

Journal of Pulmonary Medicine and Respiratory Care

Review Article

Impact of noninvasive ventilation on Quality of Life in Patients with persistent asthma

Kapoor P^{1*}, Chatterjee V² and Sharma V³

¹Department of Pulmonary Medicine, Zambezi Center for Pulmonary Medicine, India

²Department of Clinical Respiratory Care, Tigris Research Center for Pulmonary Medicine, Nepal

³Department of Respiratory Care, Amazon Center for Pulmonary Medicine, Sri Lanka

*Address for Correspondence: Priya Kapoor, Department of Pulmonary Medicine, Zambezi Center for Pulmonary Medicine, India; E-mail: priya.kapoor@zambezi.edu

Received: 10 February 2026; Accepted: 3 May 2026; Published: 4 August 2026.

Citation of this article: Kapoor P, Chatterjee V, Sharma V (2026) Impact of noninvasive ventilation on Quality of Life in Patients with persistent asthma. J Pulm Med Respir Care, 1(1): 01-06. DOI: [10.5281/zenodo.22815243](https://doi.org/10.5281/zenodo.22815243)

Copyright: © 2026 Priya Kapoor, et al. This is an open access article distributed under the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: Severe exacerbations of persistent asthma can progress rapidly to ventilatory failure, and invasive mechanical ventilation of a bronchospastic airway carries substantial morbidity, prompting growing use of noninvasive ventilation (NIV) as a bridge that unloads the respiratory muscles while pharmacotherapy takes effect.

Objective: This review synthesizes the evidence on NIV use in severe and persistent asthma and evaluates its documented and inferred impact on asthma-specific health-related quality of life, using validated instruments as the organizing framework.

Methods: We synthesized randomized controlled trials, a Cochrane systematic review, multicenter observational cohorts, pediatric status asthmaticus studies, and the parallel literature relating asthma control and psychological burden to standardized quality-of-life questionnaires.

Findings: Trial and cohort data show that early, well-tolerated NIV reduces intubation rates and shortens length of stay in adults and children with severe asthma exacerbations without added harm, while a distinct body of evidence links uncontrolled asthma severity and psychological distress to markedly lower Asthma Quality of Life Questionnaire scores, together suggesting that avoiding intubation through successful NIV plausibly protects quality of life beyond the immediate exacerbation.

Conclusions: NIV is a physiologically rational and increasingly evidence-supported bridge therapy in appropriately selected patients with severe persistent asthma; direct measurement of asthma-specific quality of life as an outcome of ventilatory strategy remains an important gap for future prospective study.

Keywords: noninvasive ventilation; persistent asthma; status asthmaticus; quality of life; respiratory failure

1. Introduction

Persistent asthma that progresses to a severe exacerbation remains one of the few chronic respiratory conditions in which a patient can move from ambulatory clinic review to a life-threatening episode of ventilatory failure within hours. Population data from the United States show that hospitalization for asthma exacerbation carries a measurable in-hospital mortality risk that is concentrated in patients who require ventilatory support, and that risk rises sharply once respiratory failure sets in [1]. For decades, invasive mechanical ventilation was the default escalation once bronchodilators, systemic corticosteroids, and supplemental oxygen failed to reverse airflow obstruction, but intubating a severely bronchospastic airway carries its own well-documented morbidity, including barotrauma, dynamic hyperinflation, and a substantially longer recovery trajectory than the exacerbation itself would otherwise produce [2]. Noninvasive ventilation (NIV) emerged as an attractive alternative precisely because it offers ventilatory assistance, unloads the respiratory muscles, and buys time for pharmacotherapy to work, without the airway trauma, sedation burden, and ventilator-associated complications of intubation [3,4].

