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**British Thoracic Society**  
**Quality Standards for Non-invasive ventilation**  
**Draft for public consultation**

**Available for public consultation from 1<sup>st</sup> August 2017 to 13<sup>th</sup> September 2017.**

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A response form is available on the BTS website.  
Please send your responses to Louise Preston by 5pm on Wednesday 13<sup>th</sup> September

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47 **British Thoracic Society**

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49 **Quality Standards for Non-Invasive Ventilation**

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51 **Draft for public consultation**

52  
53 The British Thoracic Society (BTS) has been at the forefront of the production of Guidelines for best  
54 clinical practice in respiratory medicine since the Society was established over 30 years ago. The  
55 Society was awarded NICE Accreditation for its guideline production process in November 2011 and  
56 the Society's Guideline Production Manual <sup>[1]</sup> setting out the detailed methodology and policy to  
57 produce guidelines is reviewed annually by the BTS Standards of Care Committee (SOCC).

58 A statement on quality standards based on each BTS Guideline is a key part of the range of  
59 supporting materials that the Society produces to assist in the dissemination and implementation of  
60 a Guideline's recommendations.

61 A quality standard is a set of specific, concise statements that:

- 62
- 63 • act as markers of high-quality, cost-effective patient care across a pathway or clinical area,  
64 covering treatment or prevention.
  - 65 • are derived from the best available evidence.

66 NICE Quality Standards and the NICE Quality Standards Process Guide <sup>[2]</sup> were used as a model for  
67 the development of BTS Quality Standards.

68 This document contains the BTS Quality Standards for Non- Invasive Ventilation (NIV) in adults.

69 The rationale for these quality standards is drawn from evidence and recommendations summarised  
70 in the BTS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure <sup>(3)</sup>  
71 and is informed by the 2017 NCEPOD report on Non-invasive ventilation (NIV), 'Inspiring Change' <sup>(4)</sup>.

72 The purpose of the Quality Standards document is to provide commissioners, healthcare  
73 professionals, planners and patients with a guide to standards of care which should be met for  
74 provision of acute NIV in the UK, together with measurable markers of good practice.

75 BTS quality standards are intended for:

- 76
- 77 • **Health care professionals**, to allow decisions to be made about care based on the latest  
78 evidence and best practice.
  - 79 • **People who receive NIV**, to enable understanding of what services they should expect from  
80 their health care provider.
  - 81 • **Service providers**, to be able to quickly and easily examine the clinical performance of their  
82 organisation and assess the standards of care they provide.
  - 83 • **Commissioners**, so that they can be confident that the services they are purchasing are high  
84 quality and cost effective.

85 **Method of Working**

86 A Quality Standards Working Group was convened in February 2017 and met in May 2017, with the  
87 following membership:

Name	Location/organisation
Dr Mike Davies, Chair	Consultant Respiratory Physician Papworth, Cambridge BTS NIV Clinical Audit lead, Chair, BTS Critical Care SAG
Dr Martin Allen	Consultant Respiratory Physician, Stoke RCP London representative BTS Quality Improvement Committee
Dr Ben Creagh-Brown	Consultant Physician – Intensive Care Medicine Royal Surrey County Hospital, Guildford
Dr Ravi Mahadeva	Consultant Respiratory Physician Addenbrooke's, Cambridge
Dr Stephen Bourke	Consultant Respiratory Physician Northumbria Chair, BTS COPD SAG
Ian Setchfield	Acute care nurse consultant East Kent Hospitals University NHS Foundation Trust Society of Acute Medicine
Rachael Moses Physiotherapist	Consultant Respiratory Physiotherapist Lancashire Teaching Hospital
Dr Rachel D'Oliveiro	ST/ICM trainee Ipswich
Dr Andrew Bentley	Intensive Care Society
Professor Alasdair Gray	Royal College of Emergency Medicine
Dr Phillip Jacobs	Society for Acute Medicine
Dr Alastair Glossop	Royal College of Anaesthetists

88

89 Members of the Quality Standards Group submitted Declaration of Interest forms in line with the  
90 BTS Policy and copies of forms are available on request from BTS Head Office.

91 The draft document was considered in detail by the BTS Standards of Care Committee and the BTS  
92 Quality Improvement Committee initially in June 2017.

93 The document was made available on the BTS website for public consultation for the period from 1<sup>st</sup>  
94 August to 13<sup>th</sup> September 2017.

95 Following further revision, the document was submitted for approval to the BTS Standards of Care  
96 Committee in [date tbc]

97 The Quality Standards document will be reviewed in [date tbc] or following the publication of a  
98 revised Guideline whichever is the sooner.

99 Each Quality Standard includes the following:

- 100
- **A Quality Statement**, which describes a key marker of high-quality, cost-effective care for this condition.
  - **Quality Measures**, which aim to improve the structure, process and outcomes of health care.
- 101  
102

103 The quality measures are not intended to be new sets of targets or mandatory indicators for  
104 performance management that need to be collected. The quality measures are specified in the form  
105 of a numerator and a denominator, which define a proportion or ratio (numerator/denominator). It  
106 is assumed that the numerator is a subset of the denominator population. The suggested numerator  
107 and denominator are provided to allow healthcare professionals and service providers to examine  
108 their clinical performance in relation to each quality standard. It is recognised that no national  
109 quality indicators will be available for this condition, and institutions will need to agree locally what  
110 information is required for the denominator to be used in each case, and what the expected level of  
111 achievement should be, given local circumstances. A brief description about the quality standard in  
112 relation to each audience is given.

