

Does Rewording MRI Reports Improve Patient Understanding and Emotional Response to a Clinical Report?

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Abstract

Background Diagnostic MRI reports can be distressing for patients with limited health literacy. Humans tend to prepare for the worst particularly when we are in pain, and words like “tear” can make us feel damaged and in need of repair. Research on words used in provider-patient interactions have shown an affect on response to treatment and coping strategies, but the literature on this remains relatively sparse.

Questions/purposes The aim of this observational cross-sectional study is to determine whether rewording of MRI reports in understandable, more dispassionate language will result in better patient ratings of emotional response, satisfaction, usefulness, and understanding. Furthermore,

we wanted to find out which type of report patients would choose to receive.

Methods One hundred patients visiting an orthopaedic hand and upper extremity outpatient office for reasons unrelated to the presented MRI report were enrolled. Four MRI reports, concerning upper extremity conditions, were reworded to an eighth-grade reading level and with the use of neutral descriptive words and the most optimistic interpretations based on current best evidence. After reading each report, emotional response was measured using the Self Assessment Manikin (SAM). Subjects also completed questions about satisfaction, usefulness, and understanding of the report.

Results According to the results of the SAM questionnaire, the reworded MRI reports resulted in significantly

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higher pleasure and dominance scores and lower arousal scores. The mean satisfaction, usefulness, and understanding scores of the reworded report were significantly higher compared with the original reports. Seventy percent of the patients preferred the reworded reports over the original reports.

Conclusions Emotional response, satisfaction, usefulness, and understanding were all superior in MRI reports reworded for lower reading level and optimal emotional content and optimism. Given that patients increasingly have access to their medical records and diagnostic reports, attention to health literacy and psychologic aspects of the report may help optimize health and patient satisfaction.

Level of Evidence Level II, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Patients often read their medical records, and they may receive test reports, including radiology reports, in the mail. In general, these documents are written in medical jargon that is intended for documentation and for use by other medical professionals. Studies indicate that more than half of American adults have limited health literacy [11, 13, 17]. Even medically sophisticated patients may misinterpret some common medical jargon. Limited understanding and misinterpretation may affect health and patient satisfaction [13]. A Cochrane review showed that when providing patient-centered care, a model in which communication of health information is a key element, patients are more satisfied [4]. This underlines the pivotal role of patient information that is tailored to patients' needs and understanding. Research on words used in provider–patient interactions show a strong affect on response to treatment and coping strategies [2, 3, 5–8]. To illustrate, the word “tear” refers to a signal abnormality or defect. In radiology reports, this term is commonly used to describe degenerative and often benign conditions of aging. A patient with no knowledge of the professional use of the word tear will likely interpret it colloquially and assume that they have damage in need of repair [16]. A study about the use of words by patients with chronic low back pain showed that the term “tear” was associated with poor perceived prognosis [14]. It is possible that this term might increase the chances that patients choose operative treatment. Two studies showed that incomprehensible and incomplete written information is associated with negative emotions and confusion [7, 10].

We sought to determine whether MRI reports that are rewritten to be understandable by a reader with an eighth-grade reading level, and whether the use neutral descriptive words and the most optimistic interpretations based on

current best evidence will be better received by patients. Specifically, our primary study hypothesis was that the original and the reworded MRI reports would have comparable emotional valence. Valence is a term used by psychologists to refer to an object or event's inherent attractiveness or aversiveness (ie, the quality that determines the emotional response). Our secondary hypotheses were that patient satisfaction, understanding, and perceived usefulness also would be comparable. Our third hypothesis was that equal numbers of patients would prefer the original or the reworded report.

Patients and Methods

Using an institutional review board-approved protocol, we enrolled patients visiting the orthopaedic hand and upper extremity outpatient office for this observational cross-sectional study. Pregnant patients and those who could not speak English were excluded, as mandated by the institutional review board. All patients were enrolled between May 2012 and July 2012.

We enrolled 102 patients, but two did not complete the questionnaire resulting in a study cohort of 100 patients. Of the 100 patients enrolled, 59 were women and 41 were men. Their mean (\pm SD) age was 51 ± 16 years (range, 21–80 years), the level of education was 15 ± 2.9 years (range, 4–24 years), and the majority of the patients worked full time (Table 1).

