A.G,R,C,Ef | 1.46 (1.37, 1.55) | HR |
| Tribouilloy et al (2010) | 735 | 146 | 20 | A.S,R,C,D,L | 1.44 (1.13, 1.84) | HR |

Prognostic model

| Study | Sample size (n) | COPD (n) | Prevalence (%) | Adjusted variables | ES (95% CI) | Effect type | C-statistic |
|-------|----------------|---------|----------------|--------------------|-------------|-------------|-------------|
| Barfera et al (2013) | 6975 | 1533 | 22 | A.G,R,C,Sv,D,L,P,Ef | 1.43 (1.30, 1.58) | HR | .75 |
| Lee et al (2003) | 2624 | 543 | 21 | A.C,L,P | 1.41 (1.13, 1.75) | OR | .77 |
| Martinez-Selles et al (2010) | 701 | 188 | 27 | A.C,L,Ef | 1.60 (1.30, 1.90) | HR | .75 |
| Pocock et al (2013) | 39372 | 4005 | 10 | A.G,R,C,Sv,D,P,Ef | 1.23 (1.15, 1.31) | HR | * |
| Senni et al (2006) | 292 | 45 | 15 | A.G,R,C,D,L | 1.41 (0.99, 2.35) | LogOR | 0.82 |

Figure S3d Adjusted variables: age(A), gender(G), ethnicity(E), social(S), risk factors(R), comorbidities(C), aetiology(At), heart failure severity(Sv), drugs(D), laboratory(L), physical(P), ejection fraction(Ef)
e) COPD in HF and all-cause hospital admissions: ‘general’ prognostic factor and model studies

| Study                          | Sample (n) | Prevalence | Adjusted variables | Effect |
|-------------------------------|------------|------------|--------------------|--------|
| Prognostic factors (general)  | Dunlay et al (2009) 1077 253 | 23.5       | A,G,C,Ef           | 1.47 (1.26, 1.72) HR |
| Prognostic model              | Wang et al (2012) 198640 61380 | 30.9       | A,G,S,R,C,Sv,D,L,P | 1.14 (1.10, 1.19) OR .815 |

Figure S3 Adjusted variables: age(A), gender(G), ethnicity(E), social(S), risk factors(R), comorbidities(C), aetiology(At), heart failure severity(Sv), drugs(D), laboratory(L), physical(P), ejection fraction(Ef)

f) RD and all-cause mortality: ‘general’ prognostic factor studies

| Study                          | Renal dysfunction (n) | Renal dysfunction (%) | Prevalence | Adjusted variables | Measure | Hazard Ratio (95% CI) | Effect |
|-------------------------------|-----------------------|-----------------------|------------|--------------------|---------|-----------------------|--------|
| Ahluwalia et al (2012) (community) | 1365                  | 15                    | A,G,E,C    | Type               |         | 1.77 (1.63, 1.92) HR  |        |
| Ahluwalia et al (2012) (hospital) | 3670                  | 40                    | A,G,E,C    | Type               |         | 1.57 (1.49, 1.65) HR  |        |
| Barsheshet et al (older)      | 793                   | 67                    | A,G,C,A,Sv,D,L,P,Ef | Type |         | 1.35 (1.11, 1.63) HR  |        |
| Barsheshet et al (younger)    | 568                   | 50                    | A,G,C,A,Sv,D,L,P,Ef | Type |         | 1.58 (1.28, 1.95) HR  |        |
| Fernandez-Borges (2013)       | 390                   | 18                    | A,R,C,D    | Type               |         | 1.49 (1.19, 1.87) HR  |        |
| Garty et al (2007)            | 1672                  | 41                    | A,G,C,Sv,D | Type               |         | 1.79 (1.53, 2.09) OR  |        |
| Gorelik et al (2009)          | 331                   | 70                    | A,C,S,D,L  | Type               |         | 1.42 (1.04, 1.95) HR  |        |
| Goldin et al (2008)           | 110                   | 138                   | A,G,S,C,Ef | Type               |         | 2.27 (1.42, 3.61) HR  |        |
| MacIntyre et al (2000) (men)  | 454                   | 1                     | A,S,C      | Severity (renal failure) | 2.12 (1.80, 2.59) HR |        |
| MacIntyre et al (2000) (women) | 454                   | 1                     | A,S,C      | Severity (renal failure) | 1.58 (1.32, 1.88) HR |        |
| Mogensen et al (2011) (older) | 291                   | 35                    | A,R,C,Ef   | Severity (severe)  |         | 1.36 (1.13, 1.53) HR  |        |
| Mogensen et al (2011) (younger) | 6990                  | 9                     | A,R,C,Ef   | Severity (severe)  |         | 2.21 (2.02, 2.43) HR  |        |
| Fonarow et al (2008)          | 509                   | 9                     | *          | Severity change (pre-hospital) | 1.46 (1.06, 2.00) OR |        |
| Ahmed et al (2008) (women)    | *                     | *                     | *          | A,G,E,C,A,Sv,D,L,P,Ef,gGFR (per ml/min increase) | 0.99 (0.98, 0.99) HR |        |
| Hamaguchi et al (2011)        | *                     | *                     | *          | A,G,R,C,A,Sv,D,Ef | eGFR (per ml/min decrease) | 1.02 (1.01, 1.04) HR |        |