113 The main source references for these quality standards are:

114 BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in  
115 Adults (2016)<sup>(3)</sup>.

116 National Confidential Enquiry into Patient Outcome and Death. Inspiring Change. London: NCEPOD;  
117 2017<sup>(4)</sup>.

118 There is no specific order of priority associated with the list of quality statements.

119 **Quality statement 1** - Acute non-invasive ventilation (NIV) should only be carried out in specified  
120 clinical areas designated for the delivery of NIV.

121 **Quality statement 2** - All staff who prescribe, initiate, or make changes to acute NIV treatment  
122 should have evidence of training and maintenance of competencies appropriate for their role.

123 **Quality statement 3** - Acute NIV should be offered to all patients who meet evidence-based criteria  
124 on presentation. Hospitals must ensure that adequate systems, staffing, and capacity are in place to  
125 provide NIV to all eligible patients.

126 **Quality statement 4** - Patients who meet evidence-based criteria for acute NIV on admission should  
127 start NIV within 120 minutes of hospital arrival. In patients who develop acute hypercapnic  
128 respiratory failure (AHRF) after admission, NIV should be commenced within 120 minutes of the first  
129 blood gas showing AHRF.

130 **Quality statement 5** - All patients treated with acute NIV should have blood gas analysis performed  
131 at one and four hours after initiation; failure of these blood gas measurements to improve should  
132 trigger an adjustment to NIV therapy and/or specialist review within 30 minutes.

133 **Quality statement 6** - All patients treated with acute NIV should have a timely and ongoing medical  
134 review and a documented escalation plan.

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138 **Quality Statement 1**

139 **Acute non-invasive ventilation (NIV) should only be carried out in specified clinical areas**  
140 **designated for the delivery of NIV.**

141 **Rationale:**

142 Acute NIV is delivered as a ward-based service for most patients treated in the UK. National audit  
143 data confirm that patients treated with NIV should be considered at high risk of death; national  
144 averages for in-hospital mortality exceed 30%. Use of NIV in non-specialised areas is associated with  
145 poorer outcomes; in the most recent BTS audit (2013), patients who started NIV in general medical  
146 wards experienced the highest mortality rate, when compared to NIV starting in other areas <sup>(5)</sup>.

147 Levels of trained staff, patient monitoring, and near-patient point of care testing must be sufficient  
148 to manage such patients effectively. Accepting that there are differences in hospital size and  
149 provision, defining appropriate areas for NIV is the function of a local operational policy.  
150 Nevertheless, there are some key infrastructure requirements that are uniform regardless of  
151 location for NIV treatment. These are provided in appendix 1.

152 Areas should be specified according to their capacity to provide effective NIV care, not the name of  
153 the area. Suitable areas may include emergency departments (ED), acute medical units, respiratory  
154 wards, high dependency units and critical care.

155 The severity of acute (acidaemic) hypercapnic respiratory failure (AHRF) and evidence of other organ  
156 dysfunction should influence the choice of care environment and staffing requirement.

157 This quality statement links to recommendations 6 and 7 of the NCEPOD 'Inspiring Change' report.

158 **Quality measure:**

159 **Structure:**

160 Evidence of local arrangements to ensure that NIV is delivered in clinical areas that are specified in  
161 local operational policy.

162 **Process:**

163 Proportion of adults who receive NIV care in an appropriate clinical area as defined in a local  
164 operational policy. This area should meet the recommendations of the BTS/ICS Guidelines for the  
165 Ventilatory Management of Acute Hypercapnic Respiratory failure in Adults (2016)<sup>(3)</sup> and NCEPOD's  
166 'Inspiring Change' report.<sup>(4)</sup>

167

168 **Numerator 1:**

169 Number of patients who start NIV in a designated NIV area\* of the hospital.

170 **Denominator 1:**

171 Total number of patients treated with NIV.

172 **Numerator 2:**

173 Number of patients who receive continuous oximetry monitoring during the first 24 hours of NIV.

174 **Denominator 2:**

175 Total number of patients treated with NIV.

176

177 \*A hospital's local operational policy must specify appropriate clinical areas for NIV. Designated NIV  
178 areas must meet all key infrastructure requirements as defined in appendix 1. Dedicated outreach  
179 teams may start NIV prior to transfer to an NIV area, providing that patients receive the same  
180 provision of staffing and monitoring. Transfer to an appropriate area should occur within four hours.  
181 If these criteria (appendix 1 and/or transfer) are not met, then the patient should not be included in  
182 numerator 1.

183

184 **What the quality statement means for each audience**

185 **Service providers:**

186 - Ensure systems are in place for all appropriate patients to be treated with NIV in an appropriate  
187 clinical area. This includes specifying clinical and operational pathways to ensure that such areas are  
188 identified and provide sufficient ventilators, masks and monitoring equipment to meet the expected  
189 demands of the service, and that such clinical areas have an appropriate trained staff / patient ratio  
190 (as set out in appendix 1).

