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RESEARCH ARTICLE

Medical Metaphors: Increasing Clarity but at What Cost?

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Abstract

Background: Clinicians often use metaphors to explain complex ideas. Metaphors also have the potential to reinforce unhelpful thinking regarding symptoms. We surveyed musculoskeletal specialists regarding use of metaphors in their daily practice and then assessed the contexts in which they are used, the themes of metaphors, and potential for reinforcement of common misconceptions (unhelpful thinking).
Two primary research questions were posed: 1- What are the common characteristics of the medical metaphors used in patient-clinician communication by musculoskeletal specialists? And, 2- What percentage of medical metaphors used in patient-clinician communication have potential to induce unhelpful thinking and what are the characteristics of those metaphors?

Methods: Eighty-one orthopedic and trauma specialists provided examples of metaphors they use in daily practice. Qualitative analysis of responses was performed through open coding of the data with the use of a constant-comparative technique involving several rounds of reading and rereading the data.

Results: The 157 metaphors were categorized into 15 different themes. The most common themes were mechanical, objects, and sports and leisure. We also classified metaphors as addressing the natural history of the disease, treatment, mechanism, anatomy, or other. Thirty-five metaphors (22%) were identified as having the potential to reinforce unhelpful thinking. The most common purpose of these metaphors was for explaining the mechanism or natural history of the disease.

Conclusion: Metaphors can either reinforce or reorient potentially unhealthy misconceptions. They can also reinforce despair and worry, or they can improve hope and sense of control. Orthopedic surgeons can be strategic and thoughtful in their use of metaphors, planning and practicing specific metaphors for optimal mental, social, and physical health.

Level of evidence: N\A

Keywords: Analogy, Mental health, Metaphor, Misconception, Patient-physician communication, Unhelpful thinking, Psychological distress

Introduction

A surgeon's daily work includes explaining disease processes, diagnoses, and treatments to patients and families. Effective communication strategies are related to malpractice claims, litigation rates, treatment adherence, and trust in clinicians (1-3). Clinicians often use metaphors to explain complex ideas. A metaphor is a word or phrase used in place of another to suggest a likeness or analogy between them. Reviews of metaphors used in health settings found that they facilitate patient diagnostic reasoning and attitudes about the experience of illness and treatment strategies (4,5).

Metaphors also have the potential to reinforce unhelpful thinking regarding symptoms. For instance, a metaphor of "wear on a tire" might reinforce a person's misconception that age-associated changes are caused

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by activities, thereby reinforcing the harmful thinking of kinesiophobia (fear of painful movement) and catastrophic or worst-case thinking. Metaphors can be negatively framed if needed to be accurate, but a negative frame that is inaccurate can be unhealthy (6).

Unhelpful thinking refers to the systematic ways in which the context and framing of information influences judgement and decision making. Studies demonstrate that how health information is framed (e.g. highlighting losses over gains or the reverse) can impact symptom intensity and activity tolerance, evaluation of the future, and decision making (7–11). The concepts of placebo and nocebo effect (meaning and context effects) embody the strong influence that words and concepts can have on health (6,12). Medical metaphors are frequently based on concrete rather than abstract terms (13). We may be able to learn more about the biases transferred from specialist to patient—or reinforced—by studying metaphors used in practice. For example, one qualitative study found that patients and nurses use different metaphors to understand specific problems (14). Another study involving severely ill patients demonstrated that use of metaphors can enhance clinicians' ability to communicate with patients (15). In another investigation, interviews collected from women who lost their pregnancies illustrated that metaphors can provide insight about patients feelings and experiences (16). Research offering an analysis of online forum conversations among cancer patients found that awareness about function of patients' metaphors (empowering vs. disempowering) can enhance patient-physician communication about cancer (17)in view of critiques of war-related metaphors for cancer and the adoption of the notion of the 'cancer journey' in UK policy documents.\nDesign Computer-assisted quantitative and qualitative study of two data sets totalling 753 302 words.\nSetting A UK-based online forum for patients with cancer (500 134 words.

The purpose of this study was to investigate the medical metaphors musculoskeletal specialists use in daily practice and the potential for reinforcing unhelpful thinking. Two primary research questions were posed: 1- What are the common characteristics of the medical metaphors used in patient-clinician communication by musculoskeletal specialists? And, 2- What percentage of medical metaphors used in patient-clinician communication have potential to induce unhelpful thinking and what are the characteristics of those metaphors?

