| Table H-1. Summary of diagnostic properties of studies evaluating BNP in patients with symptoms suggestive of HF at emergency department settings | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author**  **Year**  **Country** | **Study Design**  **(companion study)** | **Objectives/end-points** | **BNP**  **(Methods)** | **Sample Characteristics** | **Index Cutpoint (pg/mL)** | **Sensitivity %** | **Specificity**  **%** | **LR+** | **LR-** | **AUC** |
|
| Alibay,1  2005  France | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: CAD (n=45), cardiac heart failure (n=60), pulmonary disease (n=55);  Reference Standard: 2 cardiologists | Evaluated the influence of creatinine clearance, Age, gender and BMI on plasma BNP and NT-proBNP levels | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, all  n=160,  Mean age: 80.13y,  % Males:38  HF Prevalence: 37.5% | 50 | 99 | 31 | 1.43 | 0.03 | NR |
| 100 | 98 | 47 | 1.85 | 0.04 | NR |
| 150 | 94 | 61 | 2.41 | 0.10 | 0.82 |
| 200 | 87 | 64 | 2.42 | 0.20 | NR |
| Arenja, 2  2011  Switzerland | Cohort (BASEL); Ethnicity: NR Comorbidities: hypertension (n=452), CAD (n=212), historical MI (n=111), chronic kidney disease (n=187); Reference Standards: 2 independent cardiologists | To extend this finding to AHF using a sensitive cardiac troponin I (s-cTnI) assay. Secondary aim was to investigate whether quantification of cardiomyocyte damage by s-cTnI would also be useful diagnostically to differentiate between AHF and noncardiac causes of acute dyspnoea. | BNP (Abbott AxSYM® B-Type Natriuretic Peptide (BNP) Microparticle Enzyme Immunoassay (MEIA)) | dyspnea (n= 667,age= 76(64-83)y, %males=53); HF prevalence=56.5% | NR | NR | NR | NR | NR | 0.96 |
| Arques,3  2007  France | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: Hypertension (n=19), CAD (n=6), diabetes mellitus (n=10), previous HF (n=16), history of chronic pulmonary disease (n=11);  Reference Standard: 2 cardiologists; 1 chest physician | Emergency diagnosis of CHF with a normal left ventricular ejection fraction | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, ≥70y  n=41,  Mean age: 84y,  % Males:41  HF Prevalence: 53.7% | 200 | 96 | 74 | 3.63 | 0.06 | NR |
| 253 | 86 | 90 | 8.23 | 0.15 | 0.928 |
| [≥253](file:///C:\Users\Laura\Desktop\Documents%20and%20Settings\lmacdon\Documents%20and%20Settings\lmacdon\Local%20Settings\Temporary%20Internet%20Files\Content.MSO\7931DE76.xlsx#RANGE!#REF!) | 96 | 90 | 9.10 | 0.05 | NR |
| [≥253](file:///C:\Users\Laura\Desktop\Documents%20and%20Settings\lmacdon\Documents%20and%20Settings\lmacdon\Local%20Settings\Temporary%20Internet%20Files\Content.MSO\7931DE76.xlsx#RANGE!#REF!) | 96 | 90 | 9.10 | 0.05 | NR |
| [≥200](file:///C:\Users\Laura\Desktop\Documents%20and%20Settings\lmacdon\Documents%20and%20Settings\lmacdon\Local%20Settings\Temporary%20Internet%20Files\Content.MSO\7931DE76.xlsx#RANGE!#REF!) | 96 | 84 | 6.04 | 0.05 | NR |
| [≥200](file:///C:\Users\Laura\Desktop\Documents%20and%20Settings\lmacdon\Documents%20and%20Settings\lmacdon\Local%20Settings\Temporary%20Internet%20Files\Content.MSO\7931DE76.xlsx#RANGE!#REF!) | 96 | 79 | 4.55 | 0.06 | NR |

| Table H-1. Summary of diagnostic properties of studies evaluating BNP in patients with symptoms suggestive of HF at emergency department settings (continued) | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author**  **Year**  **Country** | **Study Design**  **(companion study)** | **Objectives/ end-points** | **BNP**  **(Methods)** | **Sample Characteristics** | **Index Cutpoint (pg/mL)** | **Sensitivity %** | **Specificity %** | **LR+** | **LR-** | **AUC** |
|
| Barcarse,4  2004  USA | Cross-sectional  (Independent study);  Ethnicity: Caucasian (n=78), African-American (n=10), Hispanic (n=6), Asian (n=4);  Comorbidities: Hypertension (n=73), CAD (n=44), stroke (n=14), atrial fibrillation (n=13), COPD (n=37), diabetes mellitus (n=41), MI (n=40), CHF (n=58), asthma (n=13), pulmonary embolism (n=3), valvular heart disease (n=14);  Reference Standard: 1 cardiologist | Cardiac death, readmission, or visit to the ED within 90 days | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test | Acute SOB  n=98,  Mean age: 64.6  1.2),  % Males:100  HF Prevalence: 58% | 110 | NR | NR | NR | NR | 0.979 |
| Diagnose CHF, BNP>100  n=33,  Mean age: NR  % Males: NR  HF Prevalence: 58% | 590 | NR | NR | NR | NR | 0.64 |
| Boldanova,5  2010  Switzerland | Cross-sectional  (BASEL);  Ethnicity: NR  Comorbidities: Hypertension (n=237), CAD (n=225), stroke (n=91), COPD (n=140), renal disease (n=112), any pulmonary disease (n=226), deep vein thrombosis (n=41), depressive disorder (n=36), previous heart failure (n=64);  Reference Standard: 1 physician | Diagnostic accuracy of BNP Prognostic value of BNP (one year mortality) | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, all  n=452,  Mean age: NR  % Males: NR  HF Prevalence: 49.3% | NR | NR | NR | NR | NR | NR |
| Dyspnea, previous history of HF  n=64,  Mean age: 73  11)y,  % Males:61  HF Prevalence: 84% | 100 | 96 | 45 | 1.75 | 0.09 | NR |
| 403 | 80 | 77 | 3.48 | 0.26 | 0.84 |
| 500 | 76 | 77 | 3.30 | 0.31 | NR |
| Dyspnea, no previous history of HF  n=388,  Mean age: 73  11)y,  % Males:52  HF Prevalence: 43.6% | 100 | 94 | 59 | 2.29 | 0.10 | NR |
| 289 | 81 | 83 | 4.76 | 0.23 | 0.883 |
| 500 | 68 | 99 | 68.00 | 0.32 | NR |
| Chenevier-Gobeaux,6  2005  France | Cross-sectional  (Independent study)  Ethnicity: NR  Comorbidities: Hypertension (n=153), COPD (n=127), MI (n=124), previous CHF (n=128);  Reference Standard: Urgentists | Diagnostic-accuracy study | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, all  n=381,  Mean age: 79±12,  % Males: NR  HF Prevalence: 30.2% | NR | NR | NR | NR | NR | NR |
| Dyspnea, GFR <30  n=41,  Mean age: 83 (11)y,  % Males: NR  HF Prevalence: 48.8% | 515 | 82 | 89 | 7.45 | 0.20 | 0.89 |
| Dyspnea, GFR 59-30  n=187,  Mean age: 81(10)y,  % Males: NR  HF Prevalence: 34.2% | 480 | 74 | 81 | 3.89 | 0.32 | 0.799 |
| Dyspnea, 89-60  n=141,  Mean age: 74(13)y,  % Males: NR  HF Prevalence: 19.9% | 290 | 76 | 88 | 6.33 | 0.27 | 0.842 |