191 **Healthcare professionals:**

192 - Ensure that patients treated with NIV are cared for in an appropriate clinical area. Senior  
193 healthcare professionals should work with operational managers to ensure that their NIV service  
194 meets BTS/ICS criteria and NCEPOD recommendations (appendix 1).

195 **Commissioners:**

196 - Ensure they commission acute NIV services that can demonstrate clinical pathways and service  
197 provision capable of providing effective delivery of care.

198 **People who receive acute NIV:**

199 - Should only be cared for in an appropriate clinical area that is configured to provide safe, effective  
200 care.

201

202 **Relevant existing indicators:**

203 BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in  
204 Adults (2016).<sup>(3)</sup>

205

206 **National data sources:**

207 National Confidential Enquiry into Patient Outcome and Death. Inspiring Change. London: NCEPOD;  
208 2017.<sup>(4)</sup>

209 BTS National NIV audit, 2010 – 2013.<sup>(5)</sup>

210

211 **Source references:**

212 BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in  
213 Adults (2016).<sup>(3)</sup>

214

215 **Other information:**

216 Appendix 1 – NIV service infrastructure checklist.

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222 **Quality Statement 2**

223 **All staff who prescribe, initiate, or make changes to acute NIV treatment should have evidence of**  
224 **training and maintenance of competencies appropriate for their role.**

225 **Rationale:**

226 NIV is an effective treatment provided it is delivered correctly. Key to this is training of staff to  
227 ensure they have both the knowledge and the practical skills commensurate with their role.

228 NCEPOD's study <sup>(4)</sup> highlights important deficiencies in the provision of training in the practical  
229 application of NIV treatment:

- 230
- 231 • 18% of hospitals did not have a defined staff competency assessment for the delivery of NIV.
  - 232 • 37% of hospitals that had a formal competency framework permitted untrained staff to supervise patients on NIV.
  - 233 • Overall, 45% of hospitals permitted staff without competency to directly supervise the care  
234 of patients receiving NIV.

235 The NCEPOD study did not investigate the level of training or competence of medical staff involved  
236 in the care of patients treated with NIV. However, important concerns were raised around clinical  
237 decision-making and overall care.

238 For some services, practical application of NIV and adjustment of ventilator settings are not within  
239 the remit of the on-call medical staff. Nevertheless, clinical responsibility requires a clear  
240 understanding of physiological principles, the evidence supporting the use of NIV, and decision-  
241 making in non-responders. Doctors at ST3+ grade usually represent the first line in clinical decision-  
242 making for patients treated with NIV; when required, training should be provided within induction  
243 for all doctors involved (including FY grades).

244 Evidence of competence should be documented within the training record (ePortfolio) for trainees  
245 or within the mandatory training record for all consultants who provide clinical input into the NIV  
246 service (including on-call input and for all locations of care).

247 This quality statement links to recommendation 8 of the NCEPOD 'Inspiring Change' report. <sup>(4)</sup>

248 **Quality measure:**

249 **Structure:**

250 Evidence that the practical delivery of NIV is only delivered by staff who are competent to do so and  
251 that individuals with clinical responsibility demonstrate competence in NIV clinical decision-making.

252 **Process:**

253 Percentage of staff delivering NIV with evidence of training / competencies together with evidence  
254 of annual updates.

255

256 **Numerator 1:** Number of healthcare professionals\* with direct responsibility to initiate and make  
257 changes to NIV treatment who have evidence of competence in the practical use of NIV.

258 **Denominator 1:** Total number of healthcare professionals with direct responsibility to initiate and  
259 make changes to NIV treatment.

260 **Numerator 2:** Number of healthcare professionals with responsibility for the clinical decision to start  
261 NIV who have evidence of competence in the theory and practice of acute NIV treatment.

262 **Denominator 2:** Total number of healthcare professionals with responsibility for the clinical decision  
263 to start NIV.

264 \* *healthcare professional = nursing / physiotherapy / medical / technical.*

265

266

267 **What the quality statement means for each audience:**

268 **Service providers:**

269 - Should ensure that **all** staff delivering NIV are competent to do so with evidence of initial training  
270 and annual updates. This should be provided via a mandatory rolling competency assessment  
271 commensurate with the role undertaken (i.e. practical delivery of NIV vs. clinical decision-making vs.  
272 both components). Service providers should ensure that training and competency assessments are  
273 standardised for all areas in which NIV is delivered, recognising that NIV services typically span  
274 across multiple clinical divisions. The Lead for service should be supported in mandating training  
275 across the whole trust.

276 **Healthcare professionals:**

277 - Who are both caring for and initiating NIV should have evidence that they are being trained in the  
278 theory and practice of NIV, commensurate of their role.

279 **Commissioners:**

280 - Should ensure that any service commissioned to provide acute NIV has staff who are trained,  
281 competent and receive annual knowledge updates.

282 **People who receive acute NIV:**

283 - Should have this delivered by trained and competent staff, commensurate with their role in the  
284 service.

