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REVIEW ARTICLE

Update of the taxonomy of mechanical ventilation modes

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Abstract The rapid technological development of mechanical ventilation has resulted in increasingly complex modes, advanced monitoring capabilities and the incorporation of artificial intelligence. However, manufacturers have created a multitude of trade names, which has generated a great deal of confusion in their understanding, handling and application. This problem is exacerbated in Spanish-speaking countries due to inconsistencies in translations and variability in nomenclature between regions. This manuscript aims to provide an updated review of the taxonomic classification of ventilatory modes in order to promote standardization of terminology, especially in the Spanish-speaking clinical context, and includes changes in the taxonomy and manner of labeling modes of mechanical ventilation. This review focuses on invasive mechanical ventilation of the adult critically ill patient, although the taxonomy is also applicable to all ventilation modalities, including noninvasive, high-frequency, pediatric, and even home ventilation.

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PALABRAS CLAVE
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Modos ventilatorios;
Ventilación mecánica

Actualización de la taxonomía de los modos de ventilación mecánica

Resumen El rápido desarrollo tecnológico de la ventilación mecánica ha dado lugar a modos cada vez más complejos, capacidades avanzadas de monitoreo y la incorporación de inteligencia artificial. Sin embargo, los fabricantes han creado una multitud de nombres comerciales, lo que ha generado una gran confusión en su comprensión, manejo y aplicación. Este problema se agrava en los países de habla hispana debido a las inconsistencias en las traducciones y la variabilidad de la nomenclatura entre regiones. Este manuscrito tiene como objetivo proporcionar una revisión actualizada de la clasificación taxonómica de los modos ventilatorios con el fin de promover la estandarización de la terminología, especialmente en el contexto clínico de habla hispana, e incluye cambios en la taxonomía y la manera de etiquetar modos de ventilación mecánica. Esta revisión se centra en la ventilación mecánica invasiva del paciente crítico adulto, aunque la taxonomía también es aplicable a todas las modalidades de ventilación, incluyendo la ventilación no invasiva, de alta frecuencia, pediátrica e incluso domiciliaria.

Introduction

Mechanical ventilation has undergone significant technological development,[1] including improved valves, controllers and software. These developments have given rise to complex ventilation modes, advanced monitoring and even the incorporation of artificial intelligence into these systems.[2] However, manufacturers have named the different ventilatory modes rather arbitrarily, resulting in a myriad of commercial names.[3] One of the main barriers is the industry's lack of motivation to use a ventilation mode taxonomy, which poses a practical challenge for end users. This has created widespread chaos in understanding, managing and applying ventilatory modes – a situation that is further complicated in Spanish-speaking countries. It is common to find ventilation modes with translated names, which adds variability and makes interpreting the literature difficult. Furthermore, the nomenclature varies even among countries. To illustrate the problem, in pharmacology, this would be equivalent to the nonexistence of generic names and the exclusive use of trade names. Using arbitrary names such as "volume-controlled assisted ventilation", "AC/VC" or "PCV" calls into question the comparability of data from mechanical ventilation studies carried out using different ventilators.

In 1992, Chatburn[4] proposed the basis for a taxonomy (classification) of ventilation modes. Although the transition to using this taxonomy has been slow, it is now present in most texts on mechanical ventilation.[5] Nevertheless, there are barriers to the use of taxonomy in routine practice. The first is that there is no pressure on clinicians or the industry to change their practices, due to the absence of a regulatory body requiring the correct use of terms, as national bodies do with drug names.[6]

In this context, the need for taxonomy arises from the desire to standardize the technical language used in clinical settings to describe different ventilatory modes. This standardization facilitates communication between the different professionals caring for critically ill patients who require ventilatory support. Moreover, taxonomy is necessary to ensure consistency across databases and in clinical research. Considering the evolution of artificial intelligence, it will be essential for the clinical databases that feed them to include the operational standardization of the existing methods, nomenclatures and classifications.