Materials and Methods

This study, as approved by our institutional review board (University of Texas at Austin, Dell Medical School), employed qualitative methods to obtain data through an online questionnaire. The instrument for data collection was a 4-item questionnaire distributed to the membership pool of the Science of Variation Group (SOVG). The SOVG is an international collaboration of musculoskeletal surgeons with the aim of studying the reliability and sources of variation in aspects of musculoskeletal care. Beginning in December 2019, three biweekly invitations to participate were sent via the SOVG e-mail list. Data collection closed after 6 weeks.

Study information was provided on the landing page of the online questionnaire, and completion of the survey implied informed consent. The questionnaire contained open-ended questions about their language use in their daily practice. Participants were asked to provide up to 10 medical metaphors that they usually use to explain complex concepts for patients in their daily practice. For each metaphor, the clinicians provided the corresponding diagnosis and the topic (the natural history of the disease, treatment, mechanism, body reaction, etc.) explained by the metaphor.

Eighty-one surgeons completed the questionnaire. Because most of the members with emails in the SOVG database are not active participants, the rate of participation is not a true response rate. In addition, as in most qualitative research, our goal is not complete participation when a representative sample is sufficient. Participants reported 201 distinct medical metaphors used in their daily surgical practice. Responses were included if they were written in English and excluded if they were duplicates, incomplete, unintelligible, or non-medical in nature. Metaphors (e.g. "You are a fighter") and similes as a type of metaphor (e.g. "It's like rubbing a rope on a rock,") were included. To determine inclusion and exclusion, the metaphors were reviewed by 2 researchers separately; One reviewer removed duplicates, non-medical metaphors, and unintelligible metaphors. This process was verified and confirmed by the second reviewer. As a result, 44 metaphors did not meet inclusion criteria and 157 metaphors remained in the dataset.

Qualitative analysis was initially performed through open coding of the data with the use of a constant-comparative technique involving several rounds of reading and rereading the data. Metaphors were categorized on an Excel sheet by theme, topic, and bodily region by the first reviewer and reviewed, revised, and confirmed by a second reviewer. The remaining responses were categorized into 15 common metaphor themes, 5 disease concepts, and 3 bodily regions.

Finally, we looked for medical metaphors that have the potential to reinforce unhelpful thinking in patients, reviewed and confirmed by one investigator and a senior author with expertise in this area identified metaphors reflecting unhelpful thinking and discussed the few where there was disagreement. Metaphors that implied negativity (e.g. "canary in the coal mine"), reinforcing misconceptions (e.g. "The bone with osteoporosis is like a damaged road"), providing incorrect information (e.g. "I tell the patient that the gel injection for the knee is like getting an oil change for your car") were considered to illicit unhelpful thinking.

Fifty-four percent of the metaphors were for Upper Extremity problems, 31% for other regions (pelvic and spine problems or general concepts not limited to a certain location e.g. cancer), and 17% for Lower Extremity.

Although prior studies addressed enhancement of patient-clinician communication using metaphors, there is not much research specific to the field of surgery. The

degree to which analogies may reinforce or reorient potentially unhealthy misconceptions is also less studied. In this study, we explored musculoskeletal specialists' use of metaphors in their daily practice and the potential for reinforcement of unhelpful thinking.

Results

The 157 metaphors were separated into 15 distinct themes [Table 1]. The most common theme was mechanical (e.g. "a cartilage flap is like sand in gears", "a baker cyst process is like valve mechanism" (27%) followed by objects (e.g. "a calcaneal compression fracture is like a crushed plastic cup", "the metatarsophalangeal sesamoid bones are like the guide rails of a curtain") (15%) and sports and leisure (e.g. "the medial patellofemoral ligament is like reins on a horse--not tight, not loose, but just enough slack to allow for mobility of the patella in the groove of the femur" (10%). Themes that were used less than 5% were categorized as other [Appendix A, B and C]. We also classified metaphors as addressing the natural history of the disease (46%; e.g. "trigger finger is like fishing line thru the rings on the fishing rod that gets a knot and has difficulty getting thru that first ring"); treatment (27%; e.g. "a Tendon transfer for chronic Achilles tendon defects is like parallel circuits in electronics"); mechanism (21%; e.g. "the pelvis is like a hard pretzel. It cannot break at just one point, if you have a break in the front like in the rami, then you must have a break in the back as well, near or at the sacrum"); , anatomy (4%; e.g. " the trapeziometacarpal joint is like a rider on a saddle"); or other (1%; e.g. "Regarding potential rare complications, I describe it as follow: 'If you are playing the lottery you have in mind that your chances to win are less than one in a million! ").

Thirty-five of the 157 metaphors (22%) were classified as having the potential to reinforce unhelpful thinking. The most common purpose of these metaphors was for explaining the natural history of the disease (18 cases; 51%) followed by treatment (10 cases; 29%) and mechanism explanation (6 cases; 17%). Fifty-four percent of metaphors were related to upper extremity problems (19 cases) followed by other (10 cases; 35%) and "lower extremity" (6 cases, 17%) [Table 1-5].