285

286 **Relevant existing indicators:**

287 BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in  
288 Adults (2016).<sup>(3)</sup>

289

290 **National data sources:**

291 National Confidential Enquiry into Patient Outcome and Death. Inspiring Change. London: NCEPOD;  
292 2017.<sup>(4)</sup>

293

294 **Source references:**

295 BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in  
296 Adults (2016).<sup>(3)</sup>

297

298 **Other information:**

299 Appendix 2 – NIV service staff training checklist

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318 **Quality Statement 3**  
319 **Acute NIV should be offered to all patients who meet evidence-based criteria on presentation.**  
320 **Hospitals must ensure that adequate systems, staffing, and capacity are in place to provide NIV to**  
321 **all eligible patients.**

322 **Rationale:**

323 For COPD exacerbations complicated by AHRF, NIV reduces mortality two-fold. <sup>(6,7)</sup> However, the  
324 CAOS study showed that 80% of clinician estimates of outcome were unduly nihilistic. <sup>(8,9)</sup> There was  
325 marked variation in the baseline characteristics of ventilated patients between units, including age  
326 and performance status. <sup>(10)</sup> The 2014 COPD audit showed that 50% of patients with AHRF on their  
327 first blood gas and 34% of those with persistent or new respiratory acidaemia on serial blood gas did  
328 not receive NIV. <sup>(10)</sup>

329 Non-randomised studies also show that NIV provides benefit for patients with AHRF in association  
330 with obesity hypoventilation, chest-wall disorders and neuromuscular disease.

331 The discussion with patients should take account of their stable state performance status, other  
332 clinical indices that may influence outcome, and patient wishes. However poor performance status  
333 alone should not be considered an exclusion criterion for NIV.

334 Failure to provide NIV when it is indicated increases length of stay and hospital mortality. This  
335 represents an omission of care and places the patient concerned at risk of moderate or serious  
336 harm. Measures should be in place via routine clinical governance to review all cases of morbidity  
337 and mortality associated with NIV. This includes escalation to investigation as a Serious Incident if  
338 omission of care is believed to have caused unexpected or avoidable death. This is the rationale for  
339 quality measure 2 in this standard. It aims to quantify the number of patients who were not treated  
340 with NIV due to a non-clinical reason, such as an insufficient capacity of trained staff, NIV ventilators  
341 or beds on an appropriate unit.

342

343 **Quality measure:**

344 **Structure:**

345 Acute hospitals and trusts should ensure:

- 346 • Patients who meet evidence-based criteria are offered NIV.
- 347 • The decision whether to initiate NIV should be based on objective review by, and an  
348 informed discussion with, a clinician with appropriate expertise.
- 349 • NIV may be provided in other conditions lacking a similar evidence base, provided senior  
350 review involving a specialist has taken place.
- 351 • There should be sufficient trained staff, ventilators and bed capacity in appropriate areas to  
352 provide NIV when required.
- 353 • There is a robust governance structure that investigates acts or omissions in care.

354 **Process:** Proportion of patients with an evidence-based indication for NIV who are treated with NIV.  
355 Measure 1 quantifies patients with COPD alone on the basis that they represent the most frequent  
356 indication for NIV and are easier to define (as a single patient population). Measure 2 quantifies all  
357 patients not treated with NIV who, on review (e.g. Morbidity and Mortality review), should have  
358 been treated with NIV.

359 **Numerator 1:** Number of patients with COPD exacerbation and a clinical indication for NIV\* who are  
360 treated with NIV.

361 **Denominator 1:** Number of patients with COPD exacerbation and a clinical indication for NIV\*.

362 \* *excluding patients who show full resolution of respiratory acidaemia following a one hour trial of*  
363 *controlled oxygen and medical optimisation, but Including all patients who: a) decline NIV following a*

364 *documented informed discussion, b) proceed direct to invasive ventilation or c) in whom a senior*  
365 *specialist has confirmed that NIV or invasive ventilation would be futile.*

366

367 **Numerator 2:** Number of patients with a clinical indication for NIV who are not treated with NIV.\*\*

368 **Denominator 2:** Number of patients with a clinical indication for NIV who are treated with NIV.

369 *\*\* excluding patients who: a) decline NIV following a documented informed discussion, b) receive*  
370 *invasive ventilation or c) in whom a senior specialist has confirmed that NIV or invasive ventilation*  
371 *would be futile.*

372

373 **What the quality statement means for each audience:**

374 **Service providers:**

375 - must ensure there are adequate systems, staffing, and capacity in place to provide NIV to all  
376 eligible patients. Service providers should ensure that there is a robust and responsive clinical  
377 governance process if NIV is not provided when it is clinically indicated.

378 **Healthcare professionals:**

379 - should ensure that patients with a clinical need for NIV are reviewed by a clinician with appropriate  
380 expertise and are offered NIV as indicated.

381 **Commissioners:**

382 - ensure that they commission services with sufficient capacity to provide NIV to all patients with a  
383 clinical indication for NIV.

384 **People who receive NIV:**

385 - should not have access to treatment restricted due to undue nihilism or lack of capacity. The  
386 decision to initiate NIV should be supported by a discussion with a clinician with appropriate  
387 expertise and include an objective estimate of outcome should NIV be provided.