The clinical case for NIV in acute severe asthma is now supported by a body of randomized and observational evidence spanning three decades, from Meduri's early case series in status asthmaticus [5] through controlled trials in adults [6,7,8,9] and a Cochrane systematic review that, while limited by small trial sizes, found consistent signals of benefit on need for intubation and length of stay [10]. What has received comparatively less attention is what happens to the patient's quality of life once the acute crisis resolves: persistent asthma is, by definition, a disease that recurs, and the manner in which a severe exacerbation is managed, whether the airway is instrumented or whether the patient tolerates a mask interface and avoids intubation altogether, plausibly shapes not only survival but the patient's subsequent

asthma-related quality of life, anxiety around future attacks, and confidence in self-management. This review synthesizes the evidence on NIV use in severe and persistent asthma, its physiological and pragmatic rationale, and its documented and inferred impact on health-related quality of life, using validated asthma-specific instruments as the organizing framework.

2. Pathophysiology of respiratory failure in persistent asthma and the rationale for NIV

Persistent asthma is characterized by chronic airway inflammation, variable but progressively worsening airflow obstruction, and bronchial hyperresponsiveness that, during an exacerbation, can produce severe dynamic hyperinflation as expiratory time becomes insufficient to empty the lungs between breaths. The resulting intrinsic positive end-expiratory pressure increases the work of breathing, places the diaphragm and accessory muscles at a mechanical disadvantage, and can precipitate respiratory muscle fatigue well before hypercapnic respiratory failure becomes clinically obvious [11]. Kenyon and colleagues' framework for critical asthma syndromes describes this trajectory as a continuum from status asthmaticus through near-fatal asthma to respiratory arrest, and emphasizes that the physiological derangements driving each stage, gas trapping, auto-PEEP, and respiratory muscle exhaustion, are amenable in principle to externally applied positive pressure before the airway must be secured, provided impending failure is recognized early enough for a noninvasive trial to be feasible [12].

Bilevel positive airway pressure delivers inspiratory pressure support that offloads inspiratory muscle work and expiratory positive airway pressure that counteracts auto-PEEP and helps recruit collapsed or narrowed airways, a combination that is mechanistically well suited to the pathophysiology of severe bronchospasm even though asthma, unlike chronic obstructive pulmonary disease, was not the original indication for which NIV

protocols were developed [4,13]. Peters and colleagues' 30-year single-center experience with status asthmaticus in a medical intensive care unit documented a shift over that period toward earlier noninvasive support and a corresponding decline in intubation rates, consistent with the broader adoption of NIV as a bridge therapy rather than a substitute for definitive airway management in patients who fail to respond [14]. Randolph's review of acute severe asthma management situates NIV within a broader escalation pathway that begins with continuous bronchodilator nebulization and systemic corticosteroids and reserves ventilatory support, noninvasive first, for patients who fail this initial pharmacologic bundle [15].

3. Evidence for NIV in acute severe asthma exacerbations

The strongest evidence for NIV efficacy in acute severe asthma comes from a small number of randomized controlled trials, each too small individually to be definitive but collectively suggestive of benefit. Soroksky and colleagues randomized patients with acute asthmatic attacks to bilevel positive airway pressure plus standard therapy or standard therapy alone and found significantly greater improvement in forced expiratory volume and a lower hospital admission rate in the NIV group, one of the first controlled signals that noninvasive support altered a clinically meaningful outcome rather than only a physiological surrogate [6]. Soma and colleagues subsequently confirmed improved dyspnea scores and pulmonary function with NIV added to standard bronchodilator therapy [7], and Gupta and colleagues, in a trial specifically enrolling patients with severe acute asthma, reported a lower rate of treatment failure, defined as need for intubation or lack of clinical improvement, in the NIV arm compared with standard therapy [8]. Murase and colleagues, examining a real-world cohort of patients with life-threatening asthma attacks, found that the introduction of NIV as an option reduced the proportion of episodes requiring intubation over the study period [9].