Although there are other ways to classify modes of mechanical ventilation,[7] they have outdated historical legacies and are not adapted to emerging technology. They are also difficult to implement and teach. The present review provides an update on the current taxonomy of ventilatory modes, aiming to promote standardization of terminology in Spanish based on etymology, physiology, engineering and the official dictionaries. This update incorporates changes in taxonomy and labeling of ventilatory modes published in the last decade. The Spanish translation was created using the same principles to ensure coherence and alignment with the etymological, physiological, engineering and lexicographical bases.

Taxonomy of ventilation modes

A mechanical ventilation mode is a predetermined ventilatory pattern that represents the interaction between the patient and the ventilator.[8] There are 624 trade names for these modes, corresponding to 74 different mechanical ventilators.[9] There is a consensus on the need for a classification system (taxonomy) to optimize understanding of the plethora of ventilation modes.

Usually, a taxonomic definition is based on fundamental principles (technical, scientific and physiological) using terms and definitions that follow certain predetermined rules and meanings.[10] The different taxonomies should allow for the classification of all current and future ventilation modes.

The taxonomy of ventilation modes is based on respiratory system motion equations, uses standardized definitions,

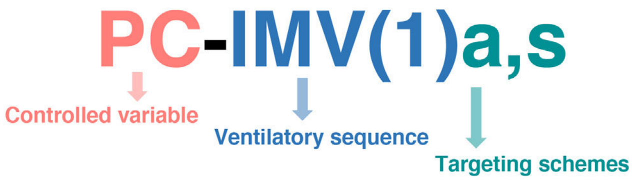

Figure 1 Components of the different ventilation modes *(Taxonomic Attribute Grouping)*.

and is based on engineering principles.[11] Based on these concepts, a series of principles or rules were generated to help maintain consistency in the classification process.[12] In addition to establishing regulations, these principles provide definitions that allow for the classification of ventilatory modes, thereby minimizing inconsistencies in future classifications. All ten principles have been published and peer-reviewed. These principles argue and build on each other to define the essential parts of a mechanical ventilation mode. These principles are:

1 A single ventilatory cycle is defined by the flow-time curve of an inspiratory cycle (positive flow) and an expiratory cycle (negative flow).
2 Assisted ventilation occurs when the mechanical ventilator performs some or all of the ventilatory work.
3 According to the equation of motion, a mechanical ventilator can only control one side of the equation, either pressure (PC) or volume (VC), at a single point in time.
4 Ventilation is classified according to the criteria of inspiration triggering and cycling.
5 Triggering and cycling can be initiated by the patient or by the ventilator.
6 Based on triggering and cycling, a ventilatory cycle is classified as either spontaneous or mandatory. Spontaneous ventilations are those in which the triggering and cycling are determined by signals from the patient's muscle effort (muscle pressure [Pmus]) or signals from the respiratory system (flow). Mandatory ventilations, in turn, are those in which inspiration is triggered or cycled (or both) by the ventilator.
7 A ventilatory sequence (Fig. 1) is a particular pattern of spontaneous and/or mandatory ventilations. There are three types of ventilatory sequences:
   a) *Continuous mandatory ventilation* (CMV).
   b) *Intermittent mandatory ventilation* (IMV). There are 5 types of IMV, which are described further below.
   c) *Continuous spontaneous ventilation* (CSV).
8 The combination of the control variable and the ventilatory sequence, in turn, generates 5 basic patterns:
   a) VC-CMV: continuous mandatory ventilation with volume control.
   b) VC-IMV: intermittent mandatory ventilation with volume control.
   c) PC-CMV: continuous mandatory ventilation with pressure control.
   d) PC-IMV: intermittent mandatory ventilation with pressure control.
   e) PC-CSV: continuous spontaneous ventilation with pressure control.
9 There are different types of target control schemes for each ventilatory pattern. A targeting scheme is the predetermined way in which the ventilator interacts with the patient. One way to understand this is to think of the targeting scheme as the type of program *(software)* that contains the instructions for patient-ventilator interaction. Seven types have been described to date:
   a) Set point (s).
   b) Dual (d).
   c) Biovariable (b).
   d) Servo (r).
   e) Adaptive (a).
   f) Optimal (o).
   g) Intelligent (i).
10 A mechanical ventilation mode is classified according to the control variable, the ventilatory sequence and the targeting scheme.