388

389 **National data sources:**

390 Stone RA, Holzhauser-Barrie J, Lowe D, et al. Who cares matters. National Chronic Obstructive  
391 Pulmonary Disease (COPD) Audit Programme: Clinical audit of COPD exacerbations admitted to  
392 acute units in England and Wales 2014. London: RCP; 2015. <sup>(10)</sup>

393 **Source references:**

394 Lightowler JV et al. Non-invasive positive pressure ventilation to treat respiratory failure resulting  
395 from exacerbations of chronic obstructive pulmonary disease: Cochrane systematic review and  
396 meta-analysis. *BMJ*. 2003;326(7382):185. <sup>(6)</sup>

397 Plant PK, Owen JL, Elliott MW. Early use of non-invasive ventilation for acute exacerbations of  
398 chronic obstructive pulmonary disease on general respiratory wards: a multicentre randomised  
399 controlled trial. *Lancet*. 2000; 3;355(9219):1931-5. <sup>(7)</sup>

400 Wildman MJ, Sanderson C, Groves J, et al. Implications of prognostic pessimism in patients with  
401 chronic obstructive pulmonary disease (COPD) or asthma admitted to intensive care in the UK within  
402 the COPD and asthma outcome study (CAOS): multicentre observational cohort study. *BMJ*;  
403 2007;335.1132. <sup>(8)</sup>

404 Wildman MJ, Sanderson CF, Groves J, et al. Survival and quality of life for patients with COPD or  
405 asthma admitted to intensive care in a UK multicentre cohort: the COPD and Asthma Outcome Study  
406 (CAOS). *Thorax* 2009;64:128-32. <sup>(9)</sup>

407 BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in  
408 Adults (2016). <sup>(3)</sup>

409 National Confidential Enquiry into Patient Outcome and Death. Inspiring Change. London: NCEPOD;  
410 2017. <sup>(4)</sup>

411

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413

414 Draft for public consultation August 2017

415 **Quality Statement 4**

416 **Patients who meet evidence-based criteria for acute NIV on admission should start NIV within 120**  
417 **minutes of hospital arrival. In patients who develop AHRF after admission, NIV should be**  
418 **commenced within 120 minutes of the first blood gas showing AHRF.**

419 **Rationale:**

420 Consensus expert opinion is that prompt application of NIV substantially reduces the risk of death in  
421 appropriately selected patients with AHRF.<sup>(6,7,9)</sup> Changes in respiratory rate and heart rate are  
422 indicators of risk. Delays in starting NIV are likely to worsen the degree of acidaemia prior to NIV  
423 which, in turn, is associated with a poorer outcome.<sup>(4,5)</sup>

424 The National Institute for Health and Clinical Excellence (NICE)<sup>(11)</sup> and NCEPOD<sup>(12)</sup> recognise the  
425 importance of immediate physiological assessment of acutely ill patients and recommend the use of  
426 physiological track and trigger systems to triage and assess. The National Early Warning Score  
427 (NEWS) is recommended by the Royal College of Physicians.

428 The NCEPOD 'Inspiring Change' study showed;

- 429
- 430 • Early warning scores were not used in 47% of patients treated with NIV.
  - 431 • When used, 56% of patients had a NEWS score of 6 or more, indicating the need for urgent  
432 clinical assessment.

433 Failure of initial triage may lead to delays in undertaking the initial blood gas sample, and  
434 subsequent delays in starting effective treatment. Minimum time to assessment and treatment  
435 targets are commonplace in ED and serve to prioritise interventions most likely to improve  
436 outcomes. This statement intends to establish recognition and treatment of AHRF as a time-critical  
437 event in ED (and the wider hospital) without bypassing the necessity for specialist clinical decision-  
438 making.

439 Evidence-based criteria include a trial of medical therapy including controlled oxygen and drugs, and  
440 should still be retained provided the patient is not in extremis. However, this should be limited to  
441 one hour. This provides sufficient time for appropriate clinical assessment to ensure that the patient  
442 meets evidence-based criteria for treatment with acute NIV.

443 This statement does not define the nature of the blood gas measurement (arterial vs. capillary vs.  
444 venous). There are strengths and limitations for each approach, and these also vary according to the  
445 clinical situation. An arterial blood gas is the gold standard against which other methods are  
446 compared. As such, the arterial method is recommended for blood gas measurement that defines  
447 the physiological requirement for NIV (i.e. after the trial of medical therapy). At other times, other  
448 methods may provide advantages such as easier access and reduced pain.

449 This quality statement links to recommendation 5 of the NCEPOD 'Inspiring Change' report, which  
450 states that NIV should start within a maximum of one hour of the blood gas measurement that  
451 identified the need for it.'

452 **Quality measure:**

453 **Structure:**

454 Evidence of local arrangements to ensure that all patients meeting evidence based criteria for NIV  
455 therapy are treated in a timely fashion, including:

- 456
- 457 • Rapid clinical assessment to establish presence of respiratory distress or requirement for  
supplemental oxygen.

- 458
- Performing a blood gas measurement within one hour of arrival to the emergency department in patients with respiratory distress.
- 459
- Recognition of qualifying blood gas criteria for treatment with NIV.
- 460
- Understanding of evidence- based criteria for starting treatment with NIV.
- 461
- Starting NIV within 60 minutes of blood gas confirmation that NIV is clinically indicated in those patients meeting evidence -based criteria.
- 462
- 463

464 **Process:**

465 Proportion of patients treated with acute NIV (after appropriate and timely initial investigation) who  
466 start treatment with NIV within 120 minutes of hospital arrival or, for inpatients who experience late  
467 deterioration, within 120 minutes of the first blood gas result that confirms AHRF.