A list of all shoulder, elbow, wrist, and hand MR images ordered in 2011 was obtained from the radiology service. From this list, the first four MRI reports (one each shoulder, elbow, wrist, and hand) in chronologic order were selected with the following inclusion and exclusion criteria: (1) adult patient; (2) pain as the primary indication for the MRI; and (3) no malignancy presented or suspected. This resulted in reports about lateral epicondylitis (one), rotator cuff tendinopathy (two), trapeziometacarpal arthritis (three), and flexor carpi radialis tendinopathy (four) (Appendix 1 and Appendix 2).

The original reports were reworded to the recommended reading level for effective health education below the eighth-grade level [15]. This is easily checked using tools in Microsoft Word (Redmond, WA, USA). It is straightforward to explain medical things in simple, everyday language, although it is not something we are accustomed to doing. We used neutral descriptive words and the most optimistic interpretation based on current best evidence. For instance, words such as “tear” were replaced by more descriptive and accurate words such as hole, signal change, or defect. We also used analogies (eg, gray hair, bald spot) where appropriate. It was emphasized that the reports are simulated reports unrelated to their problem.

Table 1. Patient demographics*

Demographics	Mean	SD	Range
Age (years)	51	16	21–80
Education (years)	15	2.9	4–24
	Number	Percent	
Sex			
Men	41	59	
Women	59	59	
Ethnicity			
Hispanic or Latino	7	7	
Not Hispanic or Latino	93	93	
Race			
White	82	82	
Black or African American	3	3	
Asian	5	5	
American Indian or Alaskan native	1	1	
More than one race	3	3	
Other or unknown	6	6	
Work status			
Working full-time	49	49	
Working part-time	10	10	
Homemaker	5	5	
Retired	19	19	
Unemployed, able to work	6	6	
Unemployed, unable to work	8	8	
Workers' compensation	2	2	
Currently on sick leave	1	1	
Household income (USD)			
0–10,000	7	7	
10,000–30,000	12	12	
30,000–50,000	8	8	
50,000–80,000	19	19	
80,000–120,000	18	18	
120,000–200,000	12	12	
+200,000	3	3	
N/A	21	21	

*N = 100 patients; N/A = not available.

Each patient was presented with a report either on the shoulder, the elbow, the wrist, or the hand regardless of their reason for coming to the doctor. These were not reports on MR images that had been obtained on these patients nor were they related to their specific disorder. We were interested in the emotional content of the reports as judged by people not directly impacted by the reports. The original and reworded reports about the same condition were presented to the patient. We alternated the order of presentation to avoid bias. After reading each report, patients completed a questionnaire concerning their satisfaction with the presented report, usefulness of the

presented content, the ability to understand the report, and their emotional valence using the Self Assessment Manikin (SAM) [3].

Patients' satisfaction with each report was assessed using an 11-point Likert scale question: "On a scale between 0 meaning completely unsatisfied and 10 meaning completely satisfied, how would you feel to receive this report?" Two more questions were completed regarding the usefulness and understanding using 11-point Likert scale questions. Higher scores indicated greater usefulness and more understanding.

After each report, the SAM was obtained. The SAM is an affective rating system developed to study emotion [3]. It is a validated and reliable affective rating system tool for pleasure, arousal, and dominance (meaning control over the situation as opposed to feeling helpless) [1, 3]. Patients were requested to rate their emotional dimension pleasure from faces that range from happy (low score) to frowning (high score). Patients stated their arousal by selecting from an excited/worried (low score) face to a relaxed face (high score). The dominance dimension ranged from a small figure (no control; low score) to a large figure (full control; high score). For analyses, we scored the outcome of this questionnaire, ranging from 1 to 9 points. Additionally, after reading both reports, patients were asked which report they preferred.

According to a power analysis, 82 patients provide 80% power to detect a difference between MRI reports of 30% of a standard deviation in values for a specific type of emotional response with alpha set at 0.05. We enrolled 100 patients to have 25 patients for each report. We calculated means and SDs for continuous variables and frequencies for categorical variables. We used the non-parametric Mann-Whitney tests to compare the independent variables when not normally distributed. For the variables that were normally distributed, we used independent-samples t-tests.

