

## Abbreviations, initialism and acronyms: their use in medical physics (THUMP)

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Manuscripts that are submitted to this journal (APESM) always contain abbreviations and acronyms. In fact despite existing advice to the contrary, the trend amongst authors seems to be to increase their use [1]. This fashion has progressed to the stage where they are now overused. We ask: why the fad (WTF)?

Abbreviations are short forms of existing words designed to save time and to take up less space in situations where there is insufficient space to write the entire words. Initialisms may be considered to be a subset of abbreviations where the abbreviation consists of using the first letters of the words (ACPSEM for example). Acronyms (in turn) may be considered to be a subset of initialisms where the abbreviation can be pronounced as if it was a word (PET for example). However, the words acronym and initialism are often used as synonyms. Truncations are another form of abbreviation where a word is shortened to its first syllable or few letters, for example linear accelerator is linac, and formula translating is Fortran. These truncated words work well as new words because they are easy to pronounce, their etymology is clear and their meaning is intuitive. When abbreviation results in unpronounceable terms which are counter-intuitive, they do not work so well.

The advice to authors of scientific writing is: “Abbreviations should also be avoided whenever possible.” and “Avoid jargon and acronyms” [2]. “Avoid unfamiliar abbreviations.....” [3]. “Additionally, authors should avoid uncommon abbreviations....” [4].

Okay (OK), sometimes it is acceptable to abbreviate, particularly when it makes your writing easier to read. In this

regard, Mack’s advice is sound: “A good rule for abbreviations is to put the reader first. Ask yourself: Will the abbreviation make the sentence easier to read, or will it confuse the reader?” [4]. If the answer to the first part of the question is no, then don’t use that abbreviation. If the abbreviation is an acronym that cannot be pronounced or is unpleasant to say, making it necessary to read each letter separately with athletic enunciation, then don’t use that abbreviation.

It is acceptable to use abbreviations in the following circumstances. When they are: Standard abbreviations of units of measurement (Gy, kV, mAs); When they are symbols in a mathematical formula; Personal titles (Ms, Dr, Prof.); The designated symbols for chemical elements; Abbreviated names of familiar organisations (ICRP, IAEA, NRPB, ARPANSA); In headings and labels for figures and tables (where the saving of space is truly useful); Industry standard acronyms that can be pronounced like words (kerma, DICOM, ROMP, PACS). Furthermore an acronym that forms a unique aggregation of letters can be useful as a web search keyword. This is particularly true for the name of an organisation (but be aware that ACPSEM is also used by the Association of Chartered Physiotherapists in Sports and Exercise Medicine!). Producers of computer software are keen on this form of unique acronym for their products.

In addition, some abbreviations work because the phrase they replace is difficult (and tedious) to read if it is used often, while the acronym rolls off the tongue. For example ASCII instead of “American National Standard Code for Information Interchange”. Or a phrase has been invented by a nerd, and it would make little sense if used in a sentence as the intended meaning of the words, when used together, is not apparent (e.g. URL for uniform resource locator, HTML for hyper-text mark up language, DOI for digital object identifier). Perhaps the phrases should never have been used in the first place.

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Some authors use acronyms of two letters that can be pronounced like a two syllable word (IC, UV, CT, MC). However you should ask what is gained by using two letters when the words ion chamber, ultraviolet, computed tomography, and Monte Carlo are so easy to say? This same argument can be applied to many three-letter acronyms (e.g. TPS, AEC). Now that publications are produced electronically (as opposed to the now obsolete physical typesetting) space saving is no longer an issue. The two or three complete words should be written out rather than being replaced by two- and three-letter acronyms.

It is not mandatory (or even necessary) to use acronyms in scientific writing. It is the author's choice to use them and when to use them (however the editor may also choose to discourage their use). If your abbreviation frustrates the reader and is an impediment to the comprehension and ease of reading, then write out the words in full.

The message is clear: if you are thinking of coining a new acronym, don't do it (DDI), use standard acronyms. What then is a standard acronym and what is a non-standard acronym? The answer depends on the field that you are working in, and on who the likely readership of your article is. I will answer by paraphrasing, with some modification, the words of Justice Potter Stewart (of the United States supreme court): I shall not attempt to define what I understand to be embraced within that shorthand description "standard acronym" and perhaps I could never succeed in doing so. But I know one when I see one.

Acronyms should not be used in the following situations. When the acronym has not been defined (with the possible exception of the names of organisations); When the acronym is not used more than (say) five times; When the acronym is unfamiliar or not a standard one in medical physics or biomedical engineering and causes the reader to repeatedly search back through the article for its definition; When reading the acronym is harder than reading the words themselves; When the acronym consists of two letters (in this case, just write out the words!).

Acronyms seem to provide difficulties for the authors of manuscripts as well as for the reader. This can be seen by the many instances I see where the author defines an acronym that does not appear again in the manuscript after it has been defined. It is tempting to conclude that some authors use this device because they fear that the original words (for example: computer aided design (CAD)) are less well known than the acronym. Additionally the author

may define an acronym twice or thrice, or not at all. These oversights are not uncommon in submitted manuscripts and indicate an embarrassing lack of care in their preparation.

If, as I argue, two-letter acronyms are less convenient than the words they replace, and many three-letter acronyms do little to improve the readability of a sentence, how many letters should an acronym extend to? I think it safe to say that four and five letter acronyms can be justified if they are "standard". Some six-letter acronyms such as MOSFET and HDR SMB (high dose rate surface mould brachytherapy) work well. Longer acronyms are of course possible if the authors are brave, and in the case of EBRT EQD<sub>2</sub> (external beam radiation therapy equivalent dose for 2 Gy fractions), inventive.

I will end with some acronyms that roll off the tongue and are somehow appealing in their structure and perhaps illustrate why some authors can't resist the temptation to be creative with words: OSAQA (open source automatic quality assurance) and HABA (human anti-human antibody). My current favourite acronym—which possibly is even a new category of abbreviation as the words it replaces seem to follow each other in almost random order, is the algorithm sLORETA-FOCUSS (standardised low resolution electromagnetic tomography focal under-determined system solution). Furthermore, this algorithm is available in a modified form named Standardized Shrinking LORETA-FOCUSS, which is known by the abbreviated acronym (!) SSLOFO.

#### Compliance with ethical standards

**Disclosure** All the acronyms above, except for five, come from articles published in APESM.

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