In sum, from the 10 principles, we conclude that each ventilation mode has three components: 1) the control variable, 2) the ventilatory sequence, and 3) the targeting scheme. These three variables are abbreviated and grouped by taxonomic attributes: *Taxonomic Attribute Grouping* (TAG).[13] The Anglo-Saxon abbreviations have been maintained to promote consistency in scientific publications, databases and medical records.

The glossary of terms included in Appendix B, Annex 1, was developed to standardize the nomenclature in Spanish. It was developed based on official dictionaries, physiological and engineering principles applied to mechanical ventilation, as well as on the review by authors, who provide a broad perspective from different Spanish-speaking regions. This review was conducted to reach a consensus. While it does not represent the official position of any organization, this glossary will improve understanding of the current literature and may contribute to the unification of terminology in the field in the future.

Taxonomy application

The taxonomy can be used to classify all modes of mechanical ventilation, including those of noninvasive, portable and high-frequency ventilators. There are multiple ventilator trade names worldwide, and new versions with different modes are constantly emerging. Many of these new versions have not yet been classified, and only a few are mentioned in this review. Our objective is to explain how to apply the taxonomy and detail its recent changes, rather than perform an exhaustive review of all the modes described thus far. To illustrate its application, we present examples that highlight its usefulness in classifying the different components of a ventilation mode. We focus on the clinical plausibility and technical characteristics.

Control variable

We will start by examining the taxonomy of one of the most frequently used ventilatory modes worldwide, called "volume control".[14] This example illustrates the variety of trade names that exist for the same ventilation mode, and highlights the importance of taxonomy in revealing that, in many cases, the ventilation mode we believe to be volume-controlled is not (Table 1).

Table 1 Differences between *Taxonomic Attribute Grouping* (TAG) and volume-control ventilation trade names.

Ventilator	Trade name	TAG
Maquet Servo U	Volume Control	VC-CMVs
	Volume Control + Flow adaptation	VC-IMV(4)d,d
Dräger V800	Continuous Mandatory Ventilation	VC-CMVs
	Continuous Mandatory Ventilation + Autoflow	PC-CMVa
	Continuous Mandatory Ventilation + ATC	VC-CMVsr
	Continuous Mandatory Ventilation + Pressure Limit	VC-CMVd
	Continuous Mandatory Ventilation + Autoflow + ATC	PC-CMVar
Hamilton C6	(s)CMV	VC-CMVs
Vyaire Bellavista 1000	Volume Controlled Ventilation	VC-IMV(1)d,d
	Volume Controlled Ventilation + TC	VC-IMV(1)d,sr
	Volume A/C	VC-CMVd
	Volume A/C + TC	VC-CMVdr
Vyaire Avea-CVS	Volume A/C	VC-CMVs
	Volume A/C + demand flow	VC-IMV(4)d,d
	Volume A/C + Vsync	PC-CMVa
	Volume A/C + Vsync + Flow Cycle	PC-IMV(4)a,s
	Volume A/C + Vsync + Flow Cycle + Artificial Airway Compensation	PC-IMV(4)ar,sr
GE Carescape r860	AC Volume Control	VC-CMVd[Pmus]
	A/C Volume Control + Pressure Limit	VC-CMVd[PLimit]
Medtronic PB980	A/C VC	VC-CMVs

TAG: VC-CMVs

–Control variable: volume (VC)

- According to the equation of motion, this means that both tidal volume and inspiratory flow are preset.

–Ventilatory sequence: CMV

- All ventilatory cycles are mandatory. Mandatory ventilation is when the ventilator controls triggering or cycling. There are three possibilities: triggering and cycling by the ventilator; triggering by the patient and cycling by the ventilator; or triggering by the ventilator and cycling by the patient.

