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REVIEW ARTICLE

Modes, settings, and the place where ventilation should be initiated

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Abstract

Home non-invasive ventilation (NIV) has evolved from a hospital-based supportive therapy into a sophisticated, technology-driven treatment with advanced monitoring, telemedicine, and automated ventilatory modes. Despite these advances, key controversies remain regarding optimal ventilatory mode selection, parameter personalization, and the best setting for NIV initiation. Pressure-targeted ventilation has become the predominant strategy because of its adaptability and leak compensation, although conventional volume-targeted ventilation remains a valid option in selected patients. Hybrid automated modes, including volume-assured pressure support and automatic EPAP systems, offer physiological advantages and modest benefits in comfort or adherence, but have not consistently demonstrated superiority over carefully optimized conventional NIV. Across disease phenotypes, clinical success depends less on mode selection than on individualized physiological titration of pressures, backup rate, triggering, and cycling. Finally, outpatient and home initiation supported by telemonitoring are increasingly feasible, supporting a more patient-centered and cost-effective model of NIV care.

Keywords: *Home non-invasive ventilation. Pressure support ventilation. Hybrid ventilatory modes. Auto-titrating ventilation. Telemedicine.*

Introduction

Home non-invasive ventilation (NIV) has demonstrated its effectiveness in the treatment of chronic respiratory failure and specific ventilatory disorders for more than three decades.[1-4] Since its early days, characterized by rudimentary, bulky devices and manually assembled interfaces, NIV technology has evolved considerably. Modern ventilators are now portable, sophisticated, and capable of functioning as advanced monitoring systems, providing detailed information on device usage and patient-ventilator interactions.

Ventilatory modes have also undergone substantial transformation. While volume-targeted modes predominated in the early implementation of home NIV, pressure-targeted modes have progressively become the standard of care.[5,6] More recently, the introduction of hybrid modes has further expanded the technical options available for prescribing ventilation.[7] In parallel, advances in telemonitoring capabilities have increased clinicians' confidence in initiating and adjusting NIV outside the hospital setting.[8] As a result, NIV initiation has progressively shifted from an exclusively inpatient procedure to one that can be safely performed in outpatient settings or even at the patient's home.

Despite these advances, several unresolved issues remain. Ongoing controversies include the comparative effectiveness of different ventilatory modes, the optimal personalization of settings according to underlying disease, and the appropriate setting for NIV initiation. In particular, the traditional hospital-based model must be weighed against ambulatory approaches, which

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are potentially more cost-effective but may offer less procedural control. This review aims to explore these controversies and provide an updated perspective on current practice.

Controversies in conventional modes: pressure versus volume

At the most fundamental level, mechanical ventilation can be understood according to the variable that governs gas delivery during inspiration, typically pressure or volume. In volume-targeted modes, the clinician prioritizes the delivery of a predefined tidal volume, which remains constant regardless of changes in patient effort or respiratory mechanics. This requires the setting of parameters such as tidal volume, respiratory rate, and inspiratory time (or flow), whereas airway pressures (the dependent variable) vary because of these settings. In addition to the drawback of the lack of adaptation of the tidal volume, since it is always preset, to the patient's effort, the main limitation of volume-controlled ventilation is the lack of compensation for unintentional leaks.[7]

In contrast, pressure-targeted modes are based on the delivery of a preset inspiratory pressure (independent variable), usually defined by the combination of inspiratory and expiratory pressure levels (IPAP and EPAP), with the resulting flow and tidal volume (dependent variables) changing according to lung mechanics and patient effort. Additional parameters, such as trigger sensitivity, cycling criteria, and rise time, play a central role in determining how the ventilator interacts with the patient in these modes, which are also able to compensate for leaks.[9]

Modern NIV is predominantly delivered using portable, turbine-driven ventilators designed to operate under low-pressure conditions (without the need for connection to an external high-pressure gas source). These devices have progressively incorporated advanced triggering, cycling, and monitoring capabilities.[10] However, the choice between pressure- and volume-based strategies remains a matter of debate, reflecting different priorities in terms of control, adaptability, and patient-ventilator interaction, as well as an important component of clinician preference and experience.