468

469 **Numerator 1:** Number of patients meeting evidence-based criteria for acute NIV who are treated  
470 with NIV within 120 minutes of admission or, for inpatients who develop AHRF at a later stage,  
471 within 120 minutes of the first blood gas showing AHRF.

472 **Denominator 1:** Total number of patients meeting evidence-based criteria for acute NIV who are  
473 treated with NIV.

474 **Numerator 2:** Number of patients treated with NIV whose first blood gas measurement is performed  
475 within 60 minutes of admission.

476 **Denominator 2:** Total number of patients who present with AHRF on admission who are treated  
477 with NIV.

478

479 **What the quality statement means for each audience:**

480 **Service providers:**

481 - ensure there are operational systems in place to ensure timely, effective triage and treatment with  
482 NIV, with accurate and reliable recording of the time of the following events for patients treated  
483 with NIV: ED arrival, point of care blood gas analysis, time of starting treatment with NIV. Providers  
484 are also required to support audit and data collection, plus mechanisms for feedback and quality  
485 improvement.

486 **Healthcare professionals:**

487 - ensure that they are adequately trained in the recognition of AHRF via clinical and blood gas  
488 parameters and understand the evidence-based criteria for treatment with NIV.

489 **Commissioners:**

490 - ensure that services are commissioned with sufficient available resources to establish acute NIV  
491 services that achieve prompt treatment as specified.

492 **People who receive NIV:**

493 - are promptly recognised and treated with an evidence-based intervention to improve outcomes in  
494 AHRF.

495

496 **Source references:**

497 Hill NS, Brennan J, Garpestad E, Nava S. Noninvasive ventilation in acute respiratory failure. *Crit Care*  
498 *Med.* 2007;35(10):2402-7.

499 National Institute for Health and Clinical Excellence. Acutely ill patients in hospital: recognition of  
500 and response to acute illness in adults in hospital 2007. (NICE clinical guideline No 50.).<sup>(11)</sup>

501 National Confidential Enquiry into Patient Outcome and Death. An acute problem? A report of the  
502 national confidential enquiry into patient outcome and death (NCEPOD) London: NCEPOD, 2005.<sup>(12)</sup>

503 National Confidential Enquiry into Patient Outcome and Death. Inspiring Change. London: NCEPOD;  
504 2017.<sup>(4)</sup>

505 BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in  
506 Adults (2016).<sup>(3)</sup>

507

508

509 **Quality Statement 5**

510 **All patients treated with acute NIV should have blood gas analysis performed at one and four**  
511 **hours after initiation; failure of these blood gas measurements to improve should trigger specialist**  
512 **review within 30 minutes.**

513 **Rationale:**

514 In addition to continuous monitoring of oxygen saturations and measurement of respiratory rate,  
515 blood gas sampling is used to assess the response to NIV. Routine analysis at one and four hours  
516 after starting treatment with NIV is recommended, with additional sampling in the event of clinical  
517 deterioration.<sup>(3)</sup>

518 Studies show that improvements in pH and PaCO<sub>2</sub> values, and a reduction in respiratory rate after  
519 two hours of NIV are strong predictors of treatment success<sup>(13)</sup>; conversely, failure of physiological  
520 improvement is associated with poor outcome.

521 NCEPOD's 'Inspiring Change' study<sup>(4)</sup> provides evidence of inadequate patient monitoring; case-note  
522 reviewers found that blood gas sampling was too infrequent for 32% and that overall monitoring  
523 could have been improved for 54% of patients treated with NIV. Where sampling took place, the  
524 clinical response was often suboptimal; ventilator management after initial set-up was rated as  
525 inappropriate for 35% of patients. Clinical review did not take place for 31% of patients who  
526 deteriorated while treated with NIV.

527 Failure to improve after four hours of appropriately instituted treatment requires specialist review  
528 (link to QS6).

529 This quality statement therefore aims to quantify key blood gas measurements and the response to  
530 these results.

531

532 **Quality measure:**

533 **Structure:**

534 Evidence that all patients treated with NIV have a routine blood gas performed at least at one and  
535 four hours to establish their response to therapy. Failure of these blood gas results to improve (pH  
536 the same or worse / or PaCO<sub>2</sub> the same or worse) should trigger specialist review within 30 minutes.  
537 A specialist is a healthcare professional with the necessary responsibility and NIV competence to  
538 make clinical decisions, including ST3+ doctor/specialist respiratory nurse practitioner /  
539 physiotherapist.

540 **Process:**

541 Proportion of patients treated with NIV who have a blood gas at the specified times, and the  
542 proportion of those whose blood gas reveals a failure to improve and are not seen by an  
543 appropriately trained specialist within 30 minutes.

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545 **Numerator 1:** Number of patients who have a blood gas 30-90 minutes after starting treatment with  
546 NIV.

547 **Denominator 1:** Total number of patients treated with NIV.

548 **Numerator 2:** Number of patients who have a blood gas three - five hours after starting treatment  
549 with NIV.

550 **Denominator 2:** Total number of patients treated with NIV.

551 **Numerator 3:** Number of occasions when specialist review takes place within 30 minutes in response  
552 to a one or four-hour blood gas result that fails to improve in comparison to the prior sample.