–Targeting scheme: set point (s)

- The fixed point is the most basic targeting scheme. The operator programs the ventilation parameters (tidal volume, inspiratory flow, inspiratory time and minimum respiratory rate).[15]

When volume-control ventilation is not exactly what we think it is

The use of non-specific trade names, such as "volume-controlled assisted ventilation", "AC/VC" or "asysto-controlled", has become widespread and normalized, even outside of the Intensive Care Unit (ICU). For example, we have analyzed four mechanical ventilators and chose the ventilation mode colloquially called "volume control". Table 1 shows a variety of trade names. These names change not only between ventilators of different brands but also between ventilators of the same brand, and even more so when translated into Spanish. Thus, it is evident that some mechanical ventilators have many varieties of volume control, which occur when options on the control panel are activated. Notably, not all ventilators are VC-CMVs. In fact, the TAG changes with the activation of options, so volume is not always controlled. Some of these options lack sufficient clinical evidence. However, the important point to emphasize is:

a The name of the mode does not change on the screen, even though the mode's classification changes and interaction with the patient is significantly altered.
b Not all modes that we interpret as "volume control" allow for a predetermined tidal volume and flow. In fact, some ventilators do not have the mode classically known as "volume control" (VC-CMVs).
c In a hypothetical case where it is planned to perform a clinical study or establish a ventilation protocol in different centers or with different ventilation platforms, these differences could produce heterogeneous results.

Ambiguous names: volume control with pressure regulation

Next, we will explore another situation in which the control variable is confusing: the so-called *pressure-regulated volume control* (PRVC) mode. This mode is found under various trade names. Since the name includes ''VC'' and we program a tidal volume, it is common to assume that the controlled variable is volume. We will now use the taxonomy to understand this mode.

Trade name: CMV + Autoflow (Dräger V800), PRVC (Maquet Servo U), VC+ (PB 840), APVcmv or (s)CMV+ (Hamilton G6), A/C Pressure Regulated Volume Control (Carestation GE).

TAG: PC-CMVa

–Control variable: pressure (PC)

- Pressure control means that: 1) inspiratory pressure is preset (either the full waveform or just the target pressure), or 2) inspiratory pressure is automatically

Table 2 Types, descriptions and trade names of intermittent mandatory ventilation.

Type	Description	Trade names
IMV(1)	Operator-programmed fixed mandatory ventilations	*SIMV*, PB 980
IMV(2)	Spontaneous ventilations suppress mandatory ventilations if they occur more frequently	ST in *BiPAP*, Vision *Automode*, Servo
IMV(3)	Spontaneous ventilations suppress mandatory ventilations only if they exceed a target minute ventilation	*MMV*, Evita
IMV(4)	If inspiratory effort is sufficient, mandatory ventilations become spontaneous during the same inspiration	*Volume Control + Flow adaptation*, Servo
IMV(5)	If spontaneous ventilations are very short, they become mandatory ventilations during the same inspiration	A/C with Flow cycle, Avea

adjusted to be proportional to inspiratory effort (Pmus). Patient variables (resistance, compliance and muscular effort) will determine inspiratory flow and tidal volume.

−Ventilatory sequence: CMV

- All ventilatory cycles are mandatory. Inspiration can be triggered by the mechanical ventilator or by the patient, but is always cycled by the ventilator, since the inspiratory time is programmed by the operator.

−Targeting scheme: adaptive

- This scheme adapts a function to achieve a target. In this case, the operator programs the ventilator to achieve a target tidal volume, and the inspiratory pressure automatically adjusts to reach that target on average, based on a preprogrammed algorithm, as resistance, compliance and patient effort change. If the patient receives a tidal volume lower than the target, the adaptive targeting scheme will increase the inspiratory pressure during the next ventilation cycle. Conversely, if the tidal volume exceeds the target, the inspiratory pressure will automatically decrease. If the patient achieves the target tidal volume, the pressure remains stable.[16] In other words, the target tidal volume is an average value, so it can vary between ventilations,[17] unlike in the VC-CMVs mode, where the target tidal volume is constant in each ventilation.

This is probably the best example of the problem with using commercial nomenclature for ventilation modes. As can be seen, the trade names denote volume control in some way, which often creates confusion for the clinicians since they are usually thought to be modes in which volume is controlled. However, this mode is actually a pressure control mode.

In conditions involving ventilatory effort, two expected responses occur in this mode. Firstly, the tidal volume may intermittently exceed the target while the algorithm adjusts the pressure. Secondly, as the patient increases the ventilatory effort, the mechanical ventilator decreases inspiratory pressure to maintain the tidal volume on target. Similar to what occurs in VC-CMVs, the consequence is that the mechanical ventilator will perform less ventilatory work, which is called work displacement,[18] and this may be clinically undesirable. In patients with intense and continuous ventilatory effort, this situation may result in tidal volumes that exceed the programmed level, and low inspiratory pressures may even be close to PEEP.