Table 1. Medical Metaphors Frequency, Region and Topic

Category	Percentage (N)	Not Reinforcing Unhelpful Thinking	Reinforcing Unhelpful Thinking	Region				Topic			
				UE	LE	Other	Anatomy	Natural History of The Disease	Mechanism	Treatment	Other
Sports & Leisure	10% (15)	73% (11)	27% (4)	74% (11)	13% (2)	13% (2)		53% (8)	27% (4)	20% (3)	
Nature and animals	7% (11)	82% (9)	18% (2)	73% (8)	9% (1)	18% (2)	9% (1)	54% (6)	9% (1)	28% (3)	
Electrical/tech	5% (8)	100% (8)	0	38% (3)	12% (1)	50% (4)	37% (3)	13% (1)	13% (1)	26% (2)	
Food	9% (14)	71% (10)	29% (4)	57% (8)	37% (3)	37% (3)		50% (7)	14% (2)	36% (5)	
Mechanical	27% (42)	70% (29)	30% (13)	40% (17)	29% (12)	31% (13)		45% (19)	21% (9)	34% (14)	
Clothing & Materials	7% (12)	100% (12)	0	83% (10)	17% (2)	-	8% (1)	50% (6)	17% (2)	25% (3)	
Human Condition	6% (9)	89% (8)	11% (1)	56% (5)	11% (1)	33% (3)		89% (8)	11% (1)		
Objects	15% (24)	83% (20)	17% (4)	50% (12)	17% (4)	33% (8)	4% (1)	38% (9)	38% (9)	16% (4)	4% (1)
Other	14% (22)	68% (15)	32% (7)	32% (7)	5% (1)	63% (14)		36% (8)	18% (4)	41% (9)	5% (1)
Total	100% (157)	78% (122)	22% (35)	54% (85)	17% (27)	29% (45)	4% (6)	46% (73)	21% (33)	27% (43)	1% (2)

UE = Upper Extremity; LE = Lower Extremity

Table 2. Biased metaphors distribution

Biased Metaphors distribution per region	Percentage (N)
UE	54% (19)
LE	17% (6)
Other	29% (10)
Biased Metaphors distribution per topic	
Natural history of disease	51% (18)
Mechanism	17% (6)
Treatment	29% (10)
Other	3% (1)

UE = Upper Extremity; LE = Lower Extremity

Table 3. Examples of Potentially Bias-enhancing Metaphors and Alternatives

Bias	Example Metaphors That May Reinforce Unhelpful Thinking	Alternative Metaphors
Containing extreme or negative connotations	A calcaneal fracture is like an egg crushed flat	A calcaneal fracture is like a cracked egg.
	Carpal tunnel syndrome is like "a rock crushing a hose," or "Ziti being squished to linguini"	Carpal tunnel syndrome is like a hose that is under pressure and water flow is less than normal.
Invokes disease modification when only palliation is available	Gel injection for the knee is like getting an oil change for your car	Gel injection for knee arthritis may be like dying one's hair—temporary at best
Out-of-date inaccuracies such as overuse or damage	You're born with an empty bucket and if you only put one drop in it every day, it will overflow eventually (overuse)	It's like exercise, you might feel sore during or after, but it's definitely safe and healthy. Think of yourself as a keyboard athlete.
	Spontaneous long head of biceps rupture: "Like rubbing a rope on a rock - the rock eventually wins."	Your hair doesn't thin because of your hat or your pillow. It's just age and genetics.
	Lumbar disc herniation: "Treatment is like repair of a flat tire"	Like a jelly donut, when you press on it, the jelly comes out the hole.
Invoking fear	Abdominal aortic aneurysm is like a ticking time bomb	Like an aging garden hose, it can work for some time, but not forever.
	Distal radius fracture is like a canary in the coal mine signaling fragile bones	A fracture like this after a simple fall can be like a signpost on your life journey, marking the next stage.
Hurt means harm	Just as with a car, the motor gets older (heart) and the bearings start to grind (osteoarthritis)	Osteoarthritis is like grey hair, everyone eventually gets it.
	Ankle fracture: the ankle joint is like a wheel bearing. If it is too loose it will wear out fast.	It's like hanging a door, we want to line it up as well as possible for long-term function.
Nudging patients towards a specific treatment	A car with 100,000 miles will make noises, does not start on cold mornings, etc. You can either try to tune it up (NSAIDs, injections) or trade it in for a new one (TKA)	An old car can still get you where you want to go.
	If your car was running as rough as your knee you would take it in for service with the mechanic	Just like when you get your car checked, if there's nothing specific to address, you can keep using it like normal.
Implying vulnerability and progression	A bone with osteoporosis is like a damaged road with many holes in constant maintenance.	Osteoporosis is like grey hair and presbyopia, an expected part of aging. There are treatments to be considered with care.
Using battle analogies	You will win this battle, because you are a fighter	Just as people live with diabetes or heart failure, I live with cancer.
	Use the weapons at your disposal	

