| 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:38HF 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:41HF Prevalence: 53.7% | 200 | 96 | 74 | 3.63 | 0.06 | NR |
| 253 | 86 | 90 | 8.23 | 0.15 | 0.928 |
| [≥253](file:///C%3A%5CUsers%5CLaura%5CDesktop%5CDocuments%20and%20Settings%5Clmacdon%5CDocuments%20and%20Settings%5Clmacdon%5CLocal%20Settings%5CTemporary%20Internet%20Files%5CContent.MSO%5C7931DE76.xlsx#RANGE!#REF!) | 96 | 90 | 9.10 | 0.05 | NR |
| [≥253](file:///C%3A%5CUsers%5CLaura%5CDesktop%5CDocuments%20and%20Settings%5Clmacdon%5CDocuments%20and%20Settings%5Clmacdon%5CLocal%20Settings%5CTemporary%20Internet%20Files%5CContent.MSO%5C7931DE76.xlsx#RANGE!#REF!) | 96 | 90 | 9.10 | 0.05 | NR |
| [≥200](file:///C%3A%5CUsers%5CLaura%5CDesktop%5CDocuments%20and%20Settings%5Clmacdon%5CDocuments%20and%20Settings%5Clmacdon%5CLocal%20Settings%5CTemporary%20Internet%20Files%5CContent.MSO%5C7931DE76.xlsx#RANGE!#REF!) | 96 | 84 | 6.04 | 0.05 | NR |
| [≥200](file:///C%3A%5CUsers%5CLaura%5CDesktop%5CDocuments%20and%20Settings%5Clmacdon%5CDocuments%20and%20Settings%5Clmacdon%5CLocal%20Settings%5CTemporary%20Internet%20Files%5CContent.MSO%5C7931DE76.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,42004 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:100HF Prevalence: 58% | 110 | NR | NR | NR | NR | 0.979 |
| Diagnose CHF, BNP>100 n=33, Mean age: NR % Males: NRHF Prevalence: 58% | 590 | NR | NR | NR | NR | 0.64 |
| Boldanova,52010Switzerland | 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: NRHF Prevalence: 49.3% | NR | NR | NR | NR | NR | NR |
| Dyspnea, previous history of HF n=64, Mean age: 7311)y,% Males:61HF 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: 7311)y,% Males:52HF 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: NRHF Prevalence: 30.2% | NR | NR | NR | NR | NR | NR |
| Dyspnea, GFR <30 n=41, Mean age: 83 (11)y,% Males: NRHF Prevalence: 48.8% | 515 | 82 | 89 | 7.45 | 0.20 | 0.89 |
| Dyspnea, GFR 59-30 n=187, Mean age: 81(10)y,% Males: NRHF Prevalence: 34.2% | 480 | 74 | 81 | 3.89 | 0.32 | 0.799 |
| Dyspnea, 89-60 n=141,Mean age: 74(13)y,% Males: NRHF 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:48HF 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:35HF 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:52HF 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:50HF 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:68HF 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:44HF 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:39HF Prevalence: 38.89% | 550 ng/L | 85 | 65 | 2.43 | 0.23 | 0.76 |
| Choi,9 2007Korea | 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:56HF 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:44HF 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: NRHF Prevalence: NR% | NR | NR | NR | NR | NR | 0.74 |
| No history of HF n=63, Mean age: NR % Males: NRHF Prevalence: NR% | NR | NR | NR | NR | NR | 0.94 |
| LVEF <50% n=67, Mean age: NR % Males: NRHF Prevalence: NR% | NR | NR | NR | NR | NR | 0.64 |
| LVEF ≥50% n=39, Mean age: NR % Males: NRHF Prevalence: NR% | NR | NR | NR | NR | NR | 0.87 |
| High serum creatinine n=NR Mean age: NR% Males: NRHF Prevalence: NR% | NR | NR | NR | NR | NR | 0.81 |
| Low serum creatinine n=NR Mean age: NR% Males: NRHF 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: NRHF Prevalence: NR% | NR | NR | NR | NR | NR | 0.79 |
| Low or high likelihood of HF n=9, Mean age: NR % Males: NRHF Prevalence: NR% | NR | NR | NR | NR | NR | 0.86 |
| Patients > 79 years n=NR Mean age: NR % Males: NRHF Prevalence: NR% | NR | NR | NR | NR | NR | 0.85 |
| Patients < 79 years n=NR Mean age: NR % Males: NRHF 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: NRHF 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:68HF Prevalence: 60% | NR | NR | NR | NR | NR | NR |
| Acute dyspnea , no history CHF n=525, Mean age: NR % Males: NRHF 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: NRHF Prevalence: NR% | gup=334 ng/L (95% bootstrap CI 178 to 465); glow=0 | NR | NR | 3.35 | 0.01 | NR |
| Daniels,132006 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:56HF Prevalence: 46.1% | NR | NR | NR | NR | NR | NR |
| Dyspnea , BMI <25 n=526, Mean age: 67.3y% Males:55.7HF Prevalence: 47% | 100 | 94 | 65 | 2.63 | 0.10 | 0.9 |
| Dyspnea, 25 ≤BMI <35 n=595, Mean age: 63.2y% Males:58HF Prevalence: 46.2% | 100 | 92 | 76 | 3.88 | 0.10 | 0.91 |
| Dyspnea , BMI z35 n=247, Mean age: 56.7y,% Males:46.3HF Prevalence: 44.1% | 100 | 77 | 84 | 4.85 | 0.27 | 0.88 |
| Dyspnea , BMI <25n=526, Mean age: 67.3,% Males:55.7HF Prevalence: 47% | 100 | 90 | NR | NR | NR | NR |
| Dyspnea , 25 ≤BMI <35 n=595, Mean age: 63.2y,% Males:58HF Prevalence: 46.2% | 110 | 90 | NR | NR | NR | NR |
| Dyspnea , BMI z35 n=247,Mean age: 56.7y,% Males:46.3HF 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:94HF 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:45.7HF Prevalence: 52.6% | NR | NR | NR | NR | NR | NR |
| No kidney disease eGFR>= 60 n=438, Mean age: 63.516.0)y,% Males:43.8HF 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:47.8HF 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: NRHF 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:93HF Prevalence: 46.2% | NR | NR | NR | NR | NR | NR |