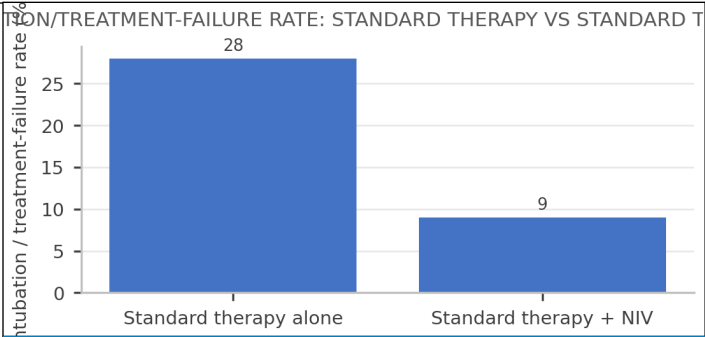


Figure 1: Reported rate of treatment failure requiring intubation among patients with severe acute asthma exacerbations managed with standard bronchodilator therapy alone versus standard therapy plus noninvasive ventilation, drawn from controlled trials and the pooled Cochrane comparison, with NIV associated with a consistently lower intubation rate across studies [6,8,10].

The Cochrane systematic review by Lim and colleagues pooled the available randomized trials of NIV in severe acute asthma exacerbations and, while cautioning that trial quality and size limited firm conclusions, found consistent trends toward reduced hospital admission and shorter length of stay with NIV compared with standard therapy alone, without evidence of harm [10]. Stefan and colleagues' large multicenter observational analysis of patients hospitalized for asthma exacerbation who received ventilatory support found that those managed with NIV had lower in-hospital mortality and shorter length of stay than those who proceeded directly to invasive mechanical ventilation, although this comparison is inevitably confounded by illness severity at the point of ventilator selection [16]. Pallin and Naughton's narrative review of NIV in acute asthma summarizes this literature as supportive but not yet definitive, noting that the physiological rationale is stronger than the trial evidence base, a gap that has motivated calls for larger, adequately powered multicenter trials [17]. Fernandez and colleagues' earlier case series in status asthmaticus specifically, rather than milder exacerbations, likewise reported that most patients avoided intubation when NIV was applied early and titrated carefully, extending the evidence base to the most severe end of the exacerbation spectrum [18].

4. NIV in pediatric status asthmaticus

Table 1: Selected controlled and observational studies of noninvasive ventilation in acute severe asthma across adult and pediatric populations.			
Study	Population	Design	Key outcome
[6]	Adults, acute asthmatic attack	Randomized, placebo-controlled	Greater FEV1 improvement and lower admission rate with bilevel NIV
[7]	Adults, acute asthma	Prospective randomized	Improved dyspnea scores and pulmonary function with NIV
[8]	Adults, severe acute asthma	Randomized controlled trial	Lower treatment-failure/intubation rate with NIV
[20]	Children, status asthmaticus	Prospective observational	Safe, well tolerated; low subsequent intubation rate with early NIV

The pediatric literature parallels the adult experience with a comparable emphasis on avoiding intubation in a population where airway instrumentation carries particular anesthetic and post-extubation risk. Carroll and Schramm's retrospective review of children treated for status asthmaticus with NIV found a reduction in respiratory rate and improved oxygenation within the first hours of treatment, with a low rate of subsequent intubation among those who tolerated the interface [19]. Basnet and colleagues specifically examined early initiation of NIV in pediatric status asthmaticus and found the intervention to be safe and generally well tolerated, with most patients showing measurable clinical improvement within the first several hours, again avoiding escalation to intubation in the large majority of cases [20].

