What's in a Name – Does it Matter? Scientific Notations in Respiratory Care

Introduction

Ever since scientists began unfolding the mysteries of the universe, from the times of Archimedes to Isaac Newton to Albert Einstein, scientific notations have played a significant role in finding a convenient way to express ideas and numbers which measured the vastness of the universe and the littleness of the atomic world. Scientists could speak the language of the universe with these notations and mathematical equations, which sometimes were an inch long, like the famous Einstein equation, or a foot long, like the string theory. The role of physics and chemistry in medical practice, teaching, and research are colossal, and this compelled the physiologists of the mid-20th century to adhere to a uniform system of units.

The need for a uniform nomenclature in respiratory physiology was initially put forth more than a one and a half centuries ago, by the Pappenheim Committee.[1] Moran Campbell published an article titled, "terminology and symbols used in respiratory physiology" in the British Journal of Anaesthesia in 1957.[2] This article aimed to stress the need for an agreed terminology and system of symbols. He encouraged people to use the same conventions and terminology to avoid confusion. He went on to add abbreviations for the mechanics of breathing to the recommendations by the Pappenheimer Committee. In 1975, the American College of Chest Physicians and American Thoracic Society published guidelines on the use of pulmonary terms and symbols.[3] Guidelines to the use of units and symbols are also published by the journal as a guide to authors.[4,5]

In this article, we have listed a few common abbreviations and symbols and how they should be written according to the guidelines. Table 1 shows the units of measurement and their abbreviations according to Systeme Internationale.[6] Common errors seen in articles or manuscripts are hr or hrs for hours, yr or yrs for years, etc.

Table 2 lists some of the general variables used in respiratory physiology and their primary symbols. These are always be written in capital letters, for example, pressure and volume. A dot placed above a symbol indicates time derivative and a dash above indicates a mean value.

To describe their location, symbols are added to them and are called modifiers. Localization for the gaseous phase is written in small capital letters whereas for blood phase are written in small letters, all in the same line [Table 3]. When the modifiers are molecular species, the full chemical symbol of the molecule is written in small capital letters, also in the same line. However, if both location and molecular species need to be indicated, the symbol for general variable is followed by that of localization in small capitals in the same line. The symbol for molecular species is then indicated next as a subscript [Table 4]. Table 5 shows some common combinations of primary symbols and some modifiers.

Table 1: Units of measurement and their Systeme Internationale abbreviations

Unit of measurement	Symbol	Unit of measurement	Symbol
Metre	m	Millisecond	ms
Gram	g	Second	s
Kilogram	kg	Minute	min
Mole	mol	Hour	h (not hr)
Litre	L (not l)	Day	d
Millilitre	ml (mL is also valid)	Week	wk
Degree centigrade	°C	Year	y (not yr)
Degree kelvin	°K	Pascal	Pa
Milliequivalent	mEq	Joule	J

Never add an "s" to the above abbreviations (e.g. 10 kg, not 10 kg), Use the style $ml.min^{-1}.kg^{-1}$ for scientists and ml/min/kg for nonscientists, millimetres of mercury is written as mmHg, centimetres of water as cmH_2O, There must be space between the number and the corresponding unit of measurement, e.g., 120 mmHg, 50 psi (pounds per square inch)

Table 2: General variables used in respiratory physiology and their abbreviations (written in capital letters)

Main parameter	Symbols
Pressure in general	P
Volume of gas	V
Volume of gas/unit time (flow)	$\dot{V}$
Saturation	S
Frequency	f
Concentration in blood	C
Fractional concentration in dry gas	F
Volume of blood	Q
Volume of blood per unit time (flow)	$\dot{Q}$

The common notations used in acid-base physiology are shown in Table 6. The term pH depicts the acidity or alkalinity of a solution or tissue. It is the negative logarithm to the base 10, of the hydrogen ion concentration expressed in mol/L. Almost everyone is familiar with the term pH and its implications. There may be uncertainty as to what pH stands for power of hydrogen, potential of hydrogen, potenz, potentia hydrogenii, or pondus hydrogenii.[5] However, there should be no confusion as to how it should be written: P in small letter and H in capitals pH (not Ph!). Similarly, pKa denoted the dissociation

Table 3: Secondary (qualifiers or modifiers - localization) variables and their abbreviations (small capitals for gas phase and ordinary small letters for blood phase written in the same line as the main symbol)

Parameter	Symbols
In the gas phase	
Inspired	I
Expired	E
End-tidal	ET
Lung	L
Tidal	T
Alveolar	A
Dead space	D
In the blood phase	
Shunt	s
Arterial	a
Venous	v
Mixed venous	$\bar{v}$
Capillary	c
End-capillary	c'
Airway	aw
Blood	b