Early large-scale European survey data already highlighted substantial variability in home mechanical ventilation practices across countries, including marked differences in the use of pressure- versus volume-preset ventilators, largely reflecting local experience, historical availability, and healthcare system factors rather than uniform evidence-based criteria.[5]

More recent international survey data focused on restrictive disorders have confirmed that these variations persist in contemporary practice, but with a clear predominance of pressure-targeted modes (including hybrid modes with assured volume overnight).[6] Indeed, pressure support-based modes have largely replaced volume-controlled ventilation in routine clinical use, and current recommendations in both chronic obstructive pulmonary disease (COPD)[11] and obesity hypoventilation syndrome (OHS)[12] predominantly favor pressure-targeted strategies. However, at a clinical level, there is still no definitive evidence demonstrating the superiority of pressure-based modes over volume-targeted ventilation.

Consistent with this, randomized data in patients with chest-wall deformity showed no significant differences between volume- and pressure-targeted NIV in terms of time required to achieve effective ventilation or improvements in gas exchange, although some patients were unable to tolerate volume modes and switched successfully to pressure support, suggesting a role for patient preference in mode selection.[13] Similarly, a retrospective study in patients with amyotrophic lateral sclerosis (ALS) found that, although volume-targeted NIV was associated with greater ventilatory effectiveness, no significant differences in survival were observed compared with pressure-targeted NIV, highlighting the influence of factors such as bulbar dysfunction severity on overall outcomes.[14]

Therefore, despite the clear predominance of pressure-targeted ventilation in clinical practice, volume-targeted modes remain a valid option, with no evidence demonstrating their inferiority in clinically meaningful outcomes.

Automated and hybrid modes: progress or added complexity?

Automated and hybrid ventilatory modes are generally based on closed-loop control systems, in which the ventilator continuously adjusts one or more parameters in response to a measured, or more often estimated, physiological variable.[15] Among these, volume-assured pressure support (VAPS) limited modes represent the most widely implemented approach in home NIV. These modes aim to combine the advantages of pressure-targeted ventilation, such as leak compensation and improved patient-ventilator synchrony, with the assurance of a minimum level of ventilation, typically defined as a target tidal or alveolar volume. In practice, this is achieved through breath-by-breath adjustments of pressure support within predefined limits (IPAP_min and IPAP_max), allowing adaptation to

changes in respiratory mechanics, patient effort, or leak conditions.[7]

A key limitation of these systems is that the target variable, usually tidal volume, is not directly measured but estimated, particularly in single-limb circuits. This estimation relies on leak calculation algorithms that extrapolate values from specific points in the respiratory cycle, typically during transitions where patient flow is assumed to be zero.[16] In the presence of asymmetric or non-linear leaks, this approach may lead to inaccuracies and inappropriate pressure adjustments.[17,18] Different proprietary algorithms have been developed to address these challenges. Average VAPS targets a predefined tidal volume through gradual pressure adjustments, whereas intelligent VAPS aims to maintain alveolar ventilation by incorporating estimates of dead space and adapting the backup respiratory rate (BURR).

More advanced hybrid modes also incorporate automated titration of expiratory pressure (auto-EPAP), primarily to maintain upper airway patency. These systems rely on different detection strategies, such as forced oscillation techniques or flow-based analyses, to identify obstructive events and adjust EPAP within preset limits. However, their performance may be affected by factors such as detection timing, the presence of leaks, and the inability to distinguish between different types or levels of airway obstruction, particularly in cases without respiratory effort or in those not responsive to EPAP increases, for example, anatomic obstruction in the upper airway.

From a physiological standpoint, the rationale for automated modes lies in their ability to address dynamic respiratory disturbances that are difficult to manage with fixed settings. VAPS systems are primarily intended to correct hypoventilation by maintaining stable ventilation despite variability in respiratory mechanics, sleep stage, or patient effort, an approach particularly relevant in conditions such as OHS or neuromuscular disease. In contrast, auto-EPAP systems target upper airway obstruction, functioning similarly to automatic CPAP devices. Their combination is especially attractive in patients with overlapping disorders, although variability in algorithm performance may influence their effectiveness across clinical scenarios.