Ventilatory sequence

The ventilatory sequence has evolved considerably over the last four decades. Although there are only three basic patterns, one of them, intermittent mandatory ventilation (IMV), has become more specialized. IMV, which was used in the mechanical ventilator release clinical trials,[19] is no longer implemented in the same way. There are currently better targeting schemes and improvements in mechanical ventilator operation, allowing for greater development.

The original taxonomy mentions only one type of IMV; however, 5 fundamental types are currently described,[20,21] which were added to the TAG in parentheses (Table 2). Below are two illustrative examples:

Trade name: Pressure Controlled ventilation Plus/Pressure Support (Dräger V800), SIMV [Pressure Control] (Maquet Servo U), SIMV-Pressure Control + Pressure Support (PB 840), P-SIMV+ [Psync off] (Hamilton G6), SIMV Pressure Control (GE Carestation).

TAG: PC-IMV(1)s,s

−Control variable: pressure (PC)

- The ventilator controls the pressure during inspiration. The resulting flow and tidal volume are determined by patient variables (resistance, compliance, and muscular effort).

−Ventilatory sequence: IMV(1)

- This sequence allows for mandatory and spontaneous ventilations to coexist. Mandatory ventilations are primary, and spontaneous ventilations are secondary. Type 1 IMV is the classic IMV, in which the patient receives mandatory ventilations (synchronized or not) regardless of the respiratory rate. In other words, the ventilatory frequency in IMV(1) is both the minimum and at the same time the maximum number of mandatory ventilations that the patient receives. This depends on what the operator has programmed.

−Targeting scheme: set point (s,s)

- The operator programs the variables (inspiratory pressure for both mandatory and spontaneous ventilations). In the taxonomy, the first "s" always refers to the targeting scheme for mandatory ventilations, and the second "s" refers to the spontaneous ventilations.

Thus, if we program 10 ventilations per minute with the TAG PC-IMV(1)s,s, assuming that the patient does not exhibit ventilatory effort, the mechanical ventilator will deliver the programmed 10 mandatory ventilations. However, if the patient exhibits ventilatory effort (Pmus), he or she will still receive 10 mandatory ventilations (synchronized or not), and may achieve spontaneous cycles between the mandatory cycles (assisted or not).

The evolution of the IMV sequence[22] currently allows us to recognize 5 available types,[21] although not all IMVs are the same (Table 2).

We will now use the PC-IMV(2)s,s mode as an example:

Trade name: Automode (pressure control to pressure support) (Servo U, Maquet) P-SIMV+ (Psync on) (G6, Hamilton), Pressure support + Backup rate (Carestation GE).

TAG: PC-IMV(2)s,s

–Control variable: pressure (PC)

- The ventilator controls the pressure during inspiration. Patient variables such as resistance, compliance and muscular effort will determine the resulting flow and tidal volume.
- In all forms of IMV, all spontaneous ventilations are pressure-controlled (there can be no spontaneous ventilations in volume-control mode).

–Ventilatory sequence: IMV(2)

- There are mandatory and spontaneous ventilations. In this sequence, the patient receives mandatory ventilations if there are no spontaneous ones. However, when the ventilator detects spontaneous ventilation, the mandatory ventilations are suppressed. The algorithm governing the number of spontaneous ventilations required to suppress mandatory ventilations varies among the different mechanical ventilators. In this case, if the patient stops ventilating, the mandatory frequency is activated. The programmed frequency is the minimum frequency that the patient will receive, regardless of his or her ventilatory rate.

–Targeting scheme: set point (s,s)

- The operator programs the critical variables (minimum pressure and inspiratory time), and the mechanical ventilator provides them. The operator programs the inspiratory pressure, as well as the mandatory and spontaneous ventilations.