Table 4: Some common molecular species relevant to respiratory physiology

Parameter	Symbols
Oxygen	O_2
Carbon dioxide	CO_2
Nitrogen	N_2
Water	H_2O
Carbon monoxide	CO

Table 5: Common terms used in respiratory gas exchange and acid-base physiology

Common terms	Symbols
Fractional concentration of inspired oxygen	F_{IO_2}
Partial pressure of oxygen in the inspired air	P_{IO_2}
Partial pressure of oxygen in the alveolar air	P_{AO_2}
Partial pressure of oxygen in the arterial blood	PaO_2
Alveolo-arterial oxygen partial pressure difference	P(A-a) O_2
Arteriovenous oxygen content difference	C(a-v) O_2
End-tidal partial pressure of carbon dioxide	$P_{ET}CO_2$
Anatomical dead space	VDanat
Expired minute volume	$\dot{V}_E$
Arterial oxygen saturation	SaO_2
Oxygen saturation as measured by pulse oximetry	SpO_2
Mixed venous oxygen saturation	$S\bar{v}O_2$
Oxygen concentration in arterial blood	CaO_2
Oxygen consumption per minute	$\dot{V}O_2$
Peak airway pressure	$P\hat{a}w$
Mean airway pressure	$P\overline{aw}$

Table 6: Common notations in acid-base and electrolyte physiology

Element	Symbol
Sodium ion	Na^+
Potassium ion	K^+
Magnesium	Mg^{++}
Bicarbonate ion	HCO_3^-
Chloride ion	Cl^-
Phosphate ion	PO_4^{--}
Hydrogen ion	H^+

constant and must be written as shown here. If the elements are in ionized form, the symbol of the element is written and the charge is shown as superscript after the symbol of the element. If the symbol and the charge are placed inside square brackets, it indicates the concentration of that ion for example, [H+] denoted hydrogen ion concentration.

There are a multitude of scientific terms and notations, and only the common ones are mentioned here. Although many reputed journals ensure that the guidelines are adhered to, it is common to come across these notations and symbols written without any consideration to accuracy. Educators must consider it their responsibility to ensure that their trainees and younger staff members maintain a culture of meticulously adhering to these standard terms, symbols, and notation so that their misuse is minimized. A well-written article where due care has been taken to ensure that these terms are written correctly would indicate a disciplined mind and a love for science.

"Do you fnid tihs smilpe to raed? Bceauase of the phaonmneal pweor of the hmuan mnid, msot plepoe do" is a famous jumbled letters puzzle or garbled text that circulates in the media illustrating the amazing power of the human mind to be able to decipher words even if they are spelled wrongly. Although reading a single jumbled word sentence seems simple, the human mind will be able to do the same with entire paragraphs or text with jumbled letters is questionable. Quite possibly, the individual is likely to find it tiresome and may abandon the reading. Text with words spelled correctly will definitely make a better impact on the reader. The purpose of this editorial is to stress that the phenomenal ability of the human mind to decipher jumbled letters should not be used as an excuse for inattention to detail.

Aboo Abdul Rahiman Ramzi, Anitha Nileshwar

Department of Anaesthesiology, Kasturba Medical College, Manipal Academy of Higher Education, Manipal, Karnataka, India

Address for correspondence: Dr. Anitha Nileshwar, Department of Anaesthesiology, Kasturba Medical College, Manipal Academy of Higher Education, Manipal, Karnataka, India. E-mail: anitharshenoy@gmail.com

References

1. Pappenheimer JR. Standardisation of definitions and symbols in respiratory physiology. Fed Prec 1950;9:602.
2. Campbell EJ. Terminology and symbols used in respiratory physiology. Br J Anaesth 1957;29:534-9.

3. Burrows B. Pulmonary terms and symbols - ACCP-ATS joint committee on pulmonary nomenclature. Chest 1975;67:583-93.
4. Brougher P. Respiratory care: Standard abbreviations and symbols. Respir Care 1997;42:637-42.
5. Respiratory Physiology and Neurobiology: Guide for Authors. Available from https://www.elsevier.com/__data/promis_misc/RESPNBsymbolsunits.pdf. [Last dowloaded on 2018 May 02].
6. Young DS. Implementation of SI units for clinical laboratory data. Style specifications and conversion tables. Ann Intern Med 1987;106:114-29.

Access this article online	
Quick Response Code:	**Website:** www.ijrconline.org
	DOI: 10.4103/ijrc.ijrc_19_18

How to cite this article: Ramzi AA, Nileshwar A. What's in a name – Does it matter? scientific notations in respiratory care. Indian J Respir Care 2018;7:59-61.