Importantly, these modes do not operate as fully autonomous systems. Their performance depends heavily on appropriate initial parameterization, including pressure limits, and on the clinical context in which they are applied. Inadequate settings may lead to insufficient correction of hypoventilation or inappropriate pressure responses to misclassified events. Moreover, variability between algorithms underscores the need to understand device-specific behavior.

From a clinical perspective, automated modes may be particularly useful in patients who remain inadequately controlled under fixed pressure support or in those with conditions that benefit from dynamic adjustment. However, current evidence does not support their indiscriminate use. Rather than “set-and-forget” solutions, these modes should be considered advanced tools that require careful selection, appropriate configuration, and ongoing monitoring, often including complementary measures such as transcutaneous CO_2 assessment. This aspect is particularly important, as abrupt ventilator-driven adjustments in pressure support may produce rapid changes in $PaCO_2$, which in susceptible patients could alter central respiratory drive and contribute to breathing instability or the emergence of central respiratory events.

Clinical studies comparing hybrid automated modes have generally shown modest and inconsistent benefits over conventional pressure support ventilation. Most randomized studies and meta-analyses have failed to demonstrate significant improvements in gas exchange, sleep quality, or clinical outcomes compared with standard pressure support ventilation.

Nevertheless, most study designs have focused on broad comparisons between hybrid automated modes and conventional pressure support ventilation, rather than specifically evaluating whether hybrid modes provide additional benefit in patients who remain inadequately controlled with standard fixed-pressure settings. This “head-to-head” approach has often included patients who were already well managed under conventional ventilation, making it inherently more difficult to demonstrate the superiority of hybrid strategies.

Table 1 summarizes the principal comparative studies evaluating VAPS ventilatory modes against conventional pressure support ventilation, with particular emphasis on the parameterization of conventional arms. This aspect is critical for interpretation, as in many studies the comparator consisted of well-optimized conventional NIV, often using relatively high inspiratory pressures, preset backup rates, and careful physiological titration, thereby limiting the opportunity for hybrid modes to demonstrate additional benefit. Conversely, studies comparing automated modes against less intensively configured conventional ventilation may overestimate their apparent advantage.[19-26]

A similar comparison (Table 2) was performed for studies evaluating automatic EPAP modes. Most reported only modest benefits, mainly related to comfort, adherence, or cost-effectiveness, while maintaining comparable physiological outcomes. Importantly, in

Table 1. Comparative studies in VAPS systems

Authors	Population	Hybrid mode	Conventional NIV parameterization	Main findings	Interpretation
Jaye et al., 2009[19]	NMD/CWD, experienced NIV users	AVAPS	Conventional NIV previously optimized	Similar nocturnal SpO_2	Comparator already stable/optimized
Oscroft et al., 2010[20]	COPD, experienced NIV users	iVAPS	Mean IPAP 30 ± 5, EPAP 4 ± 2 cmH_2O	Similar $PaCO_2$/$TcCO_2$/ SpO_2	Very aggressive PSV comparator. Max IPAP in iVAPS 25 cm H_2O
Kelly et al., 2014[21]	Mixed etiology, NIV-naïve	iVAPS	Conventional PSV individualized	Similar gas exchange. Lower pressures in iVAPS	Small sample size. PSV with low pressures
Oscroft et al., 2014[22]	Stable COPD	iVAPS	Median IPAP 28, EPAP 5, backup RR 15/min	Similar $PaCO_2$, $TcCO_2$, QoL	High-intensity NIV comparator (IPAP 28 cm H_2O)
Ekkernkamp et al., 2014[23]	COPD	iVAPS	Conventional PSV carefully titrated	Similar adherence. Better sleep quality with iVAPS	High intensity NIV comparator
Nilius et al., 2017[25]	COPD	iVAPS	Comparator PSV (single night)	Similar $TcCO_2$/PSG higher pressures in iVAPS	Single night study under PSG
Murphy et al. 2012[26]	OHS	AVAPS	Carefully titrated NIV	Comparable gas exchange	Optimized NIV in comparator
Magdy et al.[24]	COPD	AVAPS	Standard PSV	AVAPS improvement in SF12, walking distance and CO_2 reduction	Standard PSV suboptimally titrated (IPAP12 -EPAP 4-8)