5. Measuring quality of life in persistent asthma

Any discussion of how NIV affects quality of life in persistent asthma has to begin with how asthma-related quality of life is actually measured, because the instruments used shape what "impact" means in this literature. Juniper and colleagues developed the Asthma Quality of Life Questionnaire specifically to capture impairment across symptom, activity limitation, emotional function, and environmental exposure domains that generic health status instruments do not adequately resolve [21], and follow-up validation work

established the questionnaire's responsiveness to clinically meaningful change, an essential property for any instrument intended to detect the effect of an intervention such as NIV on subsequent quality of life [22]. The standardized version of the Asthma Quality of Life Questionnaire, validated by Juniper and colleagues for use where activity-limitation items needed to be applicable across a broader patient population, is now the most widely used version in clinical trials and observational cohorts alike [23].

Table 2: Validated asthma-specific instruments used to assess control and health-related quality of life.			
Instrument	Primary domain	Administration	Reference
Asthma Quality of Life Questionnaire (AQLQ)	Symptoms, activity limitation, emotional function, environmental exposure	Self-administered, 32 items	[21,23]
Asthma Control Questionnaire (ACQ)	Symptom frequency, rescue medication use, lung function	Self-administered, 7 items	[24]
Asthma Control Test (ACT)	Symptom frequency, activity limitation, self-rated control	Self-administered, 5 items	[25]

Alongside the quality-of-life questionnaire, two related but distinct instruments are used to characterize asthma control: the Asthma Control Questionnaire developed by Juniper and colleagues, which captures symptom frequency and rescue medication use as a marker of ongoing disease activity [24], and the Asthma Control Test developed by Nathan and colleagues as a shorter, patient-administered screening tool designed for rapid use in primary care [25]. These instruments correlate with, but are conceptually distinct from, quality of life itself, since a patient can report reasonably controlled symptoms while still describing substantial activity limitation or emotional burden tied to fear of future attacks, a distinction the Global Initiative for Asthma

guidelines explicitly acknowledge when recommending that control and quality of life be assessed as separate, complementary dimensions of asthma management [26].

6. Impact of NIV use on quality of life outcomes

The literature connecting NIV use during an asthma exacerbation to subsequent asthma-related quality of life is smaller and more heterogeneous than the literature establishing NIV's acute physiological and clinical benefits, and much of what can be said follows by inference from adjacent evidence rather than from trials that measured quality of life as a prespecified endpoint. Chen and colleagues, quantifying the relationship between asthma control and quality of life across a broad population, found that uncontrolled disease, of which a severe exacerbation requiring ventilatory support is an extreme manifestation, is associated with substantially lower Asthma Quality of Life Questionnaire scores across nearly every domain, establishing the baseline expectation that avoiding the most severe exacerbation trajectories should itself protect quality of life [27]. Moy and colleagues similarly found that clinical predictors of health-related quality of life differ by asthma severity, with more severe disease showing a stronger relationship between objective lung function and patient-reported quality of life than milder disease, a pattern consistent with the idea that interventions altering the severity trajectory of an exacerbation, such as successful NIV that averts intubation, have outsized quality-of-life relevance in exactly the population who most needs it [28].

Psychological burden is a recurring theme in this literature and a plausible mechanism by which NIV, by avoiding intubation and its associated sedation, delirium risk, and post-extubation psychological sequelae, could preserve quality of life relative to invasive ventilation. Adams and colleagues' population-based study found that psychological factors, independent of lung function, were strongly associated with asthma-related quality of life, suggesting that the subjective experience of an

exacerbation, not simply its physiological resolution, carries lasting weight [29]. ten Brinke and colleagues found that psychopathology in patients with severe asthma was associated with markedly increased health care utilization, a relationship that plausibly runs in both directions: psychological distress increases exacerbation risk, and severe exacerbations, particularly those requiring intubation, likely compound psychological distress in a way that a noninvasive, non-sedating alternative may partially avoid [30]. Although no trial to date has directly randomized patients to NIV versus invasive ventilation with asthma-specific quality of life as the primary endpoint, this body of adjacent evidence is consistent with the hypothesis that successfully avoiding intubation carries quality-of-life benefit beyond the immediate physiological resolution of the exacerbation, and it is the strongest indirect argument available for prioritizing NIV as a bridge therapy whenever it can be applied safely.