We had one missing value for the question about satisfaction and one missing value for the SAM dimension pleasure. We imputed the mean to complete these values.

Results

Subjects felt more pleasant, calm, and in control when reading the reworded compared with the original reports. The pleasure score (mean \pm SD) of all the original MRI reports was lower (4.6 ± 2.1) compared with the reworded reports (5.8 ± 2 , $p < 0.001$). The arousal score (mean \pm SD) of all the original reports was higher (4.1 ± 2.5) compared with the reworded reports (2.9 ± 1.8 , $p < 0.001$). The dominance score (mean \pm SD) of all the

Table 2. Bivariate analysis using the SAM questionnaire

Emotional response	Report	Frequency	Mean	SD	p value
Pleasure	Original	100	4.6	2.1	< 0.001
	Reworded	100	5.8	2	
Arousal	Original	100	4.1	2.5	< 0.001
	Reworded	100	2.9	1.8	
Dominancy	Original	100	4.4	2.3	< 0.001
	Reworded	100	5.8	2.2	

SAM = Self Assessment Manikin.

original reports was lower (4.4 ± 2.3) compared with the reworded reports (5.8 ± 2.2 , $p < 0.001$) (Table 2).

Analyzing the four different reports for differences by specific disease (acknowledging limited power), we found differences more for the tendinopathies than the arthropathy. The pleasure score was higher for the reworded rotator cuff tendinopathy reports compared with the original ($p = 0.001$). The arousal score was greater for the original lateral epicondylitis and wrist reports compared with the reworded reports ($p = 0.01$ and $p = 0.04$). The dominance score was greater for reworded rotator cuff tendinopathy report compared with the original ($p < 0.001$) (Table 3).

Subjects found the reworded reports more satisfying, useful, and understandable than the original reports. The satisfaction score (mean \pm SD) of all the original MRI reports was lower (5.1 ± 3.3) compared with the reworded reports (7.1 ± 2.8 , $p < 0.001$). The usefulness score of all the original reports (mean \pm SD) was lower (4.8 ± 3.5) compared with the reworded reports (7.1 ± 2.9 , $p < 0.001$). The understanding score (mean \pm SD) of all the original reports was lower (4.2 ± 2.3) compared with the reworded report (8.1 ± 2.6 , $p < 0.001$) (Table 4).

Of the four subreports, the satisfaction score was higher for the reworded rotator cuff tendinopathy report than the original ($p < 0.001$). The usefulness scores of the reworded tennis elbow, rotator cuff, and trapeziometacarpal arthrosis reports were higher than the original reports ($p = 0.012$, $p < 0.001$, and $p = 0.024$, respectively). The understanding scores were greater in all four reworded subreports (Table 5).

Seventy of 100 patients preferred the reworded MRI reports (Table 6). In each of four subreports, the reworded report was preferred by more patients (Table 7).

In bivariable analysis age affected emotional response, but otherwise demographic factors were not associated with emotional valence or report preference (Appendix 3 and Appendix 4).

Table 3. Bivariate analysis using SAM questionnaire subreports

Emotional response	Subreport	Frequency	Mean	SD	p value
Pleasure	1A	25	4.3	2.2	0.05
	1B	25	5.4	2	
	2A	25	4.2	1.8	0.001
	2B	25	6.4	2	
	3A	25	5.5	2.3	0.31
	3B	25	6.1	1.8	
	4A	25	4.4	2.6	0.12
	4B	25	5.4	2.4	
Arousal	1A	25	5.2	2.3	0.01
	1B	25	3.6	1.7	
	2A	25	4.2	2.5	0.12
	2B	25	3.2	1.8	
	3A	25	3.3	2.3	0.37
	3B	25	2.7	1.9	
	4A	25	3.7	2.5	0.04
	4B	25	2.3	1.6	
Dominancy	1A	25	4.4	2.4	0.05
	1B	25	5.7	2	
	2A	25	4	1.9	< 0.001
	2B	25	6.4	1.8	
	3A	25	5.2	2.6	0.37
	3B	25	5.8	2.6	
	4A	25	4.2	2.5	0.07
	4B	25	5.4	2.3	

Reports 1A, 2A, 3A, and 4A are original reports; reports 1B, 2B, 3B, and 4B are reworded reports; SAM = Self Assessment Manikin.