Table 4. Biased metaphors distribution

Biased Metaphors distribution per region	Percentage (N)
UE	54% (19)
LE	17% (6)
Other	29% (10)
Biased Metaphors distribution per topic	
Natural history of disease	51% (18)
Mechanism	17% (6)
Treatment	29% (10)
Other	3% (1)

UE = Upper Extremity; LE = Lower Extremity

Table 5. Examples of Potentially Bias-enhancing Metaphors

Bias	Example Metaphors
Containing extreme or negative connotations	A calcaneal fracture is like an egg crushed flat Carpal tunnel syndrome is like "a rock crushing a hose",or "Ziti being squished to linguini"
Invokes disease modification when only palliation is available	Gel injection for the knee is like getting an oil change for your car
Out-of-date inaccuracies such as overuse or damage	You're born with an empty bucket and if you only put one drop in it every day, it will overflow eventually (overuse) Spontaneous long head of biceps rupture: "Like rubbing a rope on a rock - the rock eventually wins." Lumbar disc herniation: "Treatment is like repair of a flat tire"
Invoking fear	Abdominal aortic aneurysm is like a ticking time bomb Distal radius fracture is like a canary in the coal mine signaling fragile bones
Hurt means harm	Just as with a car, the motor gets older (heart) and the bearings start to grind (osteoarthritis) Ankle fracture: the ankle joint is like a wheel bearing. If it is too loose it will wear out fast.
Nudging patients towards a specific treatment	A car with 100,000 miles will make noises, does not start on cold mornings, etc. You can either try to tune it up (NSAIDs, injections) or trade it in for a new one (TKA) If your car was running as rough as your knee you would take it in for service with the mechanic
Implying vulnerability and progression	A bone with osteoporosis is like a damaged road with many holes in constant maintenance.
Using battle analogies	You will win this battle, because you are a fighter Use the weapons at your disposal

Discussion

Effective use of medical metaphors can help promote effective communication between providers and patients, simplify complex medical concepts, and enhance patient decision making. A better understanding of the pathology is useful to patients when choosing diagnostic or treatment options; however, sometimes

these metaphors can reinforce unhelpful thinking. In this study we decided to investigate metaphors that can potentially reinforce unhelpful thinking in patients.

The findings of this study can be interpreted in light of some limitations. Firstly, our participants are international; some offered metaphors in languages other than English, so some of the meanings of the metaphors may have changed when translated to English and lost cultural significance. Secondly, surgeons within the SOVG are a mostly academic subgroup (90% supervise trainees), and their values, training, and practice may differ slight from the larger community of orthopaedic surgeons; however, we think these are nuanced differences and the metaphors used within the subgroup are likely similar to the larger community. Finally, we desired and received a subset of surgeons to participate to gather a set of metaphors for example. In qualitative research a representative sample is sufficient and no quantitative conclusions are made. We can only conclude that metaphors are often at risk of reinforcing unhelpful thinking.

The observation that surgeons mostly use metaphors to explain the natural history of the diseases suggests that this may be one of the more important and more difficult aspects of providing informational support to patients. Mechanical metaphors were the most common, suggesting that surgeons may feel these are more familiar or easier for patients to understand.

The observation that more than one fifth of medical metaphors might reinforce unhelpful thinking emphasizes the need for strategic selection and thoughtful use of metaphors. More than half of the potentially bias-reinforcing metaphors were used during explanations of the natural history of the disease. Metaphors containing words with extreme or negative connotations, such as broken, crushed, squished, or lost, were common in this category; these analogies can harm health either by portraying the natural process of aging as a form of damage or by reinforcing the misconception that painful activity can accelerate the disease process, or both. Negatively framed metaphors can be useful when they are accurate, but can make people less healthy when they reinforce common misconceptions about symptoms (unhelpful thinking and cognitive error) (6). While there are many areas of musculoskeletal health where the evidence leaves room for debate, the evidence that words and concepts can harm health is solid. In the opening sentence of his editorial entitled, "The Iatrogenic Potential of the Physician's Words," Dr. Arthur Barsky notes, "Some of the information that physicians convey to their patients can inadvertently amplify patients' symptoms and become a source of heightened somatic distress, an effect that must be understood by physicians to ensure optimal management of patient care."(6)

In the mechanism category, the most common metaphors sometimes reinforce out-of-date inaccuracies such as "overuse" or "impingement." In other words, metaphors can become jargon that codify inaccuracies. When concepts become vernacular, it may limit our ability to be nimble in response to new evidence.