| Chenevier-Gobeaux,7  2008  France | Cross-sectional  (Ray 2005);  Ethnicity: NR Chenevier-Gobeaux 2005);  Comorbidities: Hypertension (n=272), CAD (n=180), COPD (n=167), previous HF (n=138), malignancy (n=94);  Reference Standard: physicians | CHF | BNP [TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, all  n=570,  Mean age: NR  % Males:48  HF Prevalence: 44.4% | NR | NR | NR | NR | NR | NR |
| Chenevier-Gobeaux,7  2008  France  (cont’d) | (repeated data)  Cross-sectional  (Ray 2005);  Ethnicity: NR Chenevier-Gobeaux 2005);  Comorbidities: Hypertension (n=272), CAD (n=180), COPD (n=167), previous HF (n=138), malignancy (n=94);  Reference Standard: physicians | (repeated data)  CHF | (repeated data)  BNP [TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea, ≥85y  n=210,  Mean age: NR  % Males:35  HF Prevalence: 52% | 250 | 85 | 64 | 2.36 | 0.23 | NR |
| 290 | 80 | 69 | 2.58 | 0.29 | 0.797 |
| 380 | 70 | 73 | 2.59 | 0.41 | NR |
| 400 | 67 | 75 | 2.68 | 0.44 | NR |
| 500 | 60 | 79 | 2.86 | 0.51 | NR |
| 590 | 55 | 85 | 3.67 | 0.53 | NR |
| Acute dyspnea, <85y  n=360,  Mean age: NR  % Males:52  HF Prevalence: 40% | 270 | 73 | 83 | 4.29 | 0.33 | 0.835 |
| Chenevier-Gobeaux,8  2010  France | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: Hypertension (n=152), prior AMI/angina (n=124), COPD (n=125), previous CHF (n=125);  Reference Standard: 2 emergency department physicians | Determine the relationship between the estimated glomerular filtration rate (eGFR) and MR-proANP concentrations in dyspnea emergency patients and to compare the diagnostic performance of MR-proANP with that of NT-proBNP and BNP with respect to renal function | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, > 60 ys,  n=378,  Mean age: 78(12)y,  % Males:50  HF Prevalence: 30.16% | 100 ng/L | 99 | 41 | 1.68 | 0.02 | 0.82 |
| Tertile 3  eGFR >= 58.6 ml/min/1.73 m2)  n=126,  Mean age: 73(13)y,  % Males:68  HF Prevalence: 17.46% | 210 ng/L | 86 | 71 | 2.97 | 0.20 | 0.85 |
| Chenevier-Gobeaux,8  2010  France  (cont’d) | (repeated data)  Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: Hypertension (n=152), prior AMI/angina (n=124), COPD (n=125), previous CHF (n=125);  Reference Standard: 2 emergency department physicians | (repeated data)  Determine the relationship between the estimated glomerular filtration rate (eGFR) and MR-proANP concentrations in dyspnea emergency patients and to compare the diagnostic performance of MR-proANP with that of NT-proBNP and BNP with respect to renal function | (repeated data)  BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Tertile 2  eGFR between 44.3 and 58.5 ml/min/1.73m2)  n=126,  Mean age: 79(11)y,  % Males:44  HF Prevalence: 34.13% | 280 ng/L | 88 | 72 | 3.14 | 0.17 | 0.86 |
| Tertile 1  eGFR<44.3 ml/ min/1.73 m2),  n=126,  Mean age: 83(10)y,  % Males:39  HF Prevalence: 38.89% | 550 ng/L | 85 | 65 | 2.43 | 0.23 | 0.76 |
| Choi,9  2007  Korea | Cross-sectional  (Independent study)  Ethnicity: NR  Comorbidities: Hypertension (n=183), COPD (n=56), diabetes mellitus (n=80), renal disease (n=15), angina (n=70), Hypertension plus diabetes (n=97), Hypertension plus COPD (n=51), Hypertension plus renal failure (n=44);  Reference Standard: the final diagnosis of CHF was defined by transthoracic echocardiography. | Determining the cut off value for diagnosis of CHF | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, all  n=1,040,  Mean age: NR  % Males:56  HF Prevalence: 36.3% | 12.5 | 100 | 28 | 1.39 | 0.00 | 0.961 |
| 100 | 99 | 67 | 3.00 | 0.02 | NR |
| 191 | 96 | 84 | 5.82 | 0.05 | NR |
| 296.5 | 91 | 91 | 10.52 | 0.10 | 0.961 |
| 400 | 85 | 96 | 22.29 | 0.16 | NR |
| 496 | 70 | 97 | 25.96 | 0.31 | NR |
| 601 | 61 | 98 | 26.35 | 0.40 | NR |
| 983.5 | 40 | 99 | 33.25 | 0.61 | NR |
| Chung,10  2006  Australia | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: Historical MI (n=25), History of HF (n=80), History of respiratory disease (n=93), History of HF and respiratory disease (n=48);  Reference Standard: 1 cardiologist | Accurate diagnosis of patients with history of HF using BNP | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Patients with dyspnea , all  n=143,  Mean age: 79(10),  % Males:44  HF Prevalence: 50.3% | 100 | 100 | 41 | 1.65 | 0.00 | 0.85 |
| 400 | 87 | 76 | 3.63 | 0.17 | NR |
| History of HF  n=80,  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.74 |
| No history of HF  n=63,  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.94 |
| LVEF <50%  n=67,  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.64 |
| LVEF ≥50%  n=39,  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.87 |
| High serum creatinine  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.81 |
| Low serum creatinine  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.9 |
| Chung,10  2006  Australia  (cont’d) | (repeated data)  Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: Historical MI (n=25), History of HF (n=80), History of respiratory disease (n=93), History of HF and respiratory disease (n=48);  Reference Standard: 1 cardiologist | (repeated data)  Accurate diagnosis of patients with history of HF using BNP | (repeated data)  BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Initial inter-emergency department likelihood of HF  n=44,  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.79 |
| Low or high likelihood of HF  n=9,  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.86 |
| Patients > 79 years  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.85 |
| Patients < 79 years  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.88 |
| Collins,11  2006  USA | Cross-sectional  (Independent study );  Ethnicity: Caucasian (n=166), other (n=177);  Comorbidities: Hypertension (n=214), CAD (n=116), congestive HF (n=164), valvular heart disease (n=100), cardiomyopathy (n=65);  Reference Standard: 2 senior cardiology fellows | Diagnosis of HF | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea  n=NR  Mean age: NR  % Males: NR  HF Prevalence: 38.8% | ‘‘indeterminate zone’’ (100 to <= 500 pg/ml) | NR | NR | NR | NR | NR |