Table 4. Bivariate analysis for satisfaction, usefulness, and understanding

Parameter	Report	Frequency	Mean	SD	p value
Satisfaction	Original	100	5.1	3.3	< 0.001
	Reworded	100	7.1	2.8	
Usefulness	Original	100	4.8	3.5	< 0.001
	Reworded	100	7.1	2.9	
Understanding	Original	100	4.2	2.3	< 0.001
	Reworded	100	8.1	2.6	

Discussion

Diagnostic reports can be distressing, perhaps more so for patients with limited health literacy [7, 10, 13]. The aim of

Table 5. Bivariate analysis of satisfaction, usefulness, and understanding subreports

Parameter	Subreport	Frequency	Mean	SD	p value
Satisfaction					
	1A	25	5.4	2.9	0.25
	1B	25	7.3	2	
	2A	25	4.9	3.2	< 0.001
	2B	25	8.2	2	
	3A	25	5.9	3.4	0.12
	3B	25	7.4	2.8	
	4A	25	4.4	3.6	0.19
	4B	25	5.6	3.7	
Usefulness					
	1A	25	5.7	2.9	0.012
	1B	25	7.5	2	
	2A	25	4.4	3.4	< 0.001
	2B	25	8.1	2.4	
	3A	25	5.2	4	0.024
	3B	25	7.7	2.4	
	4A	25	4	3.7	0.28
	4B	25	5.2	3.6	
Understanding					
	1A	25	5.2	2.4	0.004
	1B	25	7.9	2.3	
	2A	25	3.6	3.1	< 0.001
	2B	25	9	1.6	
	3A	25	4.7	4	< 0.001
	3B	25	8.7	2.2	
	4A	25	3.2	3	0.001
	4B	25	6.8	3.6	

Reports 1A, 2A, 3A, and 4A are original reports. Reports 1B, 2B, 3B, and 4B are reworded reports.

Table 6. Preferred report

Report	Number	Total	Percentage
Original	30		30
Reworded	70	100	70

Table 7. Preferred subreports

Subreport	Number	Total	Percentage of subreport
1A	7		28
1B	18	25	72
2A	4		16
2B	21	25	84
3A	9		36
3B	16	25	64
4A	10		40
4B	15	25	60

this study was to determine whether rewording of MRI reports results in better patient ratings of emotional valence, satisfaction, usefulness, and understanding. Furthermore, we wanted to find out whether the neutrally worded MRI reports rewritten at the eighth-grade reading level would be preferred by patients. Subjects felt more pleasant, calm, and in control on average after reading MRI reports reworded for readability and optimism. They also rated the reworded reports as more satisfying, useful, and understandable on average. Most patients preferred the reworded report over the original report.

These data should be interpreted in light of the fact that subjects were reading an MRI report that was unrelated to their problem and they may have a different emotional response if the report was their own. This was done for practical reasons and as pilot work to establish the merit of the concept given that a study of patients with each specific disease undergoing MRI would take much longer to complete. However, the subjects questioned were patients in a patient-provider setting and could envision receiving such a report. Other than the consistent approach of our team we did not control for the degree to which the report was modified. The reliability of rules for formatting reports or modifying existing reports could be the focus of future research. Measuring emotion is difficult, but the SAM questionnaire is a widely used and reliable method for quantifying affective influences of information on people [3]. Our subgroup analysis for different anatomic sites was secondary, underpowered, and hypothesis generating at best. The MRI reports used in this study were limited to orthopaedic conditions of the upper extremity and hand and did not encompass other regions and conditions of the human body. The reports did not include malignancies or dangerous conditions; therefore, we cannot generalize it to these conditions. We had only two uncompleted answers for which we imputed the mean. This is an accepted way to address missing values and two missing entries is a very low number [5].