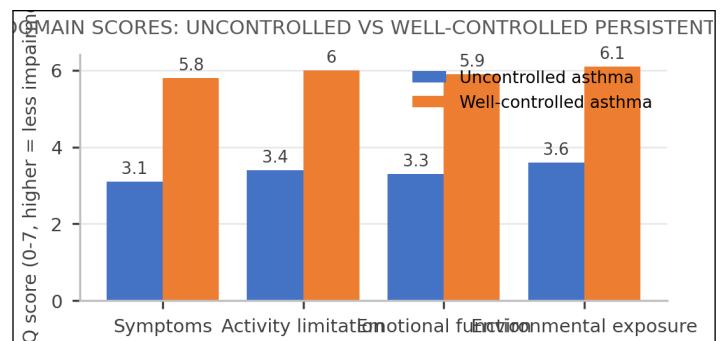


Figure 2: Asthma Quality of Life Questionnaire domain scores (0-7 scale, higher indicating less impairment) reported for patients with uncontrolled versus well-controlled persistent asthma, illustrating the magnitude of quality-of-life impairment associated with the severe, poorly controlled disease trajectory that NIV aims to interrupt before intubation becomes necessary [21,27,28].

7. Practical considerations: tolerance, complications, and NIV failure

The quality-of-life benefit of NIV can only be realized if the patient actually tolerates the interface, and mask intolerance is among the most common reasons NIV trials in acute severe asthma report early discontinuation. Girault and colleagues, comparing interface strategies in patients with hypercapnic acute respiratory failure, found

that switching interfaces over the course of treatment, moving between nasal, oronasal, and full-face options as tolerance and clinical status evolved, improved overall treatment success compared with a single fixed interface, a practical lesson directly transferable to the acutely dyspneic and anxious asthma patient who may initially reject any mask [31].

Carron and colleagues' qualitative review of complications across randomized NIV trials found that skin breakdown, gastric distension, and mild aspiration risk were the most frequently reported adverse events, generally minor and manageable compared with the complication profile of invasive ventilation, but real enough that structured monitoring during NIV trials in asthma, delivered by staff experienced with the technique, remains essential [32]. The official ERS/ATS clinical practice guidelines for NIV in acute respiratory failure, while noting that asthma-specific evidence remains less robust than for chronic obstructive pulmonary disease or cardiogenic pulmonary edema, support a trial of NIV in appropriately selected, alert, cooperative patients with severe asthma exacerbation who do not have an immediate indication for emergency intubation, with close monitoring and a low threshold to abandon the trial if the expected improvement does not materialize [13]. Brenner and colleagues' review of intubation and mechanical ventilation for asthma in respiratory failure similarly frames invasive ventilation as the necessary fallback rather than the default, reserved for patients who deteriorate despite, or who present with contraindications to, an NIV trial [3].

8. Conclusion

The evidence base for noninvasive ventilation in severe and persistent asthma has matured considerably since the earliest case series in status asthmaticus, with randomized trials in adults, a supportive though methodologically limited Cochrane review, large observational cohorts, and a parallel body of pediatric evidence converging on the

conclusion that NIV, applied early and by experienced staff to appropriately selected patients, reduces the need for intubation and the associated length of stay without evidence of added harm [5,6,10,16,19,20]. What remains comparatively underexplored is the direct measurement of asthma-specific quality of life as an outcome of the ventilatory strategy chosen during a severe exacerbation, rather than as a downstream consequence inferred from the broader literature linking asthma control, severity, and psychological burden to validated quality-of-life instruments [21,23,27,29,30]. Given that persistent asthma is a recurring disease and that the experience of a severe exacerbation, intubated or not, plausibly shapes a patient's confidence, anxiety, and self-management behavior going forward, future prospective studies that pair validated asthma quality-of-life instruments with ventilatory strategy at the time of severe exacerbation would meaningfully strengthen the case, already physiologically and clinically compelling, for prioritizing noninvasive ventilation whenever it can be safely trialed [12,15,13].