| Coste,12  2006  France | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: history of HF (n=174);  Reference Standard: 2 cardiologists | Diagnosis of acute or decompensated HF | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea  n=699,  Mean age: 72.8y(14.3)  % Males:68  HF Prevalence: 60% | NR | NR | NR | NR | NR | NR |
| Acute dyspnea , no history CHF  n=525,  Mean age: NR  % Males: NR  HF Prevalence: NR% | The cutoff points delimiting the gray zones glow=167 ng/L (95% bootstrap CI: 108 to 219) and gup= 472 ng/L (95% bootstrap CI: 390 to 501) | NR | NR | 18.25 | 0.05 | NR |
| Acute dyspnea , history of CHF  n=174,  Mean age: NR  % Males: NR  HF Prevalence: NR% | gup=334 ng/L (95% bootstrap CI 178 to 465); glow=0 | NR | NR | 3.35 | 0.01 | NR |
| Daniels,13  2006  Multi-national study | Cross-sectional  (Breathing Not Properly Study)  Ethnicity: Caucasian (n=618);  Comorbidities: COPD (n=542), Diabetes mellitus (n=347), Myocardial infarction (n=384), CHF (n=456);  Reference Standard: 2 cardiologists | How obesity affects cutpoints for BNP in diagnosis of heart failure | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, all  n=1,368,  Mean age: 65y,  % Males:56  HF Prevalence: 46.1% | NR | NR | NR | NR | NR | NR |
| Dyspnea , BMI <25  n=526,  Mean age: 67.3y  % Males:55.7  HF Prevalence: 47% | 100 | 94 | 65 | 2.63 | 0.10 | 0.9 |
| Dyspnea, 25 ≤BMI <35  n=595,  Mean age: 63.2y  % Males:58  HF Prevalence: 46.2% | 100 | 92 | 76 | 3.88 | 0.10 | 0.91 |
| Dyspnea , BMI z35  n=247,  Mean age: 56.7y,  % Males:46.3  HF Prevalence: 44.1% | 100 | 77 | 84 | 4.85 | 0.27 | 0.88 |
| Dyspnea , BMI <25  n=526,  Mean age: 67.3,  % Males:55.7  HF Prevalence: 47% | 100 | 90 | NR | NR | NR | NR |
| Dyspnea , 25 ≤BMI <35  n=595,  Mean age: 63.2y,  % Males:58  HF Prevalence: 46.2% | 110 | 90 | NR | NR | NR | NR |
| Dyspnea , BMI z35  n=247,  Mean age: 56.7y,  % Males:46.3  HF Prevalence: 44.1% | 54 | 90 | NR | NR | NR | NR |
| Dao,14  2001  USA | Cross-sectional  (Independent study)  Ethnicity: NR  Comorbidities: CAD (n=100), COPD (n=90), CHF (n=75);  Reference Standard: 2 cardiologists | Final diagnosis of CHF | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | dyspnea, all  n=250,  Mean age: 63y,  % Males:94  HF Prevalence: 38.8% | 80 | 98 | 92 | 12.25 | 0.02 | 0.98 |
| 100 | 94 | 94 | 15.67 | 0.06 | NR |
| 115 | 90 | 96 | 22.50 | 0.10 | NR |
| 120 | 90 | 96 | 22.50 | 0.10 | NR |
| 150 | 87 | 97 | 29.00 | 0.13 | NR |
| Defilippi,15  2007  USA | Cohort  (Independent study);  Ethnicity:  African-American (n=318); Inclusion criteria = patients with the complaint of dyspnea who presented to the Carolinas Medical Center emergency department who underwent BNP measurement;  Comorbidities:  Hypertension (n=555), CAD (n=263), atrial fibrillation (n=175), diabetes mellitus (n=305), prior HF (n=287);  Reference Standard: 1 cardiologist | All-cause mortality compared the diagnostic accuracies of NT-proBNP and BNP for diagnosing decompensated HF and predicting 1-year all-cause mortality) | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea all  n=831,  Mean age: NR  % Males:45.7  HF Prevalence: 52.6% | NR | NR | NR | NR | NR | NR |
| No kidney disease  eGFR>= 60  n=438,  Mean age: 63.5  16.0)y,  % Males:43.8  HF Prevalence: 45% | 100 ng/L | 90 | 37 | 1.42 | 0.27 | 0.95 |
| Kidney disease eGFR <60  n=393,  Mean age: 69.3y(13.1)  % Males:47.8  HF Prevalence: 61% | 200 ng/L | 82 | 53 | 1.74 | 0.34 | 0.68 |
| Dieplinger,16  2009  Austria | Cross-sectional  (Mueller et al 2005, Gegenhuber et al 2006); Ethnicity: NR  Comorbidities: Hypertension (n=141), CAD (n=117), atrial fibrillation (n=83), diabetes mellitus (n=58), history of HF (n=75), NYHA II (n=59), NYHA III (n=53), NYHA IV (n=25);  Reference Standard: Framingham score for HF plus echocardiographic evidence of systolic or diastolic dysfunction | Evaluate the utility of established and novel biomarkers for the diagnosis of acute destabilised HF in patients with SOB presenting to an emergency department | BNP (Abbott AxSYM® B-Type Natriuretic Peptide (BNP) Microparticle Enzyme Immunoassay (MEIA)) | Dyspnea  n=251,  Mean age: NR  % Males: NR  HF Prevalence: 54.6% | 160ng/L | 90 | 73 | 3.33 | 0.14 | 0.92 |
| Dyspnea attributable to acute emergency department HF  n=137,  Mean age: 69-82y,  % Males:93  HF Prevalence: 46.2% | NR | NR | NR | NR | NR | NR |
| Dyspnea not attributable to HF  n=114,  Mean age: 68-82y,  % Males:95  HF Prevalence: 8.3% | NR | NR | NR | NR | NR | NR |
| Gorissen,17  2007  The Netherlands | Cross-sectional  (Independent study);  Acute dyspnea , all  n=80,  Mean age: 43–90yrs,  % males=55; HF Prevalence=50%  Ethnicity: NR  Comorbidities: NR  Reference Standard: consensus on clinical dx (cardiac + pulmonary) | Diagnostic-accuracy study | BNP Centaur (ADVIA -Centaur® BNP Assay, Bayer Diagnostics ACS:180® BNP Assay, TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, all  n=160,  Mean age: 80.13y,  % Males:38  HF Prevalence: 37.5% | 138 ng/L (Centaur) | 65 | 88 | 5.42 | 0.40 | 0.775 |
| 225 ng/L (Triage) | 73 | 78 | 3.32 | 0.35 | 0.783 |
| Acute dyspnea , <65  n=17,  Mean age: NR  % Males: NR  HF Prevalence: NR% | 78 ng/L (Triage) | 100 | 55 | 2.22 | 0.00 | 0.75 |
| 91 ng/L (Centaur) | 100 | 55 | 2.22 | 0.00 | 0.705 |
| Acute dyspnea , 65-75  n=23,  Mean age: NR  % Males: NR  HF Prevalence: NR% | 260 ng/L (Triage) | 82 | 83 | 4.82 | 0.22 | 0.795 |
| 188 ng/L (Centaur) | 73 | 83 | 4.29 | 0.33 | 0.773 |
| Gorissen,17  2007  The Netherlands  (cont’d) | (repeated data)  Cross-sectional  (Independent study);  Acute dyspnea , all  n=80,  Mean age: 43–90yrs,  % males=55; HF Prevalence=50%  Ethnicity: NR  Comorbidities: NR  Reference Standard: consensus on clinical dx (cardiac + pulmonary) | (repeated data)  Diagnostic-accuracy study | (repeated data)  BNP Centaur (ADVIA -Centaur® BNP Assay, Bayer Diagnostics ACS:180® BNP Assay, TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea , >75  n=40,  Mean age: NR  % Males: NR  HF Prevalence: NR% | 309 ng/L (Triage) | 68 | 71 | 2.34 | 0.45 | 0.765 |
| 247 ng/L (Centaur) | 68 | 77 | 2.96 | 0.42 | 0.767 |
| Acute dyspnea , GFR >60  n=40,  Mean age: NR  % Males: NR  HF Prevalence: NR% | 202 ng/L (Triage) | 81 | 63 | 2.19 | 0.30 | 0.797 |
| 127 ng/L (Triage) | 73 | 85 | 4.87 | 0.32 | 0.799 |