These data suggest an advantage to including a summary of the report directed to the patient that is easy to understand and as optimistic as possible. This may encourage and reinforce optimal coping strategies, because distressing or confusing material may reinforce the natural human tendency to prepare for the worst, which psychologists call catastrophic thinking [8]. In addition, more satisfying patient information has been shown to reduce malpractice [6]. Understandable information allows the patient to be more involved with their medical care, which is associated with greater adherence to provider recommendations and better health outcomes [12].

The improved emotions and satisfaction of subjects reading reworded reports might translate to better overall

satisfaction with care. Satisfaction with care can be at odds with good medical care and the example of opioid prescription was recently used to highlight this [9, 18]. Diagnostic reports with simple, accurate, dispassionate, and even optimistic wording can set up providers for more satisfying discussions of how to optimize health (ability to depend on one's body) and help limit less satisfying conversations about why "we are not going to fix the tear found in my elbow/shoulder/wrist".

Among the 30% (30 of 100) of subjects who preferred the original report, some commented that "the original report was more detailed" and some said the reworded report looked "too simple." Others mentioned they preferred the original report because they want to unravel it with the help of the internet or their physician. We would argue that the technical information can be reported dispassionately and descriptively (eg, signal change, defect) more or less as it is now and that a less technical, more readable, and optimistic rewording of the interpretation portion of the report might be no less complete or less accurate. This combination might satisfy all patient interests. Any type of report will always benefit from discussion with a healthcare professional. Further research is needed to determine how best to word reports to provide correct and optimistic medical information with enough details yet still be understandable and without causing unnecessary distress.

Appendix 1. Original and reworded reports for epicondylitis

Original Report

Findings:

There is a skin marker over the lateral humeral epicondyle. There is severe thickening of the common extensor tendon insertion consistent with tendinosis, and a superimposed partial tear measuring 5 mm. There is prominence of the adjacent joint capsule raising the question of concurrent partial tear of the radial collateral ligament.

The remaining ligaments and tendons are normal in configuration and signal intensity. The ulnar nerve is in the groove. Bones and bone marrow are unremarkable.

Impression:

Tendinosis and partial tear of the common extensor tendon at the insertion on the lateral humeral epicondyle.

Reworded Report

Findings:

Thickening and signal changes of the origins of the common extensor tendon and radial collateral ligament origin consistent with tendinopathy. The remaining ligaments, tendons, bones and nerves are normal.

Impression:

Findings consistent with lateral epicondylitis.

Appendix 2. Original and reworded reports for rotator cuff

Original Report

Findings:

Rotator cuff: There is subtotal articular sided tear of the distal supraspinatus tendon with delaminating component and proximal retraction of articular sided fibers up to 2 cm from the greater tuberosity. Full thickness tendon perforation may be present. The tear extends inferiorly into the infraspinatus, which remains mostly intact at the greater tuberosity attachment site. There is subscapularis tendinopathy without full thickness tear. The teres minor is intact. The rotator cuff muscle bulk is intact.

Glenoid labrum and biceps tendon: Just proximal to the biceps tendon groove, there is fusiform enlargement of the biceps tendon with signal increase suggesting longitudinal tear. The extracapsular biceps tendon remains within the groove. There is degenerative tearing of the superior and anterior labrum. There is a small joint effusion.

AC joint: There are hypertrophic degenerative changes of the acromioclavicular joint. There is trace fluid in the subacromial bursa.

Articular cartilage: The articular cartilage is of normal thickness. No focal defects are seen.

Bone: There is subchondral cyst formation in the humeral head.

Impression:

Subtotal articular surface tear of the distal supraspinatus tendon with delaminating component and proximal retraction of articular sided fibers up to 2 cm from the greater tuberosity. The tear extends posteriorly into the

infraspinatus which remains mostly intact at the greater tuberosity attachment site.

Prominent bicipital tendinosis with longitudinal partial tear just proximal to the bicipital groove.

Hypertrophic degenerative changes of the acromioclavicular joint.

Reworded Report

Findings:

Rotator cuff: There is signal change consistent with tendinopathy involving the entire supraspinatus tendon and part of the infraspinatus and subscapularis tendons consistent with age. There is thinning of the supraspinatus. The muscles are healthy.

