Fig. 1. Figure 8 from Siobal et al.¹

Fig. 2. Figure 2 from Tusman et al.²

Finally, I will mention a small logical inconsistency that appears throughout the literature regarding mean exhaled fraction of CO₂. The term “fraction of carbon dioxide in mixed expired gas,” symbolized as $\bar{F}_{\text{ECO}_2}$ is attributed by Fletcher et al⁵ to Bohr.⁶ In that symbol the bar above the E indicates that it is a mean value. Indeed, the procedure for calculating the fraction of mixed expired gas was, historically, to collect several minutes of exhaled breaths in a large “Douglas bag” and measure the fraction of gas in the bag. Mathematically this gives the mean fraction per breath, and is analogous to measuring a minute’s worth of exhalations and dividing the minute volume by the frequency to get the mean tidal volume. If you agree with this line of reasoning, then the symbol should be $\bar{F}_{\text{ECO}_2}$ or $\bar{P}_{\text{ECO}_2}$. This is admittedly a minor point, but I think it illustrates a general tendency among authors to simply pass on what previous authors have said (or what they think they said) without question.

In summary, an easy way to check mathematical expressions in manuscripts is to perform simple dimensional analyses. If the units are not the same, the equation is wrong.

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Mr Chatburn has disclosed relationships with Dräger, Hamilton, CareFusion, Covidien, ResMed, Philips, IngMar, Radiometer America, Teleflex, Strategic Dynamics, Breathe Technologies, and the Alpha-1 Antitrypsin Foundation.

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The Whisper Game—Reply

In reply:

We thank Mr Chatburn for reading our paper with such meticulous and extensive attention to detail as to find and point out what seem to be inconsequential mistakes. These oversights were not unintentional distortions or corrupted information, but perhaps just minor errors overlooked during the review and editing process.

Chatburn is correct in that the equation on page 1149 and in Figure 7:

$$P_{a\text{CO}_2} = \dot{V}_{\text{CO}_2} / \dot{V}_A$$

should have been written as a proportional relationship using the “proportional to” symbol ($\propto$), as stated in the sentence that followed:

If $\dot{V}_{\text{CO}_2}$ increases without a proportional rise in $\dot{V}_A$, CO₂ production exceeds CO₂ excretion and $P_{a\text{CO}_2}$ increases.

It was never our intention for readers to apply this equation into clinical practice, but simply to express and illustrate the concept of the proportional relationship between $P_{a\text{CO}_2}$, CO₂ production, and alveolar ventilation.

The precise units in a figure or the position of a dot or a bar above a character are minor if not trivial details that most people interested in learning and understanding basic concepts would normally ignore. Chatburn’s approach to these inaccuracies from the perspective of a research scientist or engineer in the process of analyzing, simulating, and understanding precise data calculations are valid points for all authors, reviewers, and editors to consider.

We thank Mr Chatburn for his compulsion for accuracy and obsession to detail in pointing out these slight but important transgressions.

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