If the patient has ventilatory effort (Pmus), the mandatory ventilations will be suppressed. If the patient does not have ventilatory effort, mandatory ventilations are activated. In some scenarios, such as with patients emerging from anesthesia, these IMV(2) or IMV(3) ventilatory sequences may be relevant, because they could minimize patient-ventilator dyssynchrony.[4] Undoubtedly, these are areas where technology is ahead of the available evidence.[22] However, taxonomy will help to bring this to light.

Table 2 shows the other types of IMV. The actual application of these sequences is still being researched, and even their level of complexity could be a barrier to their implementation. As we learn more about patient-ventilator interactions, however, it becomes apparent that these sequences could offer certain advantages to some patients.

Targeting schemes[2]

The targeting scheme determines how the mechanical ventilator interacts with the patient in response to the feedback signals, received according to the mode's capacity and programming. The main advantage of the scheme is that it indicates the degree of automation, which theoretically makes it possible to replace the level of intervention by the personnel in charge. Targeting schemes can be combined within a single mode, i.e., a mode can have more than one targeting scheme. In some cases, the targeting scheme changes when options are activated on the command screen. This changes the TAG, though it does not significantly affect the mechanical ventilator screen. One classic example is that some ventilators allow the activation of *automatic tube compensation* (ATC), which uses a Servo (r) targeting scheme. In this case, the TAG changes to PC-IMV(1)sr,sr.[16]

The following is a description of how the 7 targeting schemes currently available operate.

Set *point (s)* is a scheme in which the operator programs all the variables. The aim is to deliver inspiration based on the control variable. For example, in pressure control (PC), the operator programs the inspiratory pressure and inspiratory flow. In volume control (VC), the operator programs the tidal volume and inspiratory flow. In some ventilators, the flow can be programmed indirectly by adjusting the inspiratory time or the I:E ratio.

Dual (d) is a scheme where the mechanical ventilator can automatically change the control variable during inspiration. In other words, the mode can change from VC to PC or vice versa. This occurs when a conditional variable is activated. Usual conditional variables include evidence of Pmus (change from VC to PC), limiting pressure (change from VC to PC), and minimum volume (change from PC to VC). This targeting scheme may be active by default or can be activated as an option. Activation in response to conditional variables occurs automatically. If, during inspiration, the activation condition is not met, the mode will remain in the initial control variable (examples: *VAPS* [Volume Pressure Support], *Flow Adaptive Volume Control* of the Servo Maquet and the Dräger pressure limit).

Biovariable (b) is a scheme where the mechanical ventilator randomly selects the inspiratory pressure level, generating variable inspiratory volumes, thereby emulating physiological ventilatory variability (e.g., Dräger, *Variable Pressure Support*). It starts from the PEEP or CPAP level and the operator-determined variability ranges from 0-100%. Up to twice the programmed pressure support level can be achieved.

Servo (r) assists spontaneous ventilation by delivering an inspiratory pressure level that is proportional to a signal. There are several presentations of this targeting scheme. The inspiratory pressure can be proportional to a signal representing ventilatory effort (Pmus). In this case, the mechanical ventilator uses signals from the patient's ventilatory effort, and the operator programs the percentage of assistance for this effort. A pressure level determined by this percentage of amplification of the measured signal is then administered, resulting in a highly variable pressure-time curve. Two common examples are proportional assist ventilation and neurally adjusted ventilatory assist.

Adaptive (a) is a scheme where the mechanical ventilator adapts a variable to achieve a defined target. The most common implementation of this scheme occurs when the operator programs a target tidal volume and the ventilator adjusts the inspiratory pressure (increases or decreases it) in pressure control mode after comparing the delivered tidal volume to the target volume. The target tidal volume can be programmed by the operator or calculated by the mechanical ventilator (examples: *APV, VC+, Autoflow, PRVC*, VS.

Optimal (o) is a more advanced version of the adaptive control scheme (a). This scheme automatically adjusts the variables to optimize the target (i.e., maximize or minimize it).

Hamilton's adaptive support ventilation *(ASV)* is an example of this. It uses a mathematical model based on the Otis-Mead equation to determine the optimal ventilatory pattern that generates the least ventilatory work (energy transfer from the ventilator to the patient). The software automatically selects the optimal combination of respiratory rate and tidal volume based on continuously updated calculated values of the respiratory system's resistance and compliance. Operators have only one level of control over ventilation: the manual adjustment of the percentage of the predicted minute volume for the patient (considering height) that will be supported by the ventilator.