553 **Denominator 3:** Number of occasions in which there is a one or four-hour blood gas result that fails  
554 to improve in comparison to the prior sample.

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*\*Failure to improve = pH the same or worse / or PaCO<sub>2</sub> the same or worse.*

**What the quality statement means for each audience:**

**Service providers:**

- ensure that all sites with a NIV service must have a local operational policy that explicitly describes:
  - A system that delivers timely blood gas analysis.
  - Clear pathways to enable prompt upward titration of ventilation pressures and troubleshooting common ventilator or mask-related issues.
  - Access to a specialist able to review patients treated with NIV within 30 minutes if needed.
  - A method to record the time the specialist is called and attends, and a means to record their assessment and changes in management.

**Healthcare professionals:**

- ensure that the response to NIV is assessed early. Furthermore, the treating clinician should have access to an appropriate specialist colleague in a timely fashion to maximise the chance of delivering optimal care.

**Commissioners:**

- ensure that commissioned services have local policies and standards of care that will facilitate timely identification of patients whose treatment needs to be changed.

**People who receive NIV:**

- will be assessed by a qualified healthcare professional within a short period of time if initial treatment is not having the desired effect.

**National data sources:**

BTS National NIV audit, 2010 – 2013. <sup>(5)</sup>

National Confidential Enquiry into Patient Outcome and Death. Inspiring Change. London: NCEPOD; 2017. <sup>(4)</sup>

**Source references:**

Confalonieri M et al, A chart of failure risk for noninvasive ventilation in patients with COPD exacerbation. *Eur Respir J.* 2005;25(2):348-55.<sup>(13)</sup>

BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in Adults (2016). <sup>(3)</sup>

591 **Quality statement 6**

592 **All patients treated with acute NIV should have a timely and ongoing medical review and a**  
593 **documented escalation plan.**

594 **Rationale:**

595 There is a high mortality in this patient population and the initial response to NIV provides key  
596 insights into treatment outcome. Failure to demonstrate at least partial physiological improvement  
597 after two hours of therapy is associated with poorer outcomes <sup>(13)</sup> and should prompt the need to  
598 consider invasive ventilation at this stage. <sup>(8,9)</sup>

599 Delivering effective care therefore requires clear escalation plans at the onset of NIV treatment, with  
600 access to consultant-level specialist support in the event of any uncertainty. <sup>(3)</sup> The initial escalation  
601 decision should be reviewed at the time of the first consultant review within 14 hours of admission.

602 This quality statement links to recommendations 9 and 10 of the NCEPOD 'Inspiring Change' report  
603 <sup>(4)</sup>, and recommendations 2 and 3 of the Clinical Quality Indicators for Acute Medical Units (Society  
604 for Acute Medicine, 2011) <sup>(14)</sup>.

605 An example of an escalation plan for acute NIV is attached. Many trusts already use generic  
606 documents, including Treatment Escalation Plans (TEP) and Universal Forms of Treatment Options  
607 (UFTO). These have the same aim as an NIV-specific document and would comply with this quality  
608 statement if the appropriate sections are completed.

609 **Quality measure:**

610 **Structure:**

611 Evidence of local arrangements to ensure that all patients treated with NIV should have:

- 612 • A documented escalation plan encompassing appropriateness of invasive ventilation, ceiling  
613 of treatment, and CPR status before starting NIV.
- 614 • Documented discussion with a specialist competent in the management of acute NIV at the  
615 time treatment is started or at the earliest opportunity afterwards.
- 616 • Specialist\* review within 4 hours of initiation of NIV.
- 617 • Consultant clinical review including escalation status within 14 hours of starting NIV. \*\*

618 \*A specialist is a healthcare professional with the responsibility and necessary NIV competence to  
619 make clinical decisions, including ST3+ doctor/specialist respiratory nurse practitioner /  
620 physiotherapist.

621 \*\* Consistent with national recommendations for acute medical care, consultant review for patients  
622 arriving 08.00am -18.00pm should usually be undertaken within 8 hours, with provision for earlier  
623 review according to clinical need.

624 **Process:**

625 Proportion of patients treated with NIV who have appropriate and timely clinical reviews including  
626 documented escalation plans.

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629 **Numerator 1:** Number of patients with evidence of specialist review and a documented escalation  
630 plan within 4 hours of starting treatment with NIV.

631 **Denominator 1:** Total number of patients treated with NIV.

632 **Numerator 2:** Number of patients with evidence of consultant review and a documented escalation  
633 plan within 14 hours of starting treatment with NIV.

634 **Denominator 2:** Total number of patients treated with NIV.

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637 **What the quality statement means for each audience:**

638 **Service providers:**

639 - should ensure there are systems in place to provide specialist review within four hours, consultant  
640 review within 14 hours and to use TEPs/UFTOs to document escalation decisions.

641 **Healthcare professionals:**

642 - should ensure that only appropriately trained specialists (up to consultant level) make clinical  
643 decisions for patients treated with NIV.

644 **Commissioners:**

645 - should ensure they commission acute NIV services that can demonstrate clinical pathways and  
646 service provision capable of providing effective delivery of care.

647 **People who receive NIV:**

648 - should be reviewed in a timely manner by senior clinicians with the necessary expertise to  
649 determine appropriate ceilings of care.