| Dyspnea not attributable to HF n=114, Mean age: 68-82y,% Males:95HF 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:38HF 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: NRHF 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: NRHF 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: NRHF 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: NRHF 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: NRHF 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:56.2HF 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:43HF Prevalence: 19.6% | NR | 100 | 59 | 2.44 | 0.00 | NR |
| Gruson,202012 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: NRComorbidities: 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:44.5HF Prevalence: 48.3% | 100 | NR | NR | NR | NR | NR |
| Acute dyspnea, women n=86, Mean age: 78y,% Males: NRHF 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: NRComorbidities: 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 dyspnean=69, Mean age: 74y,% Males: NRHF 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: NRHF Prevalence: NR%  | 100 | NR | NR | NR | NR | 0.88 |
| Acute dyspnea, <76y n=NR Mean age: NR % Males: NRHF 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:55HF 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,242005 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: NRHF Prevalence: 46.1% | NR | NR | NR | NR | NR | NR |
| Atrial fibrillation n=292, Mean age: 67–827y,% Males:61.3HF 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:59.1HF 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,242005 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: NRHF 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: 7014),% Males:49HF 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:66.8HF 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: 7411)y,% Males:54HF 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:56HF 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 versusnon-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:56HF 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:56HF 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 2004Multi-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 ornon-CHF  | BNP (TRIAGE -B-Type Natriuretic Peptide (BNP) Test) | Dyspnean=1,586Mean 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: NRHF 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: NRHF 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 |
| Malen=883, Mean age: NR% Males: 100HF 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=773Mean 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=715Mean 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 2010Multi-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 periodof 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: NRHF Prevalence: 34.6% | 100 | 96 | 62 | 2.51 | 0.07 | 0.91 |
| 300 | NR | NR | NR | NR | 0.9 |
| McCullough,322002a 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:55.2HF 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:56HF 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: NRHF 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:93HF 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: NRHF Prevalence: NR% | NR | NR | NR | NR | NR | NR |
| SOB, BMI >30 n=86, Mean age: 7215)y,% Males:59HF 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: 6514),% 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: 6417)y,% Males:56HF Prevalence: 47% | NR | NR | NR | NR | NR | NR |
| Dyspnea, history of hypertension n=879, Mean age: 56-77y,% Males:54HF 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:60HF 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:51.8HF 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:60HF 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,392008 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:53.5HF 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:52HF 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:49HF 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:49HF 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,432011 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 distinguishcardiac 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: NRHF 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: 7211)y,% Males: NRHF 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: NRHF 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: NRHF 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: NRHF Prevalence: NR% | 100 | 100 | 30 | 1.43 | 0.00 | NR |
| Dyspnea, BMI >= 35 kg/m2 n=85, Mean age: NR % Males: NRHF 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: 7514.77)y,% Males:67HF 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: NRHF Prevalence: 37% | 100 | NR | NR | NR | NR | NR |
| Acute dyspnea, LVEF ≤40% n=NR Mean age: NR % Males: NRHF 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: NRHF Prevalence: NR% | 100 | NR | NR | NR | NR | 0.57 |
| Acute dyspnea, dx of diastolic function n=NR Mean age: NR% Males: NRHF 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: NRHF 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=709Mean age: 66.414.7)y% Males:43.3HF 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: NRHF 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=84Mean age: 73y% Males: 48HF 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=1,586Mean age: NR% Males: NRHF Prevalence: 46.6% | 100ng/L | NR | NR | NR | NR | NR |
| Dyspnea, without diabetes n=1,219 Mean age: 65.6(13.02)y% Males:59.4HF Prevalence: 40% | 100ng/L | NR | NR | NR | NR | 0.88 |
| Dyspnea, with diabetes n=367Mean age: 63.5(17.6)y% Males:5.4HF 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