| Acute dyspnea , GFR <60  n=40,  Mean age: NR  % Males: NR  HF Prevalence: NR% | 229 ng/L(Centaur) | 64 | 70 | 2.13 | 0.51 | 0.669 |
| 309 ng/L (Centaur) | 64 | 74 | 2.46 | 0.49 | 0.69 |
| Gruson,18  2008  Belgium | Cohort  (Independent study);  Ethnicity: NR  Comorbidities: NR  Reference Standard: 1 cardiologist | Diagnostic accuracy of NT-proBNP in patients in the emergency department (ED) with dyspnea and/or chest pain. | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test for the Beckman Coulter Immunoassay Systems) | Patients with dyspnea and/or chest pain  with cardiovascular and/or pulmonary disorders), all  n=137,  Mean age: 69y,  % Males:56.2  HF Prevalence: 22.6% | NR | NR | NR | NR | NR | 0.93 |
| Gruson,19  2009  Belgium | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: CAD (n=10), renal disease (n=17), pulmonary disorders (n=21), pulmonary embolism (n=19), ;  Reference Standard: clinicians | To evaluate the SOB panel and to assess its reliability in patients presenting in ED with dyspnea and/or atypical thoracic pain | SOB BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test for the Beckman Coulter Immunoassay Systems) | Dyspnea, all  n=97,  Mean age: 30–95y,  % Males:43  HF Prevalence: 19.6% | NR | 100 | 59 | 2.44 | 0.00 | NR |
| Gruson,20  2012  Belgium | Cohort (Independent Study);  Ethnicity= NR Comorbidities= hypertension (n=69), atrial fibrillation (n=11), diabetes mellitus (n=30), historical MI (n=20); Reference Standard= clinicians | To evaluate the diagnostic accuracy of circulating levels of proBNP in patients admitted to ED with dyspnea and/or thoracic pain. Moreover, we compared the performances of proBNP assay to two commercial assays for BNP and Nt-proBNP. | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | dyspnea and/or chest pain, all (n=156, mean= 67y, %males=54.5); HF Prevalence= 29.5% | 100 ng/L | NR | NR | NR | NR | 0.91 |
| Havelka,21  2011  USA | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: NR  Reference Standard: discharge diagnosis | Diagnosis of CHF | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, all  n=54,  Mean age:,  % Males: 80y\*  HF Prevalence: NR% | NR | NR | NR | NR | NR | 0.77 |
| Knudsen,22 2004a  Norway | Cross-sectional  (Independent study)  Ethnicity: NR  Comorbidities: Hypertension (n=52), Angina (n=47), Atrial Fibrillation (n=39), COPD (n=73), Diabetes mellitus (n=24), Historical MI (n=56), CABG (n=14);  Reference Standard: 2 cardiologists |  | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea all  n=155,  Mean age: NR  % Males:44.5  HF Prevalence: 48.3% | 100 | NR | NR | NR | NR | NR |
| Acute dyspnea, women  n=86,  Mean age: 78y,  % Males: NR  HF Prevalence: 40.7% | 50 | 100 | 37 | 1.59 | 0.00 | NR |
| 100 | 94 | 55 | 2.09 | 0.10 | NR |
| 150 | 91 | 59 | 2.22 | 0.15 | NR |
| 200 | 89 | 63 | 2.38 | 0.18 | 0.86 |
| Knudsen,22 2004a  Norway  (cont’d) | (repeated data)  Cross-sectional  (Independent study)  Ethnicity: NR  Comorbidities: Hypertension (n=52), Angina (n=47), Atrial Fibrillation (n=39), COPD (n=73), Diabetes mellitus (n=24), Historical MI (n=56), CABG (n=14);  Reference Standard: 2 cardiologists |  | (repeated data)  BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea  n=69,  Mean age: 74y,  % Males: NR  HF Prevalence: 58% | 50 | 95 | 38 | 1.53 | 0.13 | NR |
| 100 | 90 | 55 | 2.01 | 0.18 | NR |
| 150 | 93 | 62 | 2.44 | 0.12 | NR |
| 200 | 90 | 72 | 3.26 | 0.14 | 0.9 |
| Acute dyspnea, >76y  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | 100 | NR | NR | NR | NR | 0.88 |
| Acute dyspnea, <76y  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | 100 | NR | NR | NR | NR | 0.82 |
| Knudsen,23 2004b  Multi-national study | Cross-sectional  (Breathing Not Properly Study)  Ethnicity: Caucasian (n=340), African-American (n=495);  Comorbidities: Hypertension (n=547), Acute MI (n=250);  Reference Standard: 2 cardiologists, Framingham, NHANES |  | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea, All  n=880,  Mean age: 64y,  % Males:55  HF Prevalence: 51% | 100 | 90 | 75 | 3.60 | 0.13 | NR |
| 200 | 80 | 87 | 6.15 | 0.23 | NR |
| 300 | 71 | 90 | 7.10 | 0.32 | NR |
| 400 | 64 | 92 | 8.00 | 0.39 | NR |
| Knudsen,24  2005  Multi-national study | Cohort  (Breathing Not Properly Study)  Ethnicity: NR  Comorbidities: diabetes mellitus (n=325), MI (n=353), congestive HF (n=480), arterial Hypertension (n=799);  Reference Standard: 2 cardiologists | Diagnosis of acute HF | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea all  n=1,431,  Mean age: NR  % Males: NR  HF Prevalence: 46.1% | NR | NR | NR | NR | NR | NR |
| Atrial fibrillation  n=292,  Mean age: 67–827y,  % Males:61.3  HF Prevalence: 46.6% | ≥50 | 99 | 21 | 1.24 | 0.07 | NR |
| ≥100 | 95 | 40 | 1.57 | 0.14 | NR |
| ≥200 | 85 | 73 | 3.12 | 0.20 | 0.084 |
| ≥300 | 74 | 80 | 3.63 | 0.32 | NR |
| ≥400 | 64 | 86 | 4.70 | 0.41 | NR |
| ≥500 | 55 | 88 | 4.50 | 0.51 | NR |
| ≥600 | 47 | 89 | 4.27 | 0.60 | NR |
| ≥700 | 43 | 89 | 3.86 | 0.65 | NR |
| ≥800 | 36 | 93 | 5.24 | 0.69 | NR |
| No atrial fibrillation  n=1,139,  Mean age: 49–74y,  % Males:59.1  HF Prevalence: 30.2% | ≥50 | 96 | 65 | 2.75 | 0.06 | NR |
| ≥100 | 89 | 79 | 4.15 | 0.15 | NR |
| ≥200 | 79 | 88 | 6.69 | 0.24 | 0.91 |
| ≥300 | 71 | 91 | 7.96 | 0.32 | NR |
| ≥400 | 62 | 93 | 8.56 | 0.41 | NR |
| ≥500 | 55 | 94 | 9.03 | 0.48 | NR |
| ≥600 | 50 | 95 | 9.42 | 0.53 | NR |
| ≥700 | 47 | 96 | 11.80 | 0.55 | NR |
| ≥800 | 47 | 96 | 13.06 | 0.55 | NR |
| Knudsen,24  2005  Multi-national study  (cont’d) | (repeated data)  Cohort  (Breathing Not Properly Study)  Ethnicity: NR  Comorbidities: diabetes mellitus (n=325), MI (n=353), congestive HF (n=480), arterial Hypertension (n=799);  Reference Standard: 2 cardiologists | (repeated data)  Diagnosis of acute HF | (repeated data)  BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Atrial fibrillation by ECG upon admission  n=158,  Mean age: NR  % Males: NR  HF Prevalence: NR% |  | NR | NR | NR | NR | 0.8 |
| History of atrial fibrillation but no current af  n=134,  Mean age: NR  % Males:  HF Prevalence: NR% |  | NR | NR | NR | NR | 0.86 |