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651 **Relevant existing indicators:**

652 BTS National NIV audit, 2010 – 2013. <sup>(5)</sup>

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654 **National data sources:**

655 BTS National NIV audit, 2010 – 2013. <sup>(5)</sup>

656 National Confidential Enquiry into Patient Outcome and Death. Inspiring Change. London: NCEPOD;  
657 2017. <sup>(4)</sup>

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659 **Source references:**

660 BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in  
661 Adults (2016). <sup>(3)</sup>

662 Clinical Quality Indicators for Acute Medical Units (AMUs). The Society for Acute Medicine (2011). <sup>(14)</sup>

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664 **Other information:**

665 Example TEP for acute NIV (to follow on publication)

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668 **List of appendices:**

669

670 Appendix 1 – NIV service infrastructure checklist.

671 Appendix 2 – NIV service staff training checklist

672

673 Additional appendices will be provided on publication, to include:

- 674 - Sample escalation plan
- 675 - Sample NIV prescription/protocol

676

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## Appendix 1 – NIV service infrastructure checklist

Adapted from BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in Adults (March 2016) and National Confidential Enquiry into Patient Outcome and Death – July 2017 – Inspiring Change – Acute Non-Invasive Ventilation

#	Specifications	Is it met? Y/N/Planned	Comments	Action required	Timescale	Person responsible
The purpose of this specification is to improve the quality of care provided to patients receiving acute non-invasive ventilation (NIV). Issues in relation to the timeliness, appropriateness, location, level of care and competency of staff treating patients with acute NIV have been highlighted.						
1	<p>AREA: Acute NIV should only be used in clinical areas equipped with:</p> <ul style="list-style-type: none"> <li>a) Continuous pulse oximetry for all patients.</li> <li>b) Continuous ECG monitoring for all patients with a clinical indication (pulse rate &gt; 120 bpm, dysrhythmia or possible cardiomyopathy).</li> <li>c) Point of care blood gas analyser within the NIV area.</li> </ul>					
2	LEADERSHIP: There should be a clinical lead for the NIV service with time allocated in their job plan, a designated lead nurse and, where appropriate, a designated lead physiotherapist.					
3	STAFFING: 1:2 nursing care should be provided for all patients treated with acute NIV until NIV requirements reduce to nocturnal use only. The local operational policy should include a management / escalation plan for critically ill patients who require increased (1:1) nursing care.					
4	EQUIPMENT: All ventilators used to deliver acute NIV should be designed for this purpose. There should be sufficient quantity of masks and ventilators to meet the expected demand for NIV.					
5	SERVICE CAPACITY: Designated NIV area(s) should have sufficient capacity to meet the demand for acute NIV. If NIV starts in other areas, trained staff should remain with					

	the patient during delivery of NIV; the same monitoring should be provided and transfer to a designated NIV area should occur within 4 hours.					
6	<p>GOVERNANCE: The NIV service should have:</p> <ul style="list-style-type: none"> <li>a) A locally developed NIV protocol (based on published best practice guides) uniformly applied across all areas.</li> <li>b) A process of regular audit (continuous rolling audit is recommended), including participation in national audits.</li> <li>c) A robust morbidity and mortality (M&amp;M) process including regular M&amp;M meetings (including rapid review of all inpatient deaths of patients treated with (or considered for) acute NIV).</li> </ul>					

Draft for public consultation

## Appendix 2 – NIV service staff training checklist

Adapted from BTS/ICS Guidelines for the Ventilatory Management of Acute Hypercapnic Respiratory Failure in Adults (March 2016) and National Confidential Enquiry into Patient Outcome and Death – July 2017 – Inspiring Change – Acute Non-Invasive Ventilation

#	Specifications	Is it met? Y/N/Partially/Planned	Comments	Action required	Timescale	Person responsible
The purpose of this specification is to improve the quality of care provided to patients receiving acute non-invasive ventilation (NIV). Issues in relation to the timeliness, appropriateness, location, level of care and competency of staff treating patients with acute NIV have been highlighted.						
1	Provision of an NIV training programme for staff with responsibility to start or continue NIV.					
2	Training portfolios of nurses / physiotherapists / doctors / physiologists confirm that they have attended such training.					
3	Staffing arrangements such that new / untrained members of staff with any responsibility for the care of patients treated with NIV are directly supervised by a trained member of staff until NIV competence is achieved and documented.					
4	<p>A rolling competency maintenance framework that is appropriate for their continued practice. This will differ according to role with the recommended approach as follows;</p> <p>1) <b>Healthcare professionals with responsibility to make practical changes to NIV (e.g. setting up NIV, adjusting ventilator settings and mask):</b></p> <ul style="list-style-type: none"> <li>Annual review of competence, ideally observed by the trust lead for training.</li> </ul>					

<p>2) <b>Healthcare professionals with responsibility for clinical decisions regarding NIV therapy:</b></p> <ul style="list-style-type: none"> <li>• New staff (e.g. rotating ST3+ grade) should receive a review of the theory and evidence-base for NIV as part of their induction.</li> <li>• Existing staff (e.g. consultant with on-call responsibility for NIV) should review their competence annually via appraisal / mandatory training and should ensure attendance at an acute medical update that includes NIV within each revalidation cycle.</li> </ul>					
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Draft for public consultation