Figure S3f Adjusted variables: age(A), gender(G), ethnicity(E), social(S), risk factors(R), comorbidities(C), aetiology(At), heart failure severity(Sv), drugs(D), laboratory(L), physical(P), ejection fraction(Ef)

*not reported
g) **RD in HF and all-cause mortality: prognostic model studies**

| Study                    | Sample size | Renal dysfunction (n) | (%) | Adjusted variables | Measure          | Hazard Ratio (95% CI) | Effect Type | C-statistic |
|--------------------------|-------------|-----------------------|-----|--------------------|------------------|-----------------------|-------------|-------------|
| Bouvy et al (2003)       | 152         | 19                    | 13  | A,G,C,D,P          | Type             | 5.22 (1.88, 14.45)    | OR 0.8      |             |
| Senni et al (2006)       | 292         | 41                    | 14  | A,C,Sv,D,Ef       | Type             | 1.37 (0.63, 5.54)     | logOR 0.82  |             |
| Senni et al (2013)       | 2016        | 157                   | 8   | A,C,Sv,D,Ef       | Type             | 1.79 (1.50, 2.10)     | OR 0.87     |             |
| Barfera et al (2013)     | 6975        | *                     | *   | A,G,R,C,Sv,L,PEf  | eGFR(per ml/min decrease) | 1.02 (1.01, 1.02) | HR 0.75 |             |

Figure S3g Adjusted variables: age(A), gender(G), ethnicity(E), social(S), risk factors(R), comorbidities(C), aetiology(At), heart failure severity(Sv), drugs(D), laboratory(L), physical(P), ejection fraction(Ef)

*h*not reported

h) **Additional HF and comorbid diseases included in ‘general’ prognostic factor and model studies**

| Disease                                | Mortality | Hospital admissions | Measure |
|----------------------------------------|-----------|---------------------|---------|
| Rheumatoid arthritis                   | HR 1.89   |                     | Type    |
| (Chronic disease focus) (n=1)          |           |                     |         |
| Arthritis (n=2)                        | HR 0.87-1.16 |                     | Type    |
| Dementia (n=5)                         | OR 2.0, HR 1.44-2.02 | OR 1.1 | Type    |
| Cancer – Lung (n=1)                    | HR 1.86 (hospital)-3.58(community) | Type    |
| Cancer - Colorectal (n=1)              | HR 1.39   |                     | Type    |
| Cancer – Endometrial (n=1)             | HR 2.11   |                     | Type    |
| Cancer – metastatic (n=2)              | LogOR 4.36, | OR1.22 | Type    |
| Cancer – any (n=7)                     | HR 1.44-2.97, OR 1.85-3.02 | Type    |
| Lung Disease (n=2)                     | HR 1.37-1.58 | OR 1.29 | Type    |
| Liver disease (n=3)                    | HR1.98, OR 5.8 |       | Type    |