In the treatment category, metaphors sometimes invoke disease modification when only palliation is currently possible. For instance, with respect to arthritis, the metaphor "gel injection for the knee is like getting an oil change for your car" implies a type of renewal that is not currently possible with arthritis. Such analogies risk reinforcing false hope about maintaining or restoring physiology that has been permanently altered by injury, disease, or age. These may also reinforce unhealthy cognitive errors such as "The only way to be healthy is to have no pain," "I'm too young for this problem," "As long as I have this problem I cannot be myself," and "If I find the right doctor they will fix this for me"(18).

Another potentially problematic analogy in the treatment realm is the battle analogy. The downsides of battle analogies are often addressed in the context of cancer, but they apply more broadly across medicine. One potential downside of military metaphors is stigmatization, or separating and setting aside ("othering"), of people that are ill. When one has an illness, one must "fight," and be supported in a fight, to return to belonging with the "non-ill" (19). Making an informed choice to decline treatment after considering the potential harms and potential benefits is then framed as "giving up the fight" (20). We see this in orthopedic surgery when by framing continued symptoms as "failure" proceeding to surgery becomes a type of success (21).

It is possible that surgeons use metaphors that nudge patients towards a specific treatment both consciously and unconsciously. For example, with respect to osteoarthritis of the knee, a surgeon might emphasize the irreversibility of the problem and the benefits of a "new knee" because they are proud of what they have to offer. We should also account for potential financial, reputation enhancement, and identity reinforcement incentives. As one example, one surgeon used the analogy of an old car as follows: "a car with 100,000 miles will make noises, does not start on cold mornings, etc. You can either try to tune it up (NSAIDs, injections) or trade in in for a new one (TKA)."

Other less-common unhelpful thinking-reinforcing metaphors invoked "fear" (e.g. "abdominal aorta aneurysm is a time bomb") and reinforced the misconception that "hurts equals harm." For example, "The bearing is wearing; just as with a car, the motor gets older (heart), air filter gest obstructed (lungs), and the bearings start to grind (osteoarthritis)".

Our exploration of the metaphors commonly used by orthopedic surgeons identified opportunities for our profession to be more attentive regarding the use of metaphors. Unhelpful thinking and distress can influence engagement in care, symptom intensity, and activity intolerance. This, in turn, might increase the likelihood of a person choosing treatment options that do not correspond with what matters most to them (their values). Metaphors can either reinforce or reorient potentially unhealthy misconceptions. Metaphors can

also reinforce despair and worry, or improve hope and sense of control. Orthopedic surgeons can be strategic in their use of metaphors, planning and practicing specific metaphors for optimal mental, social, and physical health [Table 3].

Each author certifies that he or she has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

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Appendix A. Other Medical Metaphors Frequency

Other Metaphors	Percentage (N)*	Not Reinforcing Cognitive Bias	biased metaphors*
Spiritual	1% (2)	100% (2)	0
War/ Violence/crime	4% (6)	17% (1)	83% (5)
Home utensils	2% (3)	67% (2)	33% (1)
Car/transportation	2% (3)	100% (3)	0
Natural processes	0.5% (1)	100% (1)	0
Fiction	0.5% (1)	100% (1)	0
Home environment	4% (6)	83% (5)	17% (1)

* Percentages are calculated from total

Appendix B. Other Medical Metaphors by Region

	Region		
	UE	LE	Other
Spiritual			(2) 100%
War/ Violence/crime	(1) 17%		(5) 83%
Home utensils	(1) 33%		(2) 67%
Car/transportation	(1) 33%		(2) 67%
Natural processes			(1) 100%
Fiction	(1) 100%		
Home environment	(3) 50%	(1) 17%	(2) 33%

UE = upper extremity; LE = lower extremity

Appendix C. Other Medical Metaphors by Topic

	Topic				
	Anatomy	Natural History of The Disease	Mechanism	Treatment	Other
Spiritual			50% (1)		50% (1)
War/ Violence/crime		17% (1)	33% (2)	50% (3)	
Home utensils		67% (2)		33% (1)	
Car/transportation		67% (2)		33% (1)	
Natural processes		100% (1)			
Fiction				100% (1)	
Home environment		33% (2)	17% (1)	50% (3)	