Intelligent (i) is the most advanced targeting scheme. It operates based on artificial intelligence programs, such as *mathematical models, rule-based expert systems, fuzzy logic and artificial neural networks*.[12,16] The advantage of the Intelligent (i) scheme is that it adapts to fluctuating patient conditions by modifying the decisions previously programmed by the operator. One example is *SmartCare/PS* on Dräger ventilators. This mode was designed to optimize the mechanical ventilator weaning process.[23] The ventilator uses fixed ranges of ventilatory rate, tidal volume and capnography ($ETCO_2$) within safe limits according to a rule-based expert system. This scheme uses these rules to provide adequate pressure support and keep the patient within an acceptable range until the ventilator deems the patient is ready for evaluation of extubation. In other words, it performs a spontaneous breathing trial and reports the results to the operator.

Variety of modes with the same TAG

As the taxonomy has become more widely used, it has become increasingly apparent that modes with the same TAG can behave differently. To solve this problem, the authors of the taxonomy added a new level: variety. PC-CSVr is a clear example; it has three versions, each with a different implementation. According to the taxonomy, these are varieties of the same species. One way to clarify this is to add the variable that differentiates the variety[24] within square brackets:

–*ATC:* pressure is proportional to inspiratory flow, PC-CSVr[Flow].
–Proportional assist ventilation: pressure is proportional to inspiratory effort,[24,25] PC-CSVr[Pmus].
–Neurally adjusted ventilatory assist: pressure is proportional to the electrical activity of the diaphragm,[26] PC-CSVr[Edi].

This modification only applies to modes for which differentiation is clinically relevant. For instance, in noninvasive ventilation, the PC-CSVs TAG applies to continuous pressure airway pressure (CPAP) and pressure support ventilation (BiPAP) modes. Objective differentiation is therefore relevant for clinical application, and the PC-CSVs [CPAP] or PC-CSVs [PS] TAG provides detailed information.

It is important to recognize that within any targeting scheme, there will be situations in which it does not work. The *Achilles heel of* automated systems is that they depend entirely on the reliability and certainty of the measured data that serve as feedback. The most common errors occur when there are leaks or system failures, which will ultimately require human intervention to correct them.

The most modern and advanced ventilatory modes completely cede control of the ventilatory process to the ventilator and are governed by the patient's responses. However, currently, the evidence of this happening is not entirely satisfactory.

Advantages of using the same nomenclature and taxonomy

The main advantage is that it facilitates communication, which is especially relevant in Spanish-speaking countries, where translations could lead to confusion and the segregation of knowledge. This document is based on an extensive review by authors from different countries and etymological dictionaries, and is mainly founded on routine clinical practice.

Additionally, it generates a better understanding of how each ventilatory mode operates. In critical care units, where different brands of mechanical ventilators are common, the taxonomy enables us to establish an effective, transversal and concrete communication system. It also enables us to anticipate and predict interactions between patients and mechanical ventilators, thereby minimizing inter-operator variability.[27]

Finally, knowledge of the taxonomy helps us understand the new technologies and the modes that will be developed in the future.

Final message

This update on the latest advances in the taxonomic coding of ventilatory modes is based on an extensive review of the subject. It allows for expanded clinical assimilation in most Spanish-speaking regions. The high prevalence of different commercial or colloquial names has led to significant confusion in determining the appropriate classification of ventilatory modes.

The industry has burdened us with an excessive number of commercial names for ventilatory modes. In some cases, the same name does not refer to the same ventilatory mode. Standardizing a precise taxonomic code is essential to avoid this confusion. It is of the utmost importance that all healthcare personnel in charge of patients requiring invasive ventilatory support handle the same syntax, as confusion in terminology could affect the quality of care.

CRediT authorship contribution statement

AFC designed the document and wrote and edited the manuscript. EMC, MIE, JBT and RC performed a formal review and edited the manuscript. All authors read and approved the final version of the manuscript.

Declaration of Generative AI and AI-assisted technologies in the writing process

We declare that we have not made use of any type of artificial intelligence to prepare this document.

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Appendix A. Supplementary data

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