A Method for Improving the Readability of Patient Education Materials for Traumatic Orthopaedic Injuries

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Declarations:

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ABSTRACT

Intro

While the National Institutes of Health (NIH) and American Medical Association (AMA) recommend PEMs should be written at the sixth-grade reading level or below, many patient education materials (PEMS) related to traumatic orthopaedic injuries do not meet these recommendations. The purpose of this study is to create a standardized method for enhancing readability of trauma-related orthopaedic PEMs by reducing the use of $\geq$ 3 syllable words and reducing use of sentences $\geq$ 15 words in length. We hypothesized that applying this method will significantly improve the objective readability of orthopaedic trauma PEMs.

Materials and Methods

A patient education website was queried for PEMs relevant to traumatic orthopaedic injuries. Orthopaedic trauma PEMs included (N=40) were unique, written in a prose format, and $\leq$ 3500 words. PEM statistics, including scores for seven independent readability formulas, were determined for each PEM before and after applying this standard method.

Results

All PEMs had significantly different readability scores when comparing original and edited PEMs ($p<0.01$). The mean Flesch Kincaid Grade Level of the original PEMs (10.0±1.0) was significantly higher than that of edited PEMs (5.8±1.1) ($p<0.01$). None of the original PEMs met recommendations of a sixth-grade reading level compared to 31 (77.5%) of edited PEMs.

Conclusions

This standard method that reduces the use of $\geq$3 syllable words and $\leq$15 word sentences has shown to significantly reduce the reading-grade level of PEMs for traumatic orthopaedic injuries while preserving key content. Improving the readability of PEMs may lead to enhanced health literacy and improved health outcomes.

Significance/Clinical Relevance:

An estimated 51% of US adults read at or below an eighth-grade reading level, with 21% of them reading at or below fifth-grade level. In the realm of orthopaedic surgery, particularly concerning traumatic injuries, patients' health literacy plays a crucial role in achieving optimal outcomes. When confronted with unfamiliar, high-pressure situations, patients with traumatic orthopaedic injuries must make critical decisions about their medical care without the luxury of extended contemplation.

Readability Assessment	Formula	Description
Flesch-Kincaid Grade Level	(0.39 x B) + (11.8 x W) – 15.59	B = mean # of syllables / word W = mean # of words / sentence
Flesch Reading Ease	206.835 – (1.015 x W) – (84.6 x B)	B = mean # of syllables / word W = mean # of words / sentence
SMOG Index	1.043 x √(P x 30) + 3.1291	P = # of words with > 3 syllables S = # of sentences
Coleman-Liau	(0.0588 x L) – (0.296 x T) – 15.8	L = mean # of letters/word T = mean # of sentences/100
Gunning Fog	0.4 x (W/S + 100 - P/W)	S = mean # of sentences W = mean # of words/sentence P = mean # of words with >3 syllables
Automated Readability Index	4.71(characters/words) + 0.5(words/sentences) - 21.43	
Linsear Write	Calculates the U.S. grade level of a text sample based on sentence length and the number of words with three or more syllables.	

	Original PEMs		Edited PEMs			
READABILITY FORMULA	MEAN	*STD DEV*	MEAN	*STD DEV*	CHANGE IN MEAN	P-VALUE
Flesch Reading Ease Score	55.0	5.9	74.5	6.5	*19.6*	p = 5.3E-22
Gunning Fog	12.5	1.2	7.3	1.2	*-5.2*	p = 3.4E-25
Flesch-Kincaid Grade Level	10.0	1.0	5.8	1.1	*-4.3*	p = 8.3E-26
The Coleman-Liau Index	10.6	1.1	8.9	1.2	*-1.8*	p = 1.6E-13
The SMOG Index	9.4	0.9	5.6	1.1	*-3.8*	p = 2.5E-24
Automated Readability Index	10.3	1.2	5.7	1.4	*-4.6*	p = 9.0E-26
Linsear Write Formula	11.3	1.6	5.7	0.9	*-5.6*	p = 6.7E-26
MEASUREMENT	MEAN	*STD DEV*	MEAN	*STD DEV*	CHANGE IN MEAN	P-VALUE
Number of words (total)	1782.6	727.9	1521.6	644.8	*-261.1*	p = 8.3E-10
Number of words per sentence	17.9	1.9	11.7	1.4	*-6.2*	p = 4.4E-25
Mean characters per word	4.8	0.2	4.5	0.2	*-0.3*	p = 3.8E-15
Mean syllables per word	1.9	0.3	1.1	0.3	*-0.8*	p = 3.3E-15
% of 3+ syllable words	14.6%	2.6%	7.6%	3.0%	*-7.1%*	p = 1.0E-17
# of 3+ syllable words	258.8	109.9	118.8	74.0	*-140.0*	p = 1.6E-15

PEMs = Patient Education Materials; SMOG = Simple Measure of Gobbledygook; STD DEV = Standard Deviation

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