AVAPS: average volume assured pressure support; iVAPS: intelligent volume assured pressure support; NIV: non-invasive ventilation; PSV: pressure support ventilation; COPD: chronic obstructive pulmonary disease; OHS: obesity hypoventilation syndrome; NMD: neuromuscular disease; CWD: chest-wall disease; PSG: polysomnography; $TcCO_2$: transcutaneous CO_2; SF12: 12-Item Short-Form Health Survey; QoL: quality of life.

many of these studies, the conventional NIV arms were already well optimized, leaving little room for additional improvement through automatic EPAP adjustment. This methodological context should be considered when interpreting the incremental value of automation in ventilatory support.[27-31]

Taken together, the available evidence suggests that the clinical value of hybrid automated ventilation is likely to depend less on superiority over well-configured conventional NIV and more on its ability to achieve adequate control in patients who remain difficult to optimize using fixed-pressure strategies. Future comparative studies should therefore focus not only on mode selection, but also on defining the quality and intensity of conventional NIV parameterization used as the reference standard.

Personalizing ventilator settings: adapting the device to the patient, not the patient to the device

Regardless of the selected ventilatory mode, effective NIV depends on the appropriate adjustment of multiple parameters that determine breath delivery and patient-ventilator interaction. This process is often challenging in home NIV, where variability in patient condition and interface-related factors is the rule rather than the exception. As discussed above, in volume-targeted modes, clinicians prescribe variables such as tidal volume, respiratory rate, and inspiratory time, ensuring consistent ventilation delivery. However, this approach is limited by its inability to compensate for leaks or adapt dynamically to changes in patient demand. By contrast, pressure-targeted modes, the current standard in home NIV, offer greater adaptability, with tidal volume becoming a dependent variable influenced by pressure support, respiratory mechanics, and patient effort. This flexibility, however, requires careful adjustment of multiple settings, including inspiratory and expiratory pressure (IPAP and EPAP), BURR, trigger sensitivity, cycling criteria, and pressurization dynamics (rise time).

Among these, trigger sensitivity and cycling to expiration are particularly critical determinants of patient-ventilator synchrony.[32] Modern ventilators rely predominantly on flow-based triggering systems, often

Table 2. Comparative studies in auto-EPAP systems

Authors	Population	Hybrid mode	Conventional NIV parameterization	Main findings	Interpretation
Murphy et al.[27]	COPD + OSA	PSV versus AVAPS-AE	EPAP 8 ± 4 cmH_2O and PS 18 in PSV mode	Non-inferiority of automatic EPAP	High EPAP and PS in PSV mode
Patout et al.[28]	OHS	AVAPS-AE versus PSV	IPAP 21, EPAP 9.8 cmH_2O in PSV mode	Similar sleep quality and gas exchange after 2 months	High EPAP and PS in PSV mode
Orr[30]	Mixed population with AHI > 5. Single night	iVAPS + Auto-EPAP versus iVAPS	EPAP 7.6 (3.5) cmH_2O in iVAPS mode	Non-inferiority of Auto-EPAP mode	Single night study
Magdy et al.[31]	Stable COPD. 5 nights. Residual AHI was not assessed	iVAPS + Auto-EPAP versus iVAPS	17.3 ± 7.8 cmH_2O in iVAPS mode	Better comfort in Auto-EPAP. Higher CO_2 decrease in Auto-EPAP	Lower mean EPAP in Auto-EPAP mode. Higher TV in auto-EPAP mode (increased PS)
Sanchez-Quiroga et al.[29]	Naïve OHS patients	AVAPS-AE versus PSV	Manual PSG-based titration in PSV. IPAP 19.4, EPAP 9.2 cm H_2O	Non inferiority. Cost-effectiveness of automatic mode	Well-titrated PSV in non-automatic mode