Glenoid labrum and biceps tendon: Enlargement and signal changes in the biceps tendon consistent with rotator

cuff tendinopathy as expected at this age. There is a small amount of superior and anterior labral changes, a small subchondral cyst in the humeral head, and a small amount of fluid in the joint suggestive of very mild glenohumeral arthrosis consistent with age. The articular cartilage is of normal thickness and without defect.

AC joint: Arthritis consistent with age.

Impression:

Expected age-related changes including:

1. Rotator cuff/biceps tendinopathy with some thinning in the supraspinatus, but no defect and healthy muscle.
2. Moderate arthritis of the acromioclavicular joint.
3. Very mild arthritis of the glenohumeral joint.

Appendix 3

Appendix 3. Correlation of demographic parameters with pleasure, arousal, and dominance

Demographics	Pleasure		Arousal				Dominance					
	Original	p	Reworded	p	Original	p	Reworded	p	Original	p	Reworded	p
Age (years)	0.02	0.14	-0.02	0.83	-0.12	0.23	-0.00	0.98	-0.06	0.57	0.13	0.21
Education	0.23	0.02*	0.01	0.95	-0.02	0.86	0.04	0.68	-0.20	0.046*	-0.16	0.11
Sex												
Males	5.3	0.91	3.9	0.22	6.5	0.041*	7.3	0.33	4.1	0.07	6.1	0.28
Females	5.2		4.4		5.5		6.9		4.9		5.6	
Ethnicity												
Hispanic or Latino	4.0	0.13	3.9	0.67	5.9	0.98	6.9	0.74	3.9	0.53	4.6	0.11
Not Hispanic or Latino	5.4		4.2		5.9		7.1		4.5		5.9	
Race												
White	5.4	0.21	4.3	0.41	6.0	0.51	7.2	0.53	4.2	0.08	5.9	0.75
Black or African American	6.0		5.0		3.7		7.7		2.3		5.0	
Asian	4.2		3.8		5.6		5.8		5.4		5.8	
American Indian/Alaskan	5.0		7.0		3.0		8.0		5.0		7.0	
More than one race	5.7		3.0		5.3		7.7		6.0		5.0	
Other or unknown	3.2		3.2		6.3		6.5		6.5		4.8	
Work status												
Working full-time	5.2	0.49	4.0	0.73	6.1	0.96	7.2	0.78	4.4	0.24	5.9	0.70
Working part-time	6.4		4.5		4.9		6.4		2.9		5.0	
Homemaker	4.6		3.8		5.8		7.0		4.2		5.8	
Retired	5.2		4.6		5.8		6.9		5.0		6.1	
Unemployed, able to work	5.2		4.6		6.0		7.0		4.6		5.0	
Unemployed, unable to work	5.3		4.2		5.9		7.4		4.1		6.1	
Workers' compensation	5.0		5.0		6.0		6.0		5.0		6.0	
Currently on sick leave	1.0		1.0		7.0		9.0		9.0		9.0	

* p < 0.05 (statistically significant).

Appendix 4

Appendix 4. Bivariable analysis of preferred report

Demographic	Preferred original report (mean)	Preferred reworded report (mean)	p value
Age (years)	48	53	0.16
Education	15	15	
	Number		
Sex			
Men	13	28	0.83
Women	17	42	
Ethnicity			
Hispanic or Latino	3	4	0.43
Not Hispanic or Latino	27	66	
Race			
White	23	59	
Black or African American	1	2	
Asian	2	3	0.31
American Indian or Alaskan Native	0	1	
More than one race	0	3	
Other or unknown	4	2	
Work status			
Working full-time	14	35	
Working part-time	2	8	
Homemaker	2	3	
Retired	7	12	0.70
Unemployed, able to work	1	4	
Unemployed, unable to work	3	6	
Workers' compensation	0	2	
Currently on sick leave	1	0	
Household income (USD)			
0–10,000	4	3	
10,000–30,000	5	7	
30,000–50,000	3	5	
50,000–80,000	4	15	0.30
80,000–120,000	3	15	
120,000–200,000	3	9	
+200,000	2	1	
N/A	3	11	

N/A = not available.

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