| Lainchbury,25  2003  New Zealand | Cross-sectional  (Independent study)  Ethnicity: NR  Comorbidities: CAD (n=88), COPD (n=86), previous HF (n=52);  Reference Standard: 2 cardiologists | Final clinical diagnosis | BNP- Biosite point-of-care assay [TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea, all  n=205,  Mean age: 70  14),  % Males:49  HF Prevalence: 34.1% | 20 pmol/L | 97 | 44 | 1.73 | 0.07 | NR |
| 30 pmol/L | 97 | 49 | 1.90 | 0.06 | NR |
| 60 pmol/L | 94 | 70 | 3.13 | 0.09 | 0.89 |
| 80 pmol/L | 83 | 78 | 3.77 | 0.22 | NR |
| 100 pmol/L | 77 | 84 | 4.81 | 0.27 | NR |
| BNP- local research assay (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | 33 pmol/L | 87 | 82 | 4.83 | 0.16 | NR |
| BNP- local research assay (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | 44 pmol/L | 88 | 82 | 4.89 | 0.15 | NR |
| Logeart,26  2002  France | Cross-sectional  (Independent study)  Ethnicity: NR  Comorbidities: Hypertension (n=65), Prior AMI/angina (n=53), Diabetes mellitus (n=23), Previous CHF (n=80);  Reference Standard: 2 cardiologists and 1 pneumologist | No specified end point other than diagnosis | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea, all  n=163,  Mean age: 67y,  % Males:66.8  HF Prevalence: 70.1% | 80 | 97 | 27 | 1.33 | 0.11 | NR |
| 100 | 96 | 31 | 1.39 | 0.13 | NR |
| 150 | 93 | 45 | 1.69 | 0.16 | NR |
| 200 | 93 | 56 | 2.11 | 0.13 | NR |
| 250 | 91 | 68 | 2.84 | 0.13 | NR |
| 300 | 88 | 87 | 6.77 | 0.14 | 0.93 |
| 400 | 79 | 93 | 11.29 | 0.23 | NR |
| Lokuge,27  2010  Australia | RCT  (SOB);  Inclusion criteria: Patients presenting to the Alfred and the Northern Hospital EDs with a chief complaint of dyspnea; Ethnicity: NR  Comorbidities: Hypertension (n=308), atrial fibrillation (n=172), COPD (n=388), diabetes mellitus (n=121), ischemic heart disease (n=253), prior HF (n=220), renal failure (n=69);  Reference Standard: 1 cardiologist, emerg.or resp. | Accuracy of HF diagnosis | BNP (Abbott AxSYM® B-Type Natriuretic Peptide (BNP) Microparticle Enzyme Immunoassay (MEIA)) | Dyspnea  n=306,  Mean age: 74  11)y,  % Males:54  HF Prevalence: 48.4% | 101 | 92 | 51 | 1.88 | 0.16 | 0.87 |
| 265\* | 83 | 81 | 4.37 | 0.21 | NR |
| Maisel,28  2002  Multi-national study | Cross-sectional  (Breathing Not Properly Study)  Ethnicity: Caucasian (n=773), African-American (n=715), Other (n=98);  Comorbidities: COPD (n=650), diabetes mellitus (n=397), MI (n=523), CHF (n=523);  Reference Standard: 2 cardiologists | Final diagnosis of CHF | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea n=1,586  Mean age: 64y  % Males:56  HF Prevalence: 47% | 50 | 97 | 62 | 2.55 | 0.05 | NR |
| 80 | 93 | 74 | 3.58 | 0.09 | NR |
| 100 | 90 | 76 | 3.75 | 0.13 | 0.91 |
| 125 | 87 | 79 | 4.14 | 0.16 | NR |
| 150 | 85 | 83 | 5.00 | 0.18 | NR |
| Maisel,29  2003  Multi-national study | Cross-sectional  (Breathing Not Properly Study)  Ethnicity: Caucasian (n=773), African-American (n=715), Other (n=98);  Comorbidities: Hypertension (n=879), Prior AMI/angina (n=308), Atrial fibrillation (n=256), COPD (n=600), Diabetes mellitus (n=367), Myocardial infarction (n=385), CHF (n=527), CABG (n=176);  Reference Standard: 2 cardiologists | This study examines B-type natriuretic peptide (BNP) levels in patients with systolic versus  non-systolic dysfunction presenting with SOB for the purpose of diagnosis of HF | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea  n=1,586,  Mean age: 64y,  % Males:56  HF Prevalence: 47% | 100 | 90 | 73 | 3.33 | 0.14 | 0.9 |
| 200 | 81 | 85 | 5.40 | 0.22 | NR |
| 300 | 73 | 89 | 6.64 | 0.30 | NR |
| 400 | 63 | 91 | 7.00 | 0.41 | NR |
| CHF  n=452,  Mean age: 64y,  % Males:56  HF Prevalence: 47% | 100 | 95 | 14 | 1.10 | 0.36 | NR |
| 200 | 89 | NR | NR | NR | NR |
| 300 | 83 | 39 | 1.36 | 0.44 | 0.66 |
| 400 | 74 | 50 | 1.48 | 0.52 | NR |
| Maisel,30  2004  Multi-national study | Cross-sectional  (Breathing Not Properly Study)  Ethnicity: Caucasian (n=773), African-American (n=715), Other (n=98);  Comorbidities: NR  Reference Standard: 2 cardiologists | Final diagnosis of CHF or  non-CHF | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea  n=1,586  Mean age: 64yrs  % Males=56  HF Prevalence: 47% | 100 | 90 | 73 | 3.34 | 0.13 | NR |
| 200 | 81 | 85 | 5.46 | 0.22 | NR |
| 300 | 73 | 89 | 6.36 | 0.31 | NR |
| 400 | 63 | 91 | 7.04 | 0.41 | NR |
| 18 to 69 yrs  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | 100 | 86 | 82 | 4.69 | 0.17 | 0.915 |
| 200 | 77 | 91 | 8.45 | 0.25 | NR |
| 300 | 69 | 94 | 11.10 | 0.33 | NR |
| 400 | 60 | 95 | 11.23 | 0.43 | NR |
| 70 to 105 yrs  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | 100 | 94 | 53 | 2.00 | 0.12 | 0.844 |
| 200 | 85 | 72 | 3.03 | 0.21 | NR |
| 300 | 75 | 77 | 3.27 | 0.32 | NR |
| 400 | 65 | 83 | 3.85 | 0.42 | NR |
| Male  n=883,  Mean age: NR  % Males: 100  HF Prevalence: 47.7% | 100 | 92 | 76 | 3.84 | 0.10 | 0.918 |
| 200 | 84 | 88 | 6.93 | 0.18 | NR |
| 300 | 73 | 90 | 7.49 | 0.30 | NR |
| 400 | 64 | 93 | 9.00 | 0.39 | NR |
| n=703  Mean age: NR  % Males: NR  HF Prevalence: 45.7% | 100 | 88 | 59 | 2.16 | 0.20 | 0.87 |
| 200 | 78 | 82 | 4.27 | 0.27 | NR |
| 300 | 72 | 87 | 5.40 | 0.32 | NR |
| 400 | 61 | 89 | 5.55 | 0.44 | NR |
| Caucasian n=773  Mean age: NR  % Males: NR  HF Prevalence: 49.9% | 100 | 93 | 69 | 2.96 | 0.10 | 0.888 |
| 200 | 82 | 82 | 4.63 | 0.21 | NR |
| 300 | 72 | 86 | 5.11 | 0.33 | NR |
| 400 | 60 | 90 | 5.86 | 0.44 | NR |
| African-American n=715  Mean age: NR  % Males: NR  HF Prevalence: 43.9% | 100 | 87 | 76 | 3.61 | 0.17 | 0.903 |
| 200 | 81 | 88 | 6.45 | 0.22 | NR |
| 300 | 74 | 91 | 8.24 | 0.28 | NR |
| 400 | 66 | 93 | 8.79 | 0.37 | NR |
| Maisel,31  2010  Multi-national study | Cross-sectional  (BACH);  Ethnicity: Caucasian (n=1090), African-American (n=476), other (n=60);  Comorbidities: arrhythmia (n=405), dyslipidemia (n=570), Hypertension (n=1080), CAD (n=504), obstructive lung disease (n=201). prior AMI/angina (n=61), stroke (n=165), ACS (n=38), COPD (n=471), diabetes mellitus (n=462), historical MI (n=300), asthma (n=318), pneumonia (n=112), pulmonary embolism (n=85), chronic renal insufficiency (n=246);  Reference Standard: 2 cardiologists | Diagnosis of AHF, where the non-inferiority of MR-proANP compared with BNP was evaluated and 90-day survival, where the superiority of the utility of MR-proADM versus BNP for predicting survival over a period  of 90 days | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test for the Beckman Coulter Immunoassay Systems) | Acute dyspnea, all  n=1,641,  Mean age: NR  % Males: NR  HF Prevalence: 34.6% | 100 | 96 | 62 | 2.51 | 0.07 | 0.91 |