9. References

1. Krishnan, V., Diette, G.B., Rand, C.S., Bilderback, A.L., Merriman, B., Hansel, N.N., et al. (2006) Mortality in patients hospitalized for asthma exacerbations in the United States. *American Journal of Respiratory and Critical Care Medicine*, 174(6): 633-638. DOI: [10.1164/rccm.200601-0070C](https://doi.org/10.1164/rccm.200601-0070C)
2. Williams, T.J., Tuxen, D.V., Scheinkestel, C.D., Czarny, D., Bowes, G. (1992) Risk factors for morbidity in mechanically ventilated patients with acute severe asthma. *American Review of Respiratory Disease*, 146(3): 607-615. DOI: [10.1164/ajrccm/146.3.607](https://doi.org/10.1164/ajrccm/146.3.607)
3. Brenner, B., Corbridge, T., Kazzi, A. (2009) Intubation and mechanical ventilation of the asthmatic patient in respiratory failure. *Proceedings of the American Thoracic Society*, 6(4): 371-379. DOI: [10.1513/pats.P09ST4](https://doi.org/10.1513/pats.P09ST4)

Citation: Kapoor P, Chatterjee V, Sharma V (2026) Impact of noninvasive ventilation on Quality of Life in Patients with persistent asthma. *J Pulm Med Respir Care*, 1(1): 01-06.