AVAPS: average volume assured pressure support; iVAPS: intelligent volume assured pressure support; NIV: non-invasive ventilation; PSV: pressure support ventilation; COPD: chronic obstructive pulmonary disease; OHS: obesity hypoventilation syndrome; PSG: polysomnography. AHI: apnea-hypopnea index; AE: automatic EPAP.

combined with automatic leak-compensation algorithms, which dynamically modify sensitivity thresholds. While these systems improve adaptability, they may also introduce unintended effects, such as auto-triggering or ineffective efforts, especially in the presence of fluctuating leaks. Similarly, cycling criteria, typically based on a percentage of peak inspiratory flow in pressure support modes, must be tailored to the patient's respiratory mechanics, with shorter inspiratory times generally preferred in obstructive patterns and longer ones in restrictive conditions.[33,34]

Pressurization dynamics represent another key aspect of personalization. The rise time, traditionally considered a fixed temporal parameter, is now understood to depend on complex interactions between ventilator algorithms, patient effort, and system leaks, ultimately determining the degree of inspiratory muscle unloading.[35] Additional safety parameters, such as minimum and maximum inspiratory times, further influence breath delivery, particularly under conditions of significant leak or asynchrony.

Taken together, these elements highlight that ventilator settings are not a static prescription but a dynamic process requiring continuous adjustment. The same nominal settings may result in markedly different physiological effects depending on the device, the interface, and the patient's condition. Consequently, optimal NIV requires a shift from a device-centered approach to a patient-centered strategy, in which settings are individualized based on careful assessment of patient-ventilator interaction, rather than forcing the patient to adapt to predefined ventilatory patterns.

How this personalized approach is implemented varies substantially across disease phenotypes, as the mechanisms leading to nocturnal hypoventilation differ between obstructive, restrictive, and neuromuscular disorders.

This concept is particularly relevant in COPD, where combinations of ventilatory parameters have been extensively studied. Over recent years, evidence has supported the use of high-intensity NIV strategies, characterized by relatively high pressure support levels aimed at reducing $PaCO_2$ by at least 20% in hypercapnic COPD patients.[36,37] This approach has often been combined with the prescription of BURRs above the patient's spontaneous breathing frequency. However, it has been suggested that the reduction in $PaCO_2$ is primarily driven by the level of pressure support itself rather than by the backup rate.[38] This strategy has also been endorsed by the European Respiratory Society (ERS) task force.[11]

Despite its physiological rationale, high-intensity ventilation is not without drawbacks. Although reducing $PaCO_2$ is a logical target in nocturnal hypoventilation, high pressure levels may have hemodynamic consequences,[39] impair sleep quality,[40] and increase unintentional leaks.[36] From a physiological perspective, excessive pressure support may also worsen air trapping through two main mechanisms: insufficient expiratory time for adequate emptying of an increased tidal volume in obstructed airways with slow time constants, and abrupt pressure transitions between inspiration and expiration, which may increase dynamic

airway compression and exacerbate expiratory flow limitation.[41]

Finally, the existence of substantial technical differences between ventilators must be emphasized. As shown by Lalmolda et al., in a bench-to-bedside model, different ventilator platforms generate significantly different pressurization profiles under identical settings, and these differences translate into variable degrees of inspiratory muscle unloading in patients with COPD.[35] This raises an important conceptual question: whether a 20% reduction in $PaCO_2$ must necessarily be achieved through high-pressure support, or whether careful titration of EPAP, aimed at counterbalancing intrinsic PEEP and mitigating expiratory flow limitation, could achieve comparable physiological effects in selected patients.