| 300 | NR | NR | NR | NR | 0.9 |
| McCullough,32  2002a  Multi-national study | Cross-sectional  (Breathing Not Properly Study)  Ethnicity: Caucasian (n=230), African-American (n=161), other (n=26);  Comorbidities: Hypertension (n=196), prior AMI/angina (n=58), AF (n=54), diabetes mellitus (n=66), historical MI (n=60), MI (n=60), prior CABG (n=26), prior CHD (n=125);  Reference Standard: 2 cardiologists, Framingham, NHANES | Diagnosis of HF | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea all  n=417,  Mean age: 62.2y,  % Males:55.2  HF Prevalence: 20.9% | 100 | 93 | 77 | 4.10 | 0.09 | NR |
| McCullough,33  2002b  Multi-national study | Cross-sectional  (Breathing Not Properly Study)  Ethnicity: Caucasian (n=773), African-American (n=715), Other (n=98);  Comorbidities: Hypertension (n=854), prior AMI/angina (n=371), atrial fibrillation (n=245), COPD (n=580), diabetes mellitus (n=356), stable angina (n=205), prior CHF (n=511), prior CABG (n=168);  Reference Standard: 2 cardiologists | Diagnostic accuracy | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea  n=1,538,  Mean age: 64y,  % Males:56  HF Prevalence: 47% | 100 | 90 | 73 | 3.33 | 0.14 | 0.9 |
| Morrison,34 2002  USA | Cross-sectional  (Independent study)  Ethnicity: NR  Comorbidities: Hypertension (n=209), CAD (n=173), COPD (n=128), coronary artery bypass graft (n=71), CHF (n=135);  Reference Standard: 2 cardiologists, Framingham criteria, echocardiography, nuclear medicine, ejection fractions, or left ventriculography done at cardiac catheterization. | The purpose of this study was to determine if BNP levels could accurately differentiate CHF from dyspnea of pulmonary etiology. | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea  n=321,  Mean age: NR  % Males: NR  HF Prevalence: 42% | 94 | 86 | 98 | 43.00 | 0.14 | 0.99 |
| 105 | 86 | 94 | 14.33 | 0.15 | NR |
| 135 | 90 | 90 | 9.00 | 0.11 | NR |
| 195 | 94 | 85 | 6.27 | 0.07 | NR |
| 240 | 96 | 79 | 4.57 | 0.05 | NR |
| Mueller,35  2005 & Gegenhuber,36  2006  Austria | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: CAD (n=117), atrial fibrillation (n=83), diabetes mellitus (n=58), renal disease (n=74), arterial Hypertension (n=141);  Reference Standard: Framingham | Diagnostic accuracy of BNP/NT-proBNP | BNP (Abbott AxSYM® B-Type Natriuretic Peptide (BNP) Microparticle Enzyme Immunoassay (MEIA)) | Dyspnea all  n=251,  Mean age: 58-82y,  % Males:93  HF Prevalence: 55% | 100 ng/L | 96 | 61 | 2.46 | 0.07 | NR |
| 118 ng/L | 95 | 64 | 2.64 | 0.08 | NR |
| 160 ng/L | 90 | 73 | 3.33 | 0.14 | NR |
| 295 ng/L | 80 | 86 | 5.71 | 0.23 | NR |
| Noveanu,37  2009  Switzerland | RCT  (BASEL);  Ethnicity: NR  Comorbidities: Hypertension (n=237), CAD (n=225), COPD (n=140), diabetes mellitus (n=103), renal disease (n=112), asthma (n=29), pulmonary embolism (n=31);  Reference Standard: internal med specialist | 360 days mortality, 360-D in-hospital, 360 day treatment cost, in-hospital mortality, Time to treatment; Hospital admission; Time to discharge, Initial treatment cost | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, all  n=452,  Mean age: NR  % Males: NR  HF Prevalence: NR% | NR | NR | NR | NR | NR | NR |
| SOB, BMI >30  n=86,  Mean age: 72  15)y,  % Males:59  HF Prevalence: 44% | 100 | 91 | 68 | 2.84 | 0.13 | NR |
| 182 | 85 | 83 | 5.00 | 0.18 | 0.884 |
| 500 | 56 | 96 | 14.00 | 0.46 | NR |
| SOB, BMI <30  n=366,  Mean age: 65  14),  % Males:  HF Prevalence: 50% | 100 | 96 | 56 | 2.18 | 0.07 | NR |
| 298 | 84 | 81 | 4.42 | 0.20 | 0.885 |
| 500 | 73 | 89 | 6.64 | 0.30 | NR |
| Pahle,38  2009  Multi-national study | Cross-sectional  (Breathing Not Properly Study)  Ethnicity: NR  Comorbidities: Hypertension (n=879), atrial fibrillation (n=145), diabetes mellitus (n=353), historical MI (n=362), previous HF (n=503);  Reference Standard: 2 cardiologists, Framingham, NHANES | Utility of BNP measurement for diagnosing HF in the emergency department | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea  n=1,583,  Mean age: 64  17)y,  % Males:56  HF Prevalence: 47% | NR | NR | NR | NR | NR | NR |
| Dyspnea, history of hypertension  n=879,  Mean age: 56-77y,  % Males:54  HF Prevalence: 54.3% | 50 | 97 | 56 | 2.20 | 0.05 | NR |
| 100 | 90 | 72 | 3.21 | 0.14 | NR |
| 120 | 88 | 76 | 3.67 | 0.16 | NR |
| 140 | 86 | 78 | 3.91 | 0.18 | NR |
| 160 | 85 | 80 | 4.25 | 0.19 | NR |
| 194 | NR | NR | NR | NR | 0.88 |
| 180 | 83 | 83 | 4.88 | 0.20 | NR |
| 200 | 82 | 85 | 5.47 | 0.21 | NR |
| 300 | 74 | 88 | 6.17 | 0.30 | NR |
| Dyspnea, no history of hypertension  n=608,  Mean age: 45-75y,  % Males:60  HF Prevalence: 34.5% | 50 | 98 | 70 | 3.27 | 0.03 | NR |
| 100 | 90 | 83 | 5.29 | 0.12 | NR |
| 115 | NR | NR | NR | NR | 0.93 |
| 120 | 87 | 85 | 5.80 | 0.15 | NR |
| 140 | 83 | 88 | 6.92 | 0.19 | NR |
| 160 | 82 | 89 | 7.45 | 0.20 | NR |
| 180 | 80 | 92 | 10.00 | 0.22 | NR |
| 200 | 79 | 93 | 11.29 | 0.23 | NR |
| 300 | 68 | 95 | 13.60 | 0.34 | NR |
| Pahle,38  2009  Multi-national study  (cont’d) | (repeated data)  Cross-sectional  (Breathing Not Properly Study)  Ethnicity: NR  Comorbidities: Hypertension (n=879), atrial fibrillation (n=145), diabetes mellitus (n=353), historical MI (n=362), previous HF (n=503);  Reference Standard: 2 cardiologists, Framingham, NHANES | (repeated data)  Utility of BNP measurement for diagnosing HF in the emergency department | (repeated data)  BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, elevate emergency department BP  n=843,  Mean age: 54=78y,  % Males:51.8  HF Prevalence: 51.7% | 50 | 97 | 61 | 2.49 | 0.05 | NR |
| 100 | 91 | 78 | 4.14 | 0.12 | NR |
| 120 | 88 | 80 | 4.40 | 0.15 | NR |
| 140 | 87 | 82 | 4.83 | 0.16 | NR |
| 150 | NR | NR | NR | NR | 0.9 |