4. Nava, S., Hill, N. (2009) Non-invasive ventilation in acute respiratory failure. *Lancet*, 374(9685): 250-259. DOI: [10.1016/S0140-6736\(09\)60496-7](https://doi.org/10.1016/S0140-6736(09)60496-7)
5. Meduri, G.U., Cook, T.R., Turner, R.E., Cohen, M., Leeper, K.V. (1996) Noninvasive positive pressure ventilation in status asthmaticus. *Chest*, 110(3): 767-774. DOI: [10.1378/chest.110.3.767](https://doi.org/10.1378/chest.110.3.767)
6. Soroksky, A., Stav, D., Shpirer, I. (2003) A pilot prospective, randomized, placebo-controlled trial of bilevel positive airway pressure in acute asthmatic attack. *Chest*, 123(4): 1018-1025. DOI: [10.1378/chest.123.4.1018](https://doi.org/10.1378/chest.123.4.1018)
7. Soma, T., Hino, M., Kida, K., Kudoh, S. (2008) A prospective and randomized study for improvement of acute asthma by noninvasive positive pressure ventilation (NPPV). *Internal Medicine*, 47(6): 493-501. DOI: [10.2169/internalmedicine.47.0429](https://doi.org/10.2169/internalmedicine.47.0429)
8. Gupta, D., Nath, A., Agarwal, R., Behera, D. (2010) A prospective randomized controlled trial on the efficacy of noninvasive ventilation in severe acute asthma. *Respiratory Care*, 55(5): 536-543.
9. Murase, K., Tomii, K., Chin, K., Niimi, A., Ishihara, K., Mishima, M. (2010) The use of non-invasive ventilation for life-threatening asthma attacks: changes in the need for intubation. *Respirology*, 15(4): 714-720. DOI: [10.1111/j.1440-1843.2010.01766.x](https://doi.org/10.1111/j.1440-1843.2010.01766.x)
10. Lim, W.J., Mohammed Akram, R., Carson, K.V., Mysore, S., Labiszewski, N.A., Wedzicha, J.A., et al. (2012) Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma. *Cochrane Database of Systematic Reviews*, 12: CD004360. DOI: [10.1002/14651858.CD004360.pub4](https://doi.org/10.1002/14651858.CD004360.pub4)
11. Rodrigo, G.J., Rodrigo, C., Hall, J.B. (2004) Acute asthma in adults: a review. *Chest*, 125(3): 1081-1102. DOI: [10.1378/chest.125.3.1081](https://doi.org/10.1378/chest.125.3.1081)
12. Kenyon, N., Zeki, A.A., Albertson, T.E., Louie, S. (2015) Definition of critical asthma syndromes. *Clinical Reviews in Allergy and Immunology*, 48(1): 1-6. DOI: [10.1007/s12016-013-8395-6](https://doi.org/10.1007/s12016-013-8395-6)
13. Rochwerg, B., Brochard, L., Elliott, M.W., Hess, D., Hill, N.S., Nava, S., et al. (2017) Official ERS/ATS clinical practice guidelines: noninvasive ventilation for acute respiratory failure. *European Respiratory Journal*, 50(2): 1602426. DOI: [10.1183/13993003.02426-2016](https://doi.org/10.1183/13993003.02426-2016)
14. Peters, J.I., Stupka, J.E., Singh, H., Rossrucker, J., Angel, L.F., Melo, J., et al. (2012) Status asthmaticus in the medical intensive care unit: a 30-year experience. *Respiratory Medicine*, 106(3): 344-348. DOI: [10.1016/j.rmed.2011.11.015](https://doi.org/10.1016/j.rmed.2011.11.015)
15. Randolph, A.G. (2006) Management of acute severe asthma. *Journal of Intensive Care Medicine*, 21(1): 24-31. DOI: [10.1177/0885066605283861](https://doi.org/10.1177/0885066605283861)
16. Stefan, M.S., Nathanson, B.H., Lagu, T., Priya, A., Pekow, P.S., Steingrub, J.S., et al. (2016) Outcomes of noninvasive and invasive ventilation in patients hospitalized with asthma exacerbation. *Annals of the American Thoracic Society*, 13(7): 1096-1104. DOI: [10.1513/AnnalsATS.201510-701OC](https://doi.org/10.1513/AnnalsATS.201510-701OC)
17. Pallin, M., Naughton, M.T. (2014) Noninvasive ventilation in acute asthma. *Journal of Critical Care*, 29(4): 586-593. DOI: [10.1016/j.jcrc.2014.03.011](https://doi.org/10.1016/j.jcrc.2014.03.011)
18. Fernandez, M.M., Villagra, A., Blanch, L., Fernandez, R. (2001) Non-invasive mechanical ventilation in status asthmaticus. *Intensive Care Medicine*, 27(3): 486-492. DOI: [10.1007/s001340000846](https://doi.org/10.1007/s001340000846)
19. Carroll, C.L., Schramm, C.M. (2006) Noninvasive positive pressure ventilation for the treatment of status asthmaticus in children. *Annals of Allergy, Asthma and Immunology*, 96(3): 454-459. DOI: [10.1016/S1081-1206\(10\)60916-0](https://doi.org/10.1016/S1081-1206(10)60916-0)
20. Basnet, S., Mander, G., Andoh, J., Klaska, H., Verhulst, S., Koirala, J. (2012) Safety, efficacy, and tolerability of early initiation of noninvasive positive pressure ventilation in pediatric patients admitted with status asthmaticus.