An additional approach to ventilator parameter optimization in patients with COPD has been based on sleep studies, including polysomnography and respiratory polygraphy. Adler and colleagues demonstrated that a titration strategy guided by polysomnography can be particularly beneficial in patients with severe COPD and ventilator-induced dyspnea (so-called "deventilation syndrome"). This approach was associated not only with clinical improvement, such as a reduction in morning dyspnea after discontinuation of nocturnal ventilation, but also with a decrease in patient-ventilator asynchrony, as reflected by a lower asynchrony index. The main adjustments in this protocol concerned an increase in EPAP (by approximately 1 cmH_2O on average) and a limitation of the maximum inspiratory time, reinforcing the concept that excessively prolonged inspiratory times may be detrimental in patients with severe airflow obstruction.[42]

In OHS, the BURR appears to play a relevant role in the stability of nocturnal ventilation. A polysomnographic study comparing different BURR settings[43] showed that switching from spontaneous/timed modes to spontaneous mode increased respiratory events, mainly central and mixed, and worsened oxygen desaturation. In contrast, transcutaneous CO_2 control remained similar across settings, suggesting limited impact on overall ventilatory efficacy. A low BURR was associated with slightly better perceived sleep quality and fewer arousals than a high BURR.

In addition, ventilatory settings in OHS are strongly influenced by the underlying pathophysiology, characterized by reduced lung compliance and a restrictive ventilatory pattern, which typically requires higher levels of pressure support than in other conditions.[44] Given the high prevalence of obstructive sleep apnea in this population, adequate EPAP levels are also essential to counteract upper airway collapse.[45] In patients already treated with positive airway pressure, an EPAP set approximately 2 cmH_2O below previously used therapeutic pressures has been shown to provide comparable ventilatory effectiveness, highlighting the importance of individualized titration of both inspiratory and expiratory pressures.[46]

In patients with neuromuscular diseases, particularly ALS, the presence of leaks and, more importantly, unresolved upper airway obstruction has been identified as a marker of worse prognosis.[47] Several strategies may contribute to the resolution of residual obstructive events. Some are interface-related, such as switching to a nasal mask when upper airway obstruction is induced or exacerbated by the oronasal interface.[48] Others involve a more refined titration of EPAP, aimed at stenting the upper airway and improving patency. In selected cases, this titration can even be guided by respiratory endoscopy, allowing direct visualization of the anatomical level of obstruction and a more targeted adjustment of ventilatory settings.[49]

Ultimately, successful NIV is not about applying predefined settings, but about adapting ventilatory support to the individual patient to restore more physiological breathing.

Where should NIV be initiated? Revisiting the hospital-centered model

NIV has traditionally been started in the hospital, where patients can be closely monitored, and ventilator settings can be quickly adjusted if needed. This hospital-based approach is especially useful in acute situations or in complex cases. However, with growing experience in chronic NIV and better technology, it is increasingly clear that not all patients need to start treatment in the hospital. In stable patients, NIV can often be initiated safely in outpatient settings or even at home with proper follow-up. This has led to a rethinking of the traditional model, trying to find the right balance between safety, effectiveness, and patient comfort.

In any case, the choice of where to start NIV should be individualized, considering patient preferences, the underlying disease and its clinical stability, as well as practical factors such as geographical distance to the nearest healthcare center and the level of experience and available resources (both technological and human) at the prescribing institution.

The first observational studies exploring outpatient NIV initiation emerged in the early 2000s, suggesting that adaptation outside the conventional inpatient setting was not inferior to hospital-based initiation.[50] This shift was driven both by increasing pressure on hospital ward capacity and by the recognition that the daily time required for ventilator adaptation often did not

justify hospital admission, with the associated increase in healthcare costs. Subsequent randomized controlled studies confirmed the non-inferiority of ambulatory initiation, although in most protocols, patients were still required to attend the hospital on several occasions over a variable number of days for ventilator adjustment and monitoring.[51,52] The marked increase in the prevalence of home NIV use over the last two decades has further accelerated this transition toward extra-hospital models of care.