| 160 | 85 | 84 | 5.31 | 0.18 | NR |
| 180 | 82 | 87 | 6.31 | 0.21 | NR |
| 200 | 81 | 87 | 6.23 | 0.22 | NR |
| 300 | 72 | 91 | 8.00 | 0.31 | NR |
| Dyspnea, no elevate emergency department BP  n=740,  Mean age: 49-76y,  % Males:60  HF Prevalence: 42.4% | 50 | 97 | 63 | 2.62 | 0.05 | NR |
| 100 | 89 | 76 | 3.71 | 0.14 | NR |
| 120 | 87 | 78 | 3.95 | 0.17 | NR |
| 140 | 84 | 81 | 4.42 | 0.20 | NR |
| 160 | 84 | 84 | 5.25 | 0.19 | NR |
| 180 | 82 | 87 | 6.31 | 0.21 | NR |
| 200 | 81 | 89 | 7.36 | 0.21 | NR |
| 205 | NR | NR | NR | NR | 0.9 |
| 300 | 73 | 91 | 8.11 | 0.30 | NR |
| Parrinelo,39  2008  Italy | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: Hypertension (n=196), diabetes mellitus (n=56), ischemic heart disease (n=72), previous CHF (n=80), chronic obstructive pulmonary disease or asthma (n=112);  Reference Standard: cardiologist, Framingham | Diagnosis of acute decompensated heart failure | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | SOB  n=292,  Mean age:67.5y,  % Males:53.5  HF Prevalence: 58.9% | ≥100 | 95 | 88 | 7.58 | 0.06 | NR |
| ≥127 | 95 | 93 | 14.15 | 0.06 | 0.97 |
| Potocki,40  2010  Germany | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: Hypertension (n=195), CAD (n=80), COPD (n=98), diabetes mellitus (n=52), chronic kidney disease (n=80), previous HF (n=69);  Reference Standard: 2 cardiologists | Compare the accuracy of MR-proANP with that of NT-proBNP to diagnose HF | BNP (Abbott AxSYM® B-Type Natriuretic Peptide (BNP) Micro-particle Enzyme Immunoassay (MEIA)) | Dyspnea  n=287,  Mean age: 77  68–83)y,  % Males:52  HF Prevalence: 53.7% | BNP | NR | NR | NR | NR | NR |
| Ray,41  2005  France | Cross-sectional  (EPIDASA STUDY );  Ethnicity: NR  Comorbidities: chronic respiratory failure (n=35), cardiac disease (n=64);  Reference Standard: 2 independent experts (pulmonologist, cardiologist, emergency physician, or geriatric or internal physician) | Final diagnosis (CPE or no CPE) | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea, 65 and older  n=202,  Mean age: 65–100y,  % Males:49  HF Prevalence: 43.6% | 250 | 73 | 91 | 8.11 | 0.30 | 0.85 |
| Ray,42  2006  France | Cross-sectional  (EPIDASA study )  Ethnicity: NR  Comorbidities: cardiac insufficiency (n=63), chronic respiratory insufficiency (n=76), venous thromboembolic disease (n=36);  Reference Standard: 2 of cardiologists, pulmonologist, general medicine intern., geriatrician, emergency department physician | Diagnosis of cardiac pulmonary edema or no CPE | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea >65 yrs  n=308,  Mean age: 80y,  % Males:49  HF Prevalence: 45.7% | 100 | 90 | 59 | 2.20 | 0.17 | NR |
| 150 | 85 | 71 | 2.93 | 0.21 | NR |
| 200 | 82 | 84 | 5.13 | 0.21 | NR |
| 250 | 78 | 90 | 7.80 | 0.24 | 0.874 |
| 300 | 72 | 92 | 9.00 | 0.30 | NR |
| 350 | 67 | 92 | 8.38 | 0.36 | NR |
| 400 | 60 | 95 | 12.00 | 0.42 | NR |
| Ro,43  2011  USA | Cross-Sectional Design (Independent Study); Ethnicity:  caucasian (n=231), African American (n=8), hispanic (n=9), asian (n=1), other unspecified (n=1); Comorbidities: hypertension (n=196), CAD (n=143), acute MI (n=101), COPD (n=63), diabetes melitus (n=98), pulmonary embolism (n=13), chronic kidney disease (n=48), stable angina (n=44), unstable angina (n=21); Reference Standard: cardiologist, discharge diagnosis, echo | To compare the ease of use, performance, and diagnostic accuracy of Triage BNP (Biosite, San Diego, CA) and i-STAT BNP (Abbott, East Windsor, NJ) POC devices in patients with symp- toms suggestive of heart failure in an ED setting. | I-STAT BNP |  | 100 | 94.4 | 43.3 | 1.66 | 0.13 | 0.84 |
| BNP (TRIAGE - BNP Test)  I-STAT BNP (i-STAT BNP test) |  | 100 | 87.7 | 52.5 | 1.85 | 0.23 | 0.81 |
| Rogers,44 2009a  Multi-national study | Cohort  (HEARD-IT );  Ethnicity:  Caucasian (n=344), African-American (n=370);  Comorbidities:  history of HF (n=384),  Reference Standard:  2 cardiologists | To create a model that adjusts B-type natriuretic peptide (BNP) for specific covariates to better distinguish  cardiac from non-cardiac dyspnea | BNP (Abbott AxSYM® BNP MEIA, ADVIA -Centaur®, BNP Assay, TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnea  n=740,  Mean age: NR  % Males: NR  HF Prevalence: 49.7% | 100 | 96 | 69 | 3.10 | 0.06 | 0.937 |
| 400 | NR | 93 | NR | NR | NR |
| Adjust BNP cut-off with 96% sen | 96 | 73 | 3.56 | 0.05 | 0.948 |
| Rogers,45  2009b  USA | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities:  atrial fibrillation (n=107), COPD (n=43), history of HF (n=164);  Reference Standard:  4 physicians | Diagnostic performance for BNP, distinguishing cardiac from non-cardiac dyspnea | BNP (i-STAT BNP test) | Dyspnea, all  n=335,  Mean age: 72  11)y,  % Males: NR  HF Prevalence: 42.1% | 100 | 91 | 54 | 1.98 | 0.17 | 0.858 |
| 400 | NR | 92 | NR | NR | NR |
| Dyspnea, age >= 75 years  n=171,  Mean age: NR  % Males: NR  HF Prevalence: NR% | 100 | 94 | 41 | 1.59 | 0.15 | NR |
| 184 | 91 | 66 | 2.68 | 0.14 | NR |
| Dyspnea, atrial fibrillation  n=109,  Mean age: NR  % Males: NR  HF Prevalence: NR% | 100 | 92 | 26 | 1.24 | 0.31 | NR |
| 150 | 91 | 39 | 1.49 | 0.23 | NR |
| 449 | 91 | 78 | 4.14 | 0.12 | NR |
| Dyspnea, creatinine>= 2 mg/dl  n=47,  Mean age: NR  % Males: NR  HF Prevalence: NR% | 100 | 100 | 30 | 1.43 | 0.00 | NR |
| Dyspnea, BMI >= 35 kg/m2  n=85,  Mean age: NR  % Males: NR  HF Prevalence: NR% | 25 | 91 | 25 | 1.21 | 0.36 | NR |
| 100 | 64 | 61 | 1.64 | 0.59 | NR |
| Sanz,46  2006  Spain | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: systolic dysfunction (n=5), atrial fibrillation (n=8), COPD (n=11), ischemic heart disease (n=5), cardiomyopathy hypertensive (n=9), valvular (n=7);  Reference Standard: Symptoms and signs and the following clinical and laboratory emergency department: physical examination, blood test, ECG, chest x-radiography, and in some cases, echocardiography criteria (10) | The aim of this study was to evaluate the value of NT-proBNP and BNP in patients with acute dyspnea in the ED. diagnostic accuracy of different assays. | BNP - ADVIA (ADVIA -Centaur® BNP Assay, TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Acute dyspnea  n=100,  Mean age: 75  14.77)y,  % Males:67  HF Prevalence: NR% | 79 | 95 | 96 | 22.16 | 0.05 | NR |