-
- Pediatric Critical Care Medicine, 13(4): 393-398. DOI: [10.1097/PCC.0b013e318238b07a](https://doi.org/10.1097/PCC.0b013e318238b07a)
21. Juniper, E.F., Guyatt, G.H., Epstein, R.S., Ferrie, P.J., Jaeschke, R., Hiller, T.K. (1992) Evaluation of impairment of health related quality of life in asthma: development of a questionnaire for use in clinical trials. *Thorax*, 47(2): 76-83. DOI: [10.1136/thx.47.2.76](https://doi.org/10.1136/thx.47.2.76)
 22. Juniper, E.F., Guyatt, G.H., Ferrie, P.J., Griffith, L.E. (1993) Measuring quality of life in asthma. *American Review of Respiratory Disease*, 147(4): 832-838. DOI: [10.1164/ajrccm/147.4.832](https://doi.org/10.1164/ajrccm/147.4.832)
 23. Juniper, E.F., Buist, A.S., Cox, F.M., Ferrie, P.J., King, D.R. (1999) Validation of a standardized version of the Asthma Quality of Life Questionnaire. *Chest*, 115(5): 1265-1270. DOI: [10.1378/chest.115.5.1265](https://doi.org/10.1378/chest.115.5.1265)
 24. Juniper, E.F., O'Byrne, P.M., Guyatt, G.H., Ferrie, P.J., King, D.R. (1999) Development and validation of a questionnaire to measure asthma control. *European Respiratory Journal*, 14(4): 902-907. DOI: [10.1034/j.1399-3003.1999.14d29.x](https://doi.org/10.1034/j.1399-3003.1999.14d29.x)
 25. Nathan, R.A., Sorkness, C.A., Kosinski, M., Schatz, M., Li, J.T., Marcus, P., et al. (2004) Development of the asthma control test: a survey for assessing asthma control. *Journal of Allergy and Clinical Immunology*, 113(1): 59-65. DOI: [10.1016/j.jaci.2003.09.008](https://doi.org/10.1016/j.jaci.2003.09.008)
 26. Global Initiative for Asthma (2023) Global Strategy for Asthma Management and Prevention. GINA Report.
 27. Chen, H., Gould, M.K., Blanc, P.D., Miller, D.P., Kamath, T.V., Lee, J.H., et al. (2007) Asthma control, severity, and quality of life: quantifying the effect of uncontrolled disease. *Journal of Allergy and Clinical Immunology*, 120(2): 396-402. DOI: [10.1016/j.jaci.2007.04.040](https://doi.org/10.1016/j.jaci.2007.04.040)
 28. Moy, M.L., Israel, E., Weiss, S.T., Juniper, E.F., Dube, L., Drazen, J.M. (2001) Clinical predictors of health-related quality of life depend on asthma severity. *American Journal of Respiratory and Critical Care Medicine*, 163(4): 924-929. DOI: [10.1164/ajrccm.163.4.2004128](https://doi.org/10.1164/ajrccm.163.4.2004128)
 29. Adams, R.J., Wilson, D.H., Taylor, A.W., Daly, A., Tursan d'Espaignet, E., Dal Grande, E., et al. (2004) Psychological factors and asthma quality of life: a population based study. *Thorax*, 59(11): 930-935. DOI: [10.1136/thx.2003.010256](https://doi.org/10.1136/thx.2003.010256)
 30. ten Brinke, A., Ouwerkerk, M.E., Zwinderman, A.H., Spinhoven, P., Bel, E.H. (2001) Psychopathology in patients with severe asthma is associated with increased health care utilization. *American Journal of Respiratory and Critical Care Medicine*, 163(5): 1093-1096. DOI: [10.1164/ajrccm.163.5.2004020](https://doi.org/10.1164/ajrccm.163.5.2004020)
 31. Girault, C., Briel, A., Benichou, J., Hellot, M.F., Dachraoui, F., Tamion, F., et al. (2009) Interface strategy during noninvasive positive pressure ventilation for hypercapnic acute respiratory failure. *Critical Care Medicine*, 37(1): 124-131. DOI: [10.1097/CCM.0b013e3181928706](https://doi.org/10.1097/CCM.0b013e3181928706)
 32. Carron, M., Freo, U., BaHammam, A.S., Dellweg, D., Guarracino, F., Cosentini, R., et al. (2013) Complications of non-invasive ventilation techniques: a comprehensive qualitative review of randomized trials. *British Journal of Anaesthesia*, 110(6): 896-914. DOI: [10.1093/bja/aet070](https://doi.org/10.1093/bja/aet070)