Indeed, outpatient initiation has become the predominant model in many randomized studies, particularly in COPD, including landmark trials.[53,54] It should be acknowledged, however, that in some of these studies, the use of high-intensity ventilation strategies still required access to hospital-based resources to achieve full adaptation.[54]

The next logical step was home initiation of NIV, a model that aligns closely with patient preferences, especially in populations with severe mobility limitations or substantial difficulties traveling to healthcare facilities for elective care. The COVID-19 pandemic further reinforced the appropriateness of home-based models by accelerating the implementation of remote care strategies. In patients with COPD, home initiation has been shown to be as effective as hospital-based initiation while offering significant cost savings.[8] Although some authors have proposed continuation of hospitalization to facilitate NIV adaptation in patients with persistent post-exacerbation hypercapnia,[55] evidence showing spontaneous normalization of $PaCO_2$ within 2–4 weeks after acute hypercapnic exacerbations in a substantial proportion of patients has shifted clinical practice toward a home-centered adaptation strategy.[56]

In OHS, the introduction of hybrid modes with automatic adjustment has also driven the remote adaptation of patients to ventilation.[29] Even when accounting for the costs of home visits and community support, home initiation generally remains economically more favorable.[57]

Home initiation is increasingly linked to the concept of telemonitoring. Advances in data transmission technologies now allow ventilators not only to deliver therapy and store physiological data, but also to transmit these data remotely in near real time. Although evidence remains limited, current ERS practical guidance suggests telemonitoring during therapy initiation in patients with neuromuscular disorders, restrictive thoracic diseases, and COPD, while evidence remains insufficient to support specific recommendations in OHS or during long-term follow-up. From the patient and caregiver perspective, telemonitoring offers several advantages, including earlier detection of problems, faster clinical intervention, reduced travel burden, improved access to specialist care, and greater reassurance through continuous connection with the healthcare team. Potential drawbacks include reduced face-to-face interaction, anxiety related to device management, concerns about whether transmitted data are being adequately reviewed, and the possibility of shifting additional responsibility onto patients and caregivers.[58] Overall, when integrated into structured care pathways, telemonitoring appears to strengthen the feasibility and safety of home-based NIV initiation.

Conclusion

Home NIV has evolved far beyond its original conception as a hospital-based therapy delivered through simple, predefined ventilatory patterns. Advances in ventilator technology, monitoring capabilities, and remote data transmission have expanded the range of available modes and settings, while also enabling care pathways that increasingly extend beyond the hospital walls. Yet, despite this technological progress, several fundamental principles remain unchanged.

First, no single ventilatory mode has demonstrated clear universal superiority. Pressure-targeted ventilation has become the predominant strategy in clinical practice because of its adaptability and leak compensation, but conventional volume-targeted ventilation remains a valid option in selected patients. Likewise, hybrid automated modes should not be viewed as intrinsically superior alternatives, but rather as additional tools whose value depends on appropriate patient selection, careful parameterization, and adequate monitoring.

Second, successful NIV depends less on the choice of mode itself than on how ventilation is individualized. The optimization of inspiratory and expiratory pressures, BURR, triggering, cycling, and pressurization dynamics must be guided by the underlying pathophysiology and by close assessment of patient-ventilator interaction. In this regard, personalization, not automation, remains the cornerstone of effective home NIV.

Finally, the initiation of NIV is progressively shifting from a hospital-centered model toward outpatient and home-based approaches supported by telemonitoring. This transition appears safe, effective, and cost-efficient in appropriately selected patients, but it should not be interpreted as a universal replacement for hospital initiation. Rather, the optimal setting for NIV initiation, like the optimal ventilatory strategy itself, should be tailored to the individual patient, the disease context, and the expertise and resources available.

Ultimately, the future of home NIV will likely depend less on increasingly complex devices than on our ability to integrate technology into individualized, physiology-driven, and patient-centered models of care.

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Conflicts of interest

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Protection of human subjects and animals. The authors declare that no experiments on humans or animals were performed for this research.

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Declaration on the use of artificial intelligence. The authors declare that AI was used for the creation of the figures.

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