| 100 | 86 | 98 | 39.09 | 0.14 | NR |
| 116 | 93 | 96 | 21.11 | 0.07 | NR |
| 100 | 95 | 89 | 8.58 | 0.05 | NR |
| NR | NR | NR | NR | NR | 0.965 |
| NR | NR | NR | NR | NR | 0.975 |
| Shah,47  2009a  NR | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: Hypertension (n=267), CAD (n=178), atrial fibrillation (n=81), diabetes mellitus (n=121), CHF or cardiomyopathy (n=147);  Reference Standard:  panel of experts and antihypertensive and lipid lowering treatment to prevent heart attack trial criteria | Mortality after one-year | BNP (TRIAGE - BNP Test for the Beckman Coulter Immunoassay Systems) | Acute dyspnea  n=412,  Mean age: NR  % Males: NR  HF Prevalence: 37% | 100 | NR | NR | NR | NR | NR |
| Acute dyspnea, LVEF ≤40%  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | 100 | NR | NR | NR | NR | 0.88 |
| Shah,47  2009a  NR  (cont’d) | (repeated data)  Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: Hypertension (n=267), CAD (n=178), atrial fibrillation (n=81), diabetes mellitus (n=121), CHF or cardiomyopathy (n=147);  Reference Standard:  panel of experts and antihypertensive and lipid lowering treatment to prevent heart attack trial criteria | (repeated data)  Mortality after one year | (repeated data)  BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test for the Beckman Coulter Immunoassay Systems) | Acute dyspnea, LVEF≥50%  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | 100 | NR | NR | NR | NR | 0.57 |
| Acute dyspnea, dx of diastolic function  n=NR  Mean age: NR  % Males: NR  HF Prevalence: NR% | 100 | NR | NR | NR | NR | 0.67 |
| Shah,48  2009b  USA | Cohort  (Independent study);  Ethnicity: Caucasian (n=136), African-American (n=264), other (n=12);  Comorbidities: Hypertension (n=268), CAD (n=177), diabetes mellitus (n=124), historical MI (n=99), renal disease (n=140), heart failure (n=148);  Reference Standard: 2 physicians | 1 year all-cause mortality | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test for the Beckman Coulter Immunoassay Systems) | Acute dyspnea  n=412  Mean age: NR  % Males: NR  HF Prevalence: 35.7% | 100 | NR | NR | NR | NR | 0.9 |
| Steg,49  2005  Multi-national study | Cross-sectional  (Breathing Not Properly Study)  Ethnicity: NR  Comorbidities: NR  Reference Standard: 2 cardiologists, Framingham, NHANES | Confirmation of the diagnosis CHF or non-CHF patients | BNP (TRIAGE –  BNP Test) | Dyspnea  n=709  Mean age: 66.4  14.7)y  % Males:43.3  HF Prevalence: 69% | 50 | 95 | 50 | 1.90 | 0.10 | NR |
| 80 | 92 | 72 | 3.29 | 0.11 | NR |
| 100 | 89 | 73 | 3.30 | 0.15 | NR |
| 125 | 83 | 83 | 4.88 | 0.20 | NR |
| 150 | 84 | 80 | 4.20 | 0.20 | NR |
| 162 | 86 | 79 | 4.10 | 0.18 | NR |
| Villacorta,50 2002  Brazil | Cross-sectional  (Independent study)  Ethnicity: NR  Comorbidities: Hypertension (n=36), CAD (n=30), prior AMI/angina (n=18), atrial fibrillation (n=8), COPD (n=31), renal disease (n=6), coronary (n=14), previous CHD (n=26);  Reference Standard:  1 cardiologist | Ability of BNP in diagnosing CHF | BNP (TRIAGE - BNP Test) | Acute dyspnea  n=70,  Mean age: 72.4y  % Males: NR  HF Prevalence: 51.4% | 200 | 100 | 97 | 33.33 | 0.00 | 0.99 |
| Wang,51  2010  Taiwan | Cross-sectional  (Independent study);  Ethnicity: NR  Comorbidities: Hypertension (n=38), CAD (n=18), COPD (n=13), diabetes mellitus (n=25), prior HF (n=15);  Reference Standard:  2 cardiologists | Diagnosing AHF in patients with acute dyspnea with available plasma BNP | BNP (Abbott AxSYM® BNP MEIA) | Acute dyspnea  n=84  Mean age: 73y  % Males: 48  HF Prevalence: 58.3% | 100 | 94 | 34 | 1.43 | 0.18 | NR |
| 500 | 65 | 74 | 2.54 | 0.47 | NR |
| Wu,52  2004  Multi-national study | Cross-sectional  (Breathing Not Properly Study )  Ethnicity: Caucasian (n=773), African-American (n=715), Other (n=98);  Comorbidities: Hypertension (n=679), prior AMI/angina (n=308), atrial fibrillation (n=256), COPD (n=600), historical (n=385), prior CABG (n=176), prior (n=527);  Reference Standard: 2 cardiologists | Effect of diabetes on  BNP concentrations in patients presenting to the ED with dyspnea | BNP (TRIAGE - BNP) Test | Dyspnea all  n=1,586  Mean age: NR  % Males: NR  HF Prevalence: 46.6% | 100ng/L | NR | NR | NR | NR | NR |
| Dyspnea, without diabetes  n=1,219  Mean age: 65.6(13.02)y  % Males:59.4  HF Prevalence: 40% | 100ng/L | NR | NR | NR | NR | 0.88 |
| Dyspnea, with diabetes  n=367  Mean age: 63.5(17.6)y  % Males:5.4  HF Prevalence: 59% | 100ng/L | NR | NR | NR | NR | 0.878 |

**Abbreviations:** AHF = acute heart failure; AMI = acute myocardial infarction; AUC = area under the Curve; BACH = Biomarkers in Acute Heart Failure; BASEL = B-type natriuretic peptide for Acute Shortness of Breath Evaluation; BMI = body mass index; BP = blood pressure; BNP = B-type natriuretic peptide; CAD = coronary artery disease; CAGB = coronary artery bypass graft; CHD = chronic heart disease; CHF = chronic heart failure; CI = confidence interval; COPD = chronic obstructive pulmonary disease; CPE = cardiogenic pulmonary edema; ECG = electrocardiogram; ED = emergency department; eGFR = estimated glomerular filtration rate; EPIDASA = Epidemiological study of acute dyspnea in elderly patients; GFR = glomerular filtration rate; glow = lower gray zone; gup = upper gray zone; HEARD-IT = Heart Failure and Audicor technology for Rapid Diagnosis and Initial Treatment; HF = heart failure; KD = kidney disease; kg/m2 = kilograms per meter squared; LR- = negative likelihood ratio; LR+ = positive likelihood ratio; LVEF = left ventricular ejection fraction; MEIA = microparticle enzyme immunoassay; mg/dL = milligram per deciliter; MI = myocardial infarction; mL/min/1.73m2 = milliliter per minute per 1.73 meters squared; MR-proANP = midregional pro-A-type natriuretic peptide; ng/L = Nanogram per liter; NHANES = National Health and Nutrition Examination Survey; NR = Not reported; NT-proBNP = N-Terminal proBNP; NYHA = New York Heart Association; pg/mL = Picograms per milliliter; RCT = Randomized controlled trial; SOB = Shortness of breath; USA